**BACHELOR OF TECHNOLOGY**

# COMPUTER ENGINEERING

# SYLLABI BOOK
# 1st Year B.Tech. Program

**With effect from 2020-21**

Department of Computer Engineering
Faculty of Technology
Dharmsinh Desai University
Nadiad – 387 001, Gujarat, India.

http://www.ddu.ac.in

## B. Tech. Semester I

| SUBJECTS | Teaching Scheme | | | Total | Credit | Examination Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Th | Tut | Pract | | | Th | Sess | TW | Prac | Total |
| **Mathematics I** | 3 | 1 | 0 | 4 | 4.0 | 60 | 40 | - | - | 100 |
| **Basic Electrical Engineering** | 3 | 1 | 2 | 6 | 5.0 | 60 | 40 | 50 | - | 150 |
| **Programming for Problem Solving I** | 4 | 0 | 3 | 7 | 5.5 | 60 | 40 | 50 | - | 150 |
| **Engineering Graphics & Design** | 1 | 0 | 4 | 5 | 3.0 | - | - | 100 | - | 100 |
| **Software Workshop** | 0 | 0 | 2 | 2 | 1.0 | - | - | 50 | - | 50 |
| | 11 | 2 | 11 | 24 | 18.5 | 180 | 120 | 250 | - | 550 |

## B. Tech. Semester II

| SUBJECTS | Teaching Scheme | | | Total | Credit | Examination Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Th | Tut | Pract | | | Th | Sess | TW | Prac | Total |
| **Mathematics II** | 3 | 1 | 0 | 4 | 4.0 | 60 | 40 | - | - | 100 |
| **Programming for Problem Solving II** | 4 | 0 | 3 | 7 | 5.5 | 60 | 40 | 50 | - | 150 |
| **Physics** | 3 | 1 | 2 | 6 | 5.0 | 60 | 40 | 50 | - | 150 |
| **Hardware Workshop** | 0 | 0 | 4 | 4 | 2.0 | - | - | 100 | - | 100 |
| **English** | 2 | 0 | 2 | 4 | 3.0 | 40 | - | 50 | - | 90 |
| **Environmental Sciences** | 2 | 0 | 0 | 2 | 0.0 | 40 | - | - | - | 40 |
| | 14 | 2 | 11 | 27 | 19.5 | 260 | 120 | 250 | - | 630 |

**B. TECH. SEMESTER – I (EC/CE/IT)**

**SUBJECT: MATHEMATICS - I**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | - | - | 100 |

Reference Code BSC102

## A. COURSE OBJECTIVE

The objective of this course is to familiarize the prospective engineers with techniques in calculus, matrices, vector spaces and multivariable calculus.

## B. DETAILED SYLLABUS

### [1] CALCULUS

Evolutes and involutes, Evaluation of definite and improper integrals; Beta and Gamma functions and their properties, Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule, Maxima and minima.

### [2] MATRICES

Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Rank of a Matrix, Linear systems of equations, Determinants, Cramer's Rule, Inverse of a matrix, Gauss Elimination and Gauss Jordan method.

### [3] VECTOR SPACES

Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Linear Independence of vectors, Diagonalization.

### [4] MULTIVARIABLE CALCULUS (DIFFERENTIATION)

Limit, Continuity and Partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Vector Differential Calculus; Gradient, curl and divergence.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.

**2)** G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint,2002.

**3)** Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

**4)** D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

**5)** Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

**6)** Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint,2010.

**7)** N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

**8)** V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, AffiliatedEast–West press, Reprint 2005.

## D. COURSE OUTCOMES

At the end of the course, student should be able to

- Solve engineering problems involving calculus, matrices and vector space.
- Use mathematical tools to solve problems in calculus, matrices and vector space.

**B. TECH. SEMESTER – I (EC/CE/IT)**

## SUBJECT: BASIC ELECTRICAL ENGINEERING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 50* | - | 150 |

Reference Code ESC101

*TW Marks includes Viva based on TW

## A. COURSE OBJECTIVE

The course imparts an in-depth understanding of the fundamental concepts with an objective to expose the students to the various types of electrical, electronic and magnetic circuits and their applications. This course is designed to provide knowledge of fundamentals and various laws in electromagnetic and magnetic circuits, electrostatics.

## B. DETAILED SYLLABUS

### [1] DC CIRCUITS

Electrical circuit elements (R, L and C), impact of temperature, voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first order RL and RC circuits.

### [2] AC CIRCUITS

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phasebalanced circuits, voltage and current relations in star and delta connections

### [3] ELECTRO-MAGNETIC INDUCTION

Introduction, Magnetic effect of electric current, Current carrying conductor in magnetic field, Law of electromagnetic induction, Induced emf, Self-Inductance (L), Mutual Inductance (M), and Coupling coefficient between two magnetically coupled circuits (K), Inductances in seriesand parallel.

### [4] MAGNETIC CIRCUITS

Introduction, Definition of Magnetic quantities, Magnetic circuit, Leakage flux, Fringing effect, Comparison between magnetic and electric circuits

### [5] TRANSFORMERS

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections

### [6] ELECTRICAL MACHINES

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited

DC motor. Construction and working of synchronous generators, Construction, Principles and working theory and Types of DC Motors & Generators, 1-Ph & 3-Ph Induction Motor, AC Generator

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Basic Electrical, Electronics and Computer Engineering, R. Muthu Subramanian, S.Salvahanan, K. A. Muraleedharan, 2nd Edition, Tata McGraw Hill

**2)** Electronics Principles, Albert Paul Malvino, 6th Edition, Tata McGraw Hill

**3)** Electrical Technology (Vol: II), B. L. Theraja , A. K. Theraja, 23rd Edition, R. Chand &Company

**4)** Basic Electrical Engineering, D.P. Kothari, I. J. Nagrath, 3rd Edition, Tata McGraw Hill

**5)** Introduction to VLSI Circuit & Systems, John P. Uyemura, 1st Edition, John Willey & Sons Inc.

**6)** Basic Electrical Engineering, D.C. Kulshreshtha, 1st Edition, Tata McGraw Hill

**7)** Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson

**8)** Electrical Engineering Fundamentals, V.D. Toro, 2nd Edition, Prentice Hall India

**9)** Fundamentals of Electrical Engineering, L.S. Bobrow, , Oxford University Press


## D. COURSE OUTCOMES

At the end of the course, student should be able to

- Apply basic circuital laws (KVL, KCL and Ohm's) and Theorems (Thevenin's and Norton's) for simplifying the complex resistive network to compute node voltages and loop currents for given excitation.
- Analyze Single Phase AC Circuits, compute and demonstrate the waveforms and phasor diagram representation of alternating quantities.
- Design low pass, high pass, band pass and band elimination filter networks, analyse the frequency response of circuits to show the correlation between time domain and frequency domain response specifications.
- Analyze 3-Phase circuit (star-delta) and compute power for balanced and unbalanced load.
- Predict the behaviour of any electrical and magnetic circuits with an ability to identify, formulate, and solve magnetic circuit problems in electrical machines
- Model the Equivalent Circuit of a Transformer for Performance Analysis
- Discriminate the constructional details, principle of operation and applications of AC and DC electrical machines.

**B.TECH. SEMESTER – I (EC/CE/IT)**

**SUBJECT: PROGRAMMING FOR PROBLEM SOLVING - I**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 3 | 7 | 5.5 | 60 | 40 | 50 | - | 150 |

Reference Code ESC201

## A. COURSE OBJECTIVE

The objectives of teaching this course are:

- To impart in-depth understanding of fundamental programming concepts to build C programs.
- To explain conditional branching, iteration/looping, code reusability and pointers using C Programming Language.
- To demonstrate and teach how to code, document, test, and implement a well-structured C program.

## B. DETAILED SYLLABUS

### [1] OVERVIEW OF C

Basic structure of C program, compiling and running C program

### [2] CONSTANTS, VARIABLES AND DATA TYPES

Types of constants, basic data types, identifier, variable, enum, symbolic constant, typedef, keywords, overflow and underflow

### [3] OPERATORS AND EXPRESSIONS

Arithmetic, relational, logical, assignment, bitwise, and sizeof() operators, operator precedenceand associativity, expression evaluation

### [4] MANAGING INPUT OUTPUT OPERATIONS

getchar() and putchar() functions, formatted I/O using printf() and scanf()

### [5] DECISION MAKING AND BRANCHING

if and if...else statement, nested and ladder if...else, conditional operator, switch statement, gotostatement with warning

### [6] DECISION MAKING AND LOOPING

while, do...while, and for loops, nested loops, break and continue statements

### [7] ARRAYS AND STRINGS

Introduction to arrays, declaration, initialization and access of one-dimensional and two-dimensional arrays, Introduction to multi-dimensional and variable length arrays, declaration and initialization of strings, printing and scanning strings to/from standard I/O, string handlingfunctions, list of strings

### [8] USER-DEFINED FUNCTIONS

Function prototype and function declaration, function definition, function call, actual and

formal parameters/arguments, return type and return statement, Nested function call, recursion,scope, visibility, and lifetime of variables.

### [9] STRUCTURES AND UNIONS

Defining structure, declaring and initializing structure variables, typedef, accessing structure members, copying and comparing structure variables, nested structures, arrays and structures,structures and functions, unions

### [10] POINTERS

Introduction, accessing address of a variable, declaration and initialization of pointer variables, Accessing variable using pointer, chain of pointers, scale factor and pointer expressions, pointers and arrays, pointer to array Vs array of pointers, passing arrays and strings to the function, array of pointers, pointers and functions, pointers and structures, const pointer vs pointer to const

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Programming in ANSI C by Balagurusamy, 8th Ed., Tata McGraw Hil

**2)** Programming with C by Byron Gottfried, 3rd Ed., McGraw Hill Education

**3)** The C Programming Language by Kernighan and Ritchie, 2nd Ed., PHI Learning

**4)** Expert C Programming: Deep C Secrets by Peter Van Der Linden, Pearson Education

**5)** Let Us C by Yashvant Kanetkar, 12th Ed., BPB Publication

**6)** Programming in C by Ashok N. Kamthane, 2nd Ed., Pearson Education


## D. COURSE OUTCOMES

At the end of the course, student should be able to

- Use and understand language syntax and concepts for C Programming.
- Comprehend and use C Programming concepts to solve algorithmic and logical problems.
- Analyse the given problem and to formulate appropriate C language solution based on definitive language concept(s).
- Design a flowchart or a diagram for given problem and create C programs using decision making, branching, looping, user defined function, array, structure, pointers, etc.
- Apply concepts to write, compile, debug, execute, and document C programs with different test cases using appropriate tool(s).

**B. TECH. SEMESTER – I (EC/CE/IT)**

## SUBJECT: ENGINEERING GRAPHICS AND DESIGN

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 1 | 0 | 4 | 5 | 3 | - | - | 100* | - | 100 |

Reference Code ESC102

*TW Marks includes Viva based on TW

## A. COURSE OBJECTIVE

The objectives of teaching this course are:

- To Understand the drawing importance in Engineering.
- To Describe the 3-Dimensional object into different 2-Dimensional view.
- To Develop skills in Reading and Interpretation of Engineering Drawings.
- To enhance drawing skills through hands-on training in a CAD lab using engineering software.

## B. DETAILED SYLLABUS

**[1]** Introduction to Engineering Drawing Covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales –Plain, Diagonal and Vernier Scales;

**[2]** Orthographic Projections Covering, Principles of Orthographic Projections- Conventions Projections of Points and lines inclined to both planes; Projections of planes inclined Planes
- Auxiliary Planes;

**[3]** Projections of Regular Solids Covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

**[4]** Sections and Sectional Views of Right Angular Solids Covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid,Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects fromindustry and dwellings (foundation to slab only)

**[5]** Isometric Projections Covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

**[6]** Overview of Computer Graphics Covering, listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software.

**[7]** Customization & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and

ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

**[8]** Annotations, layering & other Functions Covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines(extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wire frame models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multi view, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar PublishingHouse
**2)** Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, PearsonEducation
**3)** Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
**4)** Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
**5)** (Corresponding set of) CAD Software Theory and User Manuals


## D. COURSE OUTCOMES

At the end of the course, student should be able to

- Skills in understanding and interpreting engineering drawings so that concepts can be communicated graphically more effectively.
- Demonstrate correct usage of methods, concept, and theories to illustrate and solve problem of conics, lines, planes, solids, and surface and many more.
- Choose a suitable standard projection method, break down a complex 3D problem into various orthographic and sectional orthographic views, and highlight missing features.
- Practical Exposure in a computer aided software to generate isometric projection and compose standard components of different streams

**B. TECH. SEMESTER – I (EC/CE/IT)**

**SUBJECT: SOFTWARE WORKSHOP**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 0 | 0 | 2 | 2 | 1 | - | - | 50* | - | 50 |

Reference Code ESC202

*TW Marks includes Viva based on TW

## A. COURSE OBJECTIVE

The objective of the course is to familiarize students with various software tools and technology. The course aims at providing hands on experience related to basic software installation, usage of Operating systems and various essential software utilities.

## B. DETAILED SYLLABUS

### [1] OPERATING SYSTEM BASICS

Introduction to Operating System and Linux Architecture

### [2] SOFTWARE INSTALLATION

Installation of open source/freeware software using package manager for programming/simulation.

### [3] SHELL COMMANDS

Linux usage, commands & shell scripting. Command structure and general purpose utility

### [4] FILE HANDLING

basic of file handling. The file system, Handling ordinary files, File attributes and permission,file system details

### [5] SHELL SCRIPTING

Basic Shell commands, Looping and Branching,

### [6] SHELL UTILITIES

Find command and shell, simple filters, advance filters.

### [7] EDITORS

VI editor for basic text editing, LATEX for scientific documents and report writing.

## C. RECOMMENDED TEXT / REFERENCE BOOKS

**1)** Unix : Concepts and Applications, Sumitabha Das, 4th Edition, Tata McGraw Hill

## D. COURSE OUTCOMES

After completing the course, the students will

- have knowledge of installation and maintainance of softwares
- be able to perform computational tasks using various utilities and commands related to operating systems
- be able to manage and maintain software system on a PC.

**B. TECH. SEMESTER II (EC/CE/IT)**

**SUBJECT: MATHEMATICS-II**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | 0 | 100 |

Reference Code BSC301

## A. COURSE OBJECTIVE

The objective of this course is to familiarize the prospective engineers with techniques in Differential Equations, numerical methods and laplace transform.

## B. DETAILED SYLLABUS

### [1] FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS AND INTRODUCTION TO HIGHER ORDER DIFFERENTIAL EQUATIONS

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, second order linear differential equations with variable coefficients, Method of variation of parameters, Cauchy-Euler equation.

### [2] NUMERICAL METHODS

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods, Runge-Kutta method of fourth order for solving first order equations, Solution of algebraic and transcendental equations: Newton Raphson's Method, Numerical integration : Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

### [3] MULTIVARIABLE CALCULUS (INTEGRATION)

Multiple Integration: Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), Scalar line integrals,Vector line integrals, Scalar surface integrals, Vector surface integrals, Theorems of Green, Gauss and Stoke's.

### [4] LAPLACE TRANSFORM

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions, Finding inverse Laplace transform by different methods, Convolution theorem. Evaluation of integrals by Laplace transform, Solving ODE by Laplace Transform method.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.

**2)** G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Ed.,Pearson, 2002.

**3)** Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

**4)** W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary ValueProblems, 9th Edn., Wiley India, 2009.

**5)** S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

**6)** E. A. Coddington, An Intro. to Ordinary Differential Equations, Prentice Hall India, 1995.

**7)** J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc- GrawHill, 2004.

**8)** N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2008.

## D. COURSE OUTCOMES

After completing the course, the students will

- Solve engineering problems involving differential equation, numerical methods and laplace transform.
- Use mathematical tools to solve problems in differential equations, numerical methods and laplace transform.

**B. TECH. SEMESTER – II (EC/CE/IT)**

**SUBJECT: PROGRAMMING FOR PROBLEM SOLVING - II**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 3 | 7 | 5.5 | 60 | 40 | 50* | - | 150 |

Reference Code ESC201

*TW Marks includes Viva based on TW

## A. COURSE OBJECTIVE

The objectives of teaching this course are:

- To provide fundamental concepts of object-oriented programming like abstraction, inheritance, polymorphism etc. and explain differences between object-oriented programming and procedural programming
- To teach programmatic implementation of these concepts using c++ language.
- Explain signifiance of these concepts to learn subjects like software engineering and object-oriented design and analysis.

## B. DETAILED SYLLABUS

### [1] BASICS OF C++

Overview, Program structure, keywords, identifiers, constants, data types, symbolic constants, declaration of variables, operators, namespaces, control structures, dynamic memory – C style – malloc(), calloc(), realloc() and free() Vs C++ style - new and delete keywords, reference andpointer

### [2] FUNCTIONS IN C++

main function (variations in signature), function prototype, inline functions, call and return by reference, default parameters, function overloading

### [3] INTRODUCTION TO OBJECT ORIENTED PROGRAMMING

Procedural Vs Object Oriented Programming, Principles of OOP, Benefits and applications of OOP

### [4] CLASSES AND OBJECTS – ENCAPSULATION AND ABSTRACTION

Introduction, private and public members, Defining member functions, static members, Objects as function arguments and return type, friend functions, const member functions, Constructors and their types, Destructor, Operator overloading, type conversion

### [5] INTRODUCTION TO C++ STRING CLASS

### [6] INHERITANCE

Introduction, types of inheritance – single, multiple, multilevel, hierarchical, and hybrid inheritance, Protected members, overriding, virtual base class

**[7] POLYMORPHISM**

Introduction, Pointers and Objects, this pointer, pointer to derived classes, virtual and pure virtual functions, dynamic binding

**[8] INPUT/OUTPUT**

Introduction to streams, standard I/O stream objects, stream classes, unformatted and formatted I/O, manipulators

**[9] EXCEPTION HANDLING**

Basics of exception handling, try-catch-throw, rethrowing exceptions, user defined exceptions

**[10] TEMPLATES**

Basics of class templates and function templates

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Object-Oriented programming with C++, Seventh Ed., by E Balagurusamy, TMH publication

**2)** The C++ Programming Language, Fourth Ed., by Bjarne Stroustrup, Addison-Wesleypublication

**3)** Object-Oriented Programming in C++, Fourth Edition, by Robert Lafore, SAMS publication

**4)** Accelerated C++: Practical Programming by Example, First Edition, by Andrew Koenig andBarbara E. Moo, Addison-Wesley publication

**5)** C++ Black Book, First edition, by Steven Holzner, Paraglyph Press

**6)** C++: The Complete Reference, Fourth Edition, by Herbert Schildt, McGraw Hill Education


## D. COURSE OUTCOME

At the end of the course students should be able to:

- Use and understand language syntax and concepts for C++ Programming along with templates for class and function.
- Apply Object Oriented Programming (OOP) concepts to solve algorithmic and logical problems.
- Identify the given problem and to formulate appropriate C++ language solution based on OOP Principle(s).
- Write C++ programs using Encapsulation, Abstraction, Inheritance, Polymorphism, Exception Handling, etc. to solve given problem(s).
- Apply concepts to write, compile and execute C++ programs with different test cases. Also be able to debug and document C++ programs.

**B. TECH. SEMESTER II (EC/CE/IT)**

**SUBJECT: PHYSICS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 50* | - | 150 |

Reference Code BSC101

*TW Marks includes Viva based on TW

## A. COURSE OBJECTIVE

The objective of this course is to relate the concept of physics with the ever-growing field of Information and Communication Technology. This course provides knowledge on the electronic devices such as Semiconductor Diodes: Bipolar Junction transistors, Amplifiers: Sinusoidal Oscillators: & build capability for designing various circuits of electronic devices. The course elaborates the concepts associated with Optoelectronics, Communication and Semiconductor switching devices. It also provides comprehensive idea about analog modulation & demodulation techniques (AM, FM and PM) and digital modulation (ASK, FSK and PSK).

## B. DETAILED SYLLABUS

### [1] SEMICONDUCTORS

Intrinsic and extrinsic semiconductors, Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic & other devices.

### [2] DIODE

Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator, Special purpose diodes.

### [3] LIGHT-SEMICONDUCTOR INTERACTION

Radiative transitions and optical absorption, LED and LASER, Photo detectors.

### [4] ACTIVE COMPONENTS AND APPLICATIONS

BJT: Structure and input-output characteristics of a BJT, The Unbiased Transistor, Transistor Currents , Biased Transistor, a single stage voltage divider biasing, Emitter Bias, The CE Connections, The Base Curve, Collector curve, Transistor approximation Variation in current Gain, The Load Line, The Operating point, Recognizing Saturation, BJT as a switch & Amplifiers, LED Drivers.

### [5] OSCILLATORS

General form of oscillator, Sinusoidal oscillator, phase shift oscillator, Crystal Oscillator.

### [6] MOSFET

MOS physics and mode of operations, nFET current-voltage relationship, MOS pass characteristics and CMOS inverter, Dynamic RAM (DRAM) 1T bit-cell.

### [7] FIBER OPTICS

Fiber Optics and Optoelectronics, Historical Developments, A Fiber-Optic Communication System, Advantages of Fiber-Optic Systems, Ray Propagation in Optical Fibers, Fundamental Laws of Optics, Ray Propagation in Step-Index Fibers, Ray Propagation in Graded-Index Fibers

### [8] COMMUNICATION SYSTEMS

Communication system components, Analog modulation- AM, FM,PM.
Digital modulation-ASK, FSK, PSK

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Electronics Principles, Albert Paul Malvino, 6th Edition, Tata McGraw Hill

**2)** David Griffiths, Introduction to Electrodynamics

**3)** S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).

**4)** R.P Khare, Fiber Optics and Optoelectronics, Oxford University Press

**5)** Sanjay Sharma, Communication Systems: Analog and Digital

**6)** Halliday and Resnick, Physics

**7)** W. Saslow, Electricity, magnetism and light

**8)** Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).

**9)** B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).

**10)** Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, OxfordUniversity Press, New York (2007).

**11)** P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997)

**12)** Behrouz A. Forouzan, Data communication and networking.

**13)** B. P lathi, Modern Digital and Analog Communication Systems, Third edition.

## D. COURSE OUTCOME

At the end of the course, students will be able to

- Illustrate intrinsic and extrinsic semiconductors, their applications and carrier generation and recombination with variations in doping density, temperature and other regulations.
- Design half wave, full wave rectifier circuit and voltage regulator circuit using Zener diode, PN diode and NPN, PNP transistors.
- Implement a transistor as a switch and Analyse Transistor input output characteristics, biasing circuits, Compute load line and calculate the operating point.
- Analyse structure of the oscillator and discriminate Sinusoidal oscillator, Phase shift oscillator and Crystal oscillator.
- Assess the performance & characteristics of Opto-electronic semiconductor devices like LED, LASER, Photo detectors
- Devise the ray optics propagation in step index and graded index fiber and Synthesize the use of optoelectronic devices in fiber optic communications.
- Illustrate pro and cons of analog and digital modulation techniques (AM, FM, PM, ASK, FSK, PSK) based on the need of system components.
- Justify the requirement of CMOS based on the fundamental study of nMOS and pMOS and describe working of 1 bit DRAM cell.

**B. TECH. SEMESTER II (EC/CE/IT)**

**SUBJECT: HARDWARE WORKSHOP**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 0 | 0 | 4 | 4 | 2 | - | - | 100* | - | 100 |

Reference Code ESC202

*TW Marks includes Viva based on TW

## A. COURSE OBJECTIVE

The objective of the course is to familiarize students with various hardware tools and techniques. The course aims at imparting practical knowledge of various electronic components, computer hardware, and internet technology.

## B. DETAILED SYLLABUS

### [1] ELECTRONIC COMPONENTS

Digital Multi-meter, Power Supply, Function Generator, Cathode Ray Oscilloscope, Digital Oscilloscope, Measurement of Phase Difference in single phase circuit, Various Electrical and Electronics component like LED, LDR, Photo-diode, MOSFET, MCB and Relay.

### [2] COMPUTER HARDWARE

Introduction to a personal computer and its basic peripherals, installation of Operating System Software and the required device drivers. Students are suggested to perform similar tasks on theLaptop scenario wherever possible.

### [3] PERIPHERALS

Programming of Computer Ports & Interfacing of Electronic Components, Cables and Connectors like RJ45, RS232 and CRO probe.

### [4] INTERNET

Introduction to Internet & World Wide Web modules, Making a PC Internet ready: Introduction to Internet and TCP/IP, Ethernet Connection, WiFi connection, configure TCP/IP (IP, Gateway,DNS, and Proxy), and use of ping command, Information sharing and data transfer over Local Area Network and Internet.

### [5] WEB INFRASTRUCTURE

Basic Components of Web Sites, Front end & back end tools and technology. HTML & CSS, Developing, Configuring and deploying a website.

### [6] IOT BOARDS AND CIRCUIT SIMULATION

Introduction to IOT boards like Arduino, Raspberry Pie etc. Interfacing, Circuit designing andPCB designing.

### [7] MINI PROJECT

Student will develop a mini project related to the topics listed above.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Electronic Components and Materials Principles, Dr. Madhuri A Joshi, 2nd Edition, ShroffPublishers & Distributors PVT. LTD.

**2)** A Textbook of Computer Hardware and Networking, Jyotika Deshmukh, D J Publications

**3)** Learning Web Design, Jennifer Robbins, 4th edition, O'Reilly Media


## D. COURSE OUTCOME

After completing the course, the students will,

- have knowledge of various electronics components and computer hardware.
- The students will be aware of Internet Technology infrastructure.

**B.TECH. SEMESTER II (EC/CE/IT)**

**SUBJECT: ENGLISH**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 2 | 0 | 2 | 4 | 3 | 40 | - | 50* | - | 90 |

Reference Code HSMC201

*TW Marks includes Viva based on TW

## A. COURSE OBJECTIVE

The objective of the course is to provide basic knowledge of English language to students coming from different background. The course aims to teach English Grammar and Communications skills which will be useful to engineers.

## B. DETAILED SYLLABUS

### [1] VOCABULARY BUILDING

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

### [2] BASIC WRITING SKILLS

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents,
Techniques for writing precisely

### [3] IDENTIFYING COMMON ERRORS IN WRITING

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

### [4] NATURE AND STYLE OF SENSIBLE WRITING

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion

### [5] WRITING PRACTICES

Comprehension, Précis Writing, Essay Writing

### [6] ORAL COMMUNICATION

(This unit involves interactive practice sessions in Language Lab) Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common, Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Practical English Usage. Michael Swan. OUP. 1995.

**2)** Remedial English Grammar. F.T. Wood. Macmillan.2007

**3)** On Writing Well. William Zinsser. Harper Resource Book. 2001

**4)** Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

**5)** Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

**6)** Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press


## D. COURSE OUTCOME

After successful completion of the course, students will be able to

- Understand the vocabulary and their root forms to enhance vocabulary level
- Enhance thier writing in effective way
- Ractify common errors in their speaking and writing
- Develop efficiency in writing
- Be competent at Public Speaking and Interviews
- Acquire Proficiency in all four skills of Language

**B. TECH. SEMESTER – II (EC/CE/IT)**

**SUBJECT: ENVIRONMENTAL STUDIES**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 2 | 0 | 0 | 2 | 0 | 40 | -- | -- | -- | 40 |

Reference Code MC-II

## A. COURSE OBJECTIVE

The objective for this course is to bring awareness about sustainable development is a key to the future of mankind. Understanding, analyzing and proposing solutions to the contemporary environmental issues and problems of pollution, population explosion, solid waste disposal, environmental degradation, economic productivity, global warming, ozone layer depletion and loss of biodiversity.

## B. DETAILED SYLLABUS

### [1] THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance & Need for public awareness

### [2] NATURAL RESOURCES

Renewable and non-renewable resource: Natural resources and associated problems**,** Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams, and their effects on forests and tribal people ,Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefit and problems,Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies, Energy resources: Growing energy needs, renewable and non-renewableenergy sources, use of alternate energy sources, case studies, Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Role of anindividual in conservation of natural resources. Equitable use of resources of sustainable lifestyles

### [3] ECOSYSTEMS

Concept of an ecosystem, Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem andAquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

### [4] BIODIVERSITY AND ITS CONSERVATION

Introduction definition: Genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: Consumptive use, productive use, social,

ethical, aesthetic and option values. Biodiversity at global, national and local levels, India as a mega- diversity nation, Hot-spots of biodiversity, Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity

### [5] ENVIRONMENTAL POLLUTION

Definition, Causes, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste management, causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

### [6] SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns. Case studies, Environmental ethics: Issues and possible solutions, Climate change: Global warming, acid rain, ozone layer depletion, nuclear accidentsand holocaust, Case studies, Wasteland reclamation, Consumerism and waste products, Environment Protection Act: Air (Prevention and Control of Pollution) Act, Water (Prevention &Control of Pollution) Act, Wildlife rotection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation,
Public awareness

### [7] HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations, population explosion, Family Welfare Program, environment and human health, human rights, Value education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environmental and human health, Case studies

### [8] FIELD WORK

Visit to a local area to document environmental assets (river/forest/grassland/hill/mountain), Visit to a local polluted site – Urban / Rural / Industrial/ Agricultural, Study of common plants, insects, birds, Study of simple ecosystems – pond, river, hill, slopes etc.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Erach Bharucha Textbook of Environmental Studies; Second Edition, Universities Press:Hyderabad, 2013.

**2)** Rajagopalan, R. Environmental Studies; Oxford University Press: India, 2015.

**3)** Varandani, N. S. Basics of Environmental studies; Lambert Academic Publishing: Germany,2013.

**4)** Rao, C. S. Environmental Pollution Control Engineering; Wiley publishers: New Delhi,2006.

**5)** Clark, R. S. Marine Pollution; Clanderson Press Oxford: Bath, 2001.

**6)** Cunningham, W.P.; Cooper; Gorhani, T. H. E.; Hepworth, M.T., Environmental Encyclopedia;Jaico Publ. House: Mumbai, 2001.

**7)** De, A. K. Environmental Chemistry; Wiley Eastern: New Delhi, 2006.

## E. COURSE OUTCOME

After learning this course students should be able to : •

- Recall, understand and interpret the terminologies used in environmental studies correctly
- Relate the importance of natural resources, biodiversity, hotspots and deduce the threats to biodiversity
- Analyse the factors causing environmental pollution, formulate the role of an individual in abatement and control of pollution, improve disaster management techniques
- Evaluate the social issues involved in climate change, water conservation, rainwater harvesting, wasteland reclamation, consumerism and waste generation, environmental ethics, environmental laws and requirement of public awareness
- Understand the issues related to population, family welfare programs, human health, value education, and role of IT in environment
- Make use of the field work including visits to local areas to document environmental assets, assess the polluted sites, study species and ecosystems in our surroundings

**BACHELOR OF TECHNOLOGY**

# COMPUTER ENGINEERING

# SYLLABI BOOK

## 2nd Year B.Tech. Program

**With effect from 2021-22**

Department of Computer Engineering
Faculty of Technology
Dharmsinh Desai University
Nadiad – 387 001, Gujarat, India.

http://www.ddu.ac.in

## B. Tech. Semester III

| SUBJECTS | Teaching Scheme | | | Total | Credit | Examination Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Th | Tut | Pract | | | Th | Sess | TW | Prac | Total |
| **Data Structure and Algorithms** | 3 | 1 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| **Database Management Systems** | 3 | 1 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| **Design of Digital Circuit** | 3 | 1 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| **Probability and Statistics** | 2 | 0 | 0 | 2 | 2.0 | 40 | - | - | - | 40 |
| **Universal Human Values** | 3 | 0 | 0 | 3 | 3.0 | 60 | - | - | - | 60 |
| **Essence of Indian Knowledge Tradition** | 2 | 0 | 0 | 2 | 0.0 | - | - | - | - | - |
| **Web Development Workshop** | 0 | 0 | 2 | 2 | 1.0 | - | - | 25 | 25 | 50 |
| | 16 | 3 | 8 | 27 | 21 | 280 | 120 | 100 | 100 | 600 |

## B. Tech. Semester IV

| SUBJECTS | Teaching Scheme | | | Total | Credit | Examination Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Th | Tut | Pract | | | Th | Sess | TW | Prac | Total |
| **Discrete Mathematics** | 3 | 1 | 0 | 4 | 4.0 | 60 | 40 | - | - | 100 |
| **Design and Analysis of Algorithm** | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| **Computer System Architecture** | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| **Professional Elective-I** | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| **Software Engineering Principles and Practices** | 3 | 1 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| **Software Project** | 0 | 0 | 2 | 2 | 1.0 | - | - | 25 | 25 | 50 |
| | 18 | 2 | 10 | 30 | 25.0 | 300 | 200 | 125 | 125 | 750 |

**B. TECH. SEMESTER – III (CE)**

**SUBJECT: DATA STRUCTURE AND ALGORITHMS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS301

## A. COURSE OBJECTIVE

Learn different types of data representation and handling which is one of the fundamental concept of computer engineering. Detailed study of various data structures and their applications. Provide an in-depth knowledge of various techniques which will be useful for problem solving.

## B. DETAILED SYLLABUS

### [1] BASIC CONCEPTS

Algorithm specifications.

### [2] ARRAYS

Array as an abstract data type, representation of Arrays

### [3] STACKS & QUEUES

Stack as an abstract data type, queue as an abstract type, evaluation of expressions

### [4] LINKED LIST

Singly linked lists, doubly linked list, circular list, linked stacks and queues, polynomials, generalized lists.

### [5] TREES

Introduction, binary trees, binary tree traversal and tree iterators, additional binary tree operations, threaded binary trees, heaps, binary search tree, forests, Huffman algorithm.

### [6] GRAPHS

The graph abstract data type, graph traversal, directed graph, weighted graph, shortest path-Dijkastra's algorithm, minimum spanning tree.

### [7] SORTING

Insertion sort, quick sort, merge sort, heap sort, shell sort, count sort, sorting on several keys,list and table sort, summary of internal sorting.

### [8] HASHING

Hash table, hash function, collision, collision resolution techniques.

### [9] SEARCH TECHNIQUES

Sequential search, Binary search, AVL trees, 2-3 trees, 2-3-4 trees, read-black trees, B-trees,Digital search trees, Tries.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Data Structures and Algorithms in Java (4th edition) by Michael T. Goodrich and Roberto Tamassia Publisher: John Wiley & Sons, Inc

**2)** Data Structures and Program Design in C, Second Edition, by Robert L. Kruse, Bruce P. Leung,Pearson Education.

**3)** Data Structures And Algorithms Made Easy In JAVA by Narasimha Karumanchi, Publisher:Careermonk Publications (Sep 2011).

**4)** An Introduction to Data Structures with Applications, Second Edition, by Tremblay and Soren-son, McGraw Hill.


## D. COURSE OUTCOME

- Obtaining in-depth knowledge of various data structures used by computers.
- To learn selection of appropriate data structure for a specific requirement.
- To be able to write efficient programs to solve various real life problems.
- To create a foundation and motivation for learning and exploring various methods of data handling.

**B. TECH. SEMESTER – III (CE)**

**SUBJECT: DATABASE MANAGEMENT SYSTEMS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS501

## A. COURSE OBJECTIVE

* Objective of this course is to provide details of database architecture
* To create database with constraints in normalized form and query it efficiently
* To learn different structures-file organization of database with proper indexing
* To gain knowledge how transaction works, transaction ACID properties, concurrency control, deadlock, recovery of database on failure.
* To prepare logical database design of any System

## B. DETAILED SYLLABUS

### [1] BASIC CONCEPTS

Purpose of database system, View of data, Database abstraction and Models, Database Languages, Transaction management, Storage management, Database administrator, Database users, Overall system structure.

### [2] ENTITY RELATION MODEL

Entity sets, Relationship sets, Attributes, Constraints, Keys, Entity relationship diagrams, Weak entity sets, Generalization, Specialization, Aggregation, Design of an E-R database schema, Reduction of an E-R schema to tables.

### [3] RELATIONAL DATABASE MANAGEMENT SYSTEM

Relational Model, Structure of database, Relational algebra, Extended relational algebra operation, tuple relational calculus, Domain relational calculus, Modification of database, Views, Structured Query Language, Background, Basic structure, Integrity Constraints, Domain constraints, Referential integrity, Assertions, Triggers, Functional Dependencies, Database Pitfalls in relational database design, Decomposition, Normalization, I,II,III normal Forms, Normalization using functional dependencies, Normalization using multi valued dependencies, Domain key normal form, Alternative approach to database design

### [4] FILE SYSTEM STRUCTURE

Indexing & Hashing, File organization, Organization of records in files, Data dictionary storage, Basic concepts of indexing, Order indices, B- Tree index files, B+ -Tree index files, Static hashing & Dynamic Hashing.

### [5] QUERY PROCESSING

Overview, Catalog information for cost estimation, Measures of query cost, Selection

operation, Sorting, Join operation, Other operations, Choice of evaluation plans

### [6] TRANSACTION PROCESSING

Transaction concepts, Transaction state, Implementation of atomicity & durability, Concurrent executions, Serializability, Conflict serializability, View serializability, Testing of conflict and view serializability.

### [7] CONCURRENCY CONTROL

Lock based protocols, Time-stamp based protocol, Validation based protocol, Multiple granularity, Multi-version schemes, Deadlock handling, Insert & delete operations, Concurrency in index structures.

### [8] RECOVERY SYSTEM

Failure classification, Storage structure, Recovery & Atomicity, Log-based recovery,Shadow paging, Recovery with concurrent transactions, Buffer management, Failure with loss of non-volatile storage, Advance recovery techniques.

### [9] DISTRIBUTED DATABASE

Security and Integrity of data base

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** "Data Base System Concepts", Henry F. Korth and A. slberschatz 2nd Edition, McGraw-Hill 1991.

**2)** An Introduction to Database Systems", C.J.Date, Pearson Publication


## D. COURSE OUTCOME

- To understand database architecture and different types of database users.
- To Create Entity-Relationship Diagram for the given system and to create normalized relational database from it with proper constraints.
- To install database on their machines and will be able to query,manipulate and manage it efficiently.
- To Understand concepts of Transactions, requirement of ACID properties, issues related to concurrency, deadlock transaction failure and recovery with their related protocols/solutions

**B. TECH. SEMESTER – III (CE)**

**SUBJECT: DESIGN OF DIGITAL CIRCUITS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code ESC302

## A. COURSE OBJECIVE

To acquire the basic knowledge of various digital logic components to understand digital electronics circuits. To prepare students to perform the analysis and design of various digital electronic circuits.

## B. DETAILED SYLLABUS

### [1] BINARY SYSTEMS

Introduction to Digital Computers and Digital Systems, Binary Numbers, Number Base Con- version, Octal and Hexadecimal Numbers, complements, binary Codes, Binary Storage and Registers, Binary Logic, Integrated Circuits.

### [2] BOOLEAN ALGEBRA AND LOGIC GATES

Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Opera- tions, Digital Logic Gates, IC Digital Logic Families.

### [3] SIMPLIFICATION OF BOOLEAN FUNCTIONS

The Map Method, Two and Three Variable Maps, Four-Variable Map, Five and Six Variable Maps, Product of Sums Simplification, NAND and NOR Implementations, Don't-Care Con- ditions, The Tabulation Method, Determination of Prime-Implicants, Selection of Prime-im- plicants, Concluding Remarks.

### [4] COMBINATIONAL LOGIC

Introduction, Design Procedure, Adders, Subtractors, Code Conversion, Analysis Procedure, Multilevel NAND Circuits, Multilevel NOR Circuits, Exclusive OR and Equivalence Functions.

### [5] COMBINATIONAL LOGIC WITH MSI AND LSI

Introduction, Binary Parallel Adder, Decimal Adder, Magnitude Comparator, Decoders, Multiplexers, Read-Only Memory (ROM), Programmable Logic Array (PLA), Concluding Remarks.

### [6] SEQUENTIAL LOGIC

Introduction, Flip-Flops, Triggering of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Flip-Flop Excitation Tables, Design Procedure, Design of Counters, Design with State Equations.

### [7] REGISTER, COUNTERS AND THE MEMORY UNIT

Introduction, Registers, Shift Registers, Ripple Counters, Synchronous Counters, Timing Se- quences, The Memory Unit, Examples of Random Access Memories.

### [8] DIGITAL INTEGRATED CIRCUITS

Introduction, Bipolar Transistor Characteristics, RTL and DTL Circuits, Integrated-Injection Logic, Transistor-Transistor Logic, Emitter-Coupled logic, Metal-Oxide Semiconductor, Complementary MOS.

### [9] VERILOG

Introduction, Overview of Digital Design with Verilog HDL, Gate-level Modeling ( full ad-dre, multiplexer, full substractor, comparator, decoder, demultiplexer, Flip-flops)

## C. RECOMMENDED TEXT / REFERENCE BOOKS

**1)** Digital Logic and Computer Design, M.Morris Mano

**2)** VERILOG HDL, Samir Palmitkar, Pearson Education

## D. COURSE OUTCOME

At the end of the course, students will be able to

- Understand, convert and examine the structure of various number systems and its application in digital design.
- Design and optimize Boolean functions and combination circuits.
- Understand, analyse and design sequential circuits.
- Apply the concept of finite state machines for digital system design

**B.TECH. SEMESTER – III (CE)**

**SUBJECT: PROBABILITY AND STATISTICS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 2 | 0 | 0 | 2 | 2 | 40 | - | - | - | 40 |

Reference Code BSC201

## A. COURSE OBJECTIVE

## B. DETAILED SYLLABUS

### [1] BASIC PROBABILITY

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

### [2] CONTINUOUS PROBABILITY DISTRIBUTION

Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

### [3] BIVARIATE DISTRIBUTION

Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

### [4] BASIC STATISTICS

Measures of Central tendency: Moments, skewness and Kurtosis – Probability distributions: Binomial, Poisson and Normal – evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
**2)** E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.
**3)** P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal BookStall, 2003.
**4)** S. Ross, "A First Course in Probability", Pearson Education India, 2002.
**5)** W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968.
**6)** N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications,

2010.
**7)** T. Veerarajan, “Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 2010.

## D. COURSE OUTCOME

**B. TECH. SEMESTER – III (CE)**
**SUBJECT: UNIVERSAL HUMAN VALUES**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 3 | 0 | 0 | 3 | 3 | 60 | - | - | - | 60 |

Reference Code HSMC301

## A. COURSE OBJECTIVE

This introductory course input is intended:

- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings
- facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

## B. DETAILED SYLLABUS

### [1] COURSE INTRODUCTION

**Need, Basic Guidelines, Content and Process for Value Education** Self Exploration– what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels

### [2] UNDERSTANDING HARMONY IN THE HUMAN BEING

**Harmony in Myself!** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya

### [3] UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY

**Harmony in Human-Human Relationship** Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha )- from family to world family!

### [4] UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE

**Whole existence as Co-existence :** Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence

### [5] IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONYON PROFESSIONAL ETHICS

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order

## C. RECOMMENDED TEXTBOOK/ REFERENCE BOOKS


**1)** R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professionalEthics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
**2)** JeevanVidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
**3)** Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
**4)** The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
**5)** Small is Beautiful - E. F Schumacher.
**6)** Slow is Beautiful - Cecile Andrews
**7)** Economy of Permanence - J C Kumarappa
**8)** Bharat Mein Angreji Raj - PanditSunderlal


## E. COURSE OUTCOME

- The students start exploring themselves: get comfortable with each other and with the teacher; they start appreciating the need and relevance for the course.

- The students are able to note that the natural acceptance (intention) is always for living in harmony, only competence is lacking!

- The students are able to present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.

- The students are able to grasp the right utilization of their knowledge in their streams of Technology/Engineering/Management/any other area of study to ensure mutual fulfilment. E.g. mutually enriching production system with rest of nature.

**B.TECH. SEMESTER – III (CE)**

**SUBJECT: ESSENCE OF INDIAN KNOWLEDGE TRADITION**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 2 | 0 | 0 | 2 | 0 | - | - | - | - | - |

Reference Code MC-2

## A. COURSE OBJECTIVE

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system. The course also focuses on Indian philosophical traditions, Indian linguistic Tradition, and Indian artistic tradition.

## B. DETAILED SYLLABUS

### [1] BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM

Ashtadashvidya, 4 - Ved, 4 - Upved, (Ayurved, dhanurved, gandharvved, sthapatya, etc), 6 – Vedang (shiksha, kalp, nirukti, vyakaran, jyotish, chhand) 4 upang (dharmshastra, mimansa, purana, tarkshastra)

### [2] MODERN SCIENCE AND INDIAN KNOWLEDGE SYSTEM

Relating modern science with Tradition Indian knowledge, Relevance of Indian Knowledge System

### [3] YOGA AND HOLISTIC HEALTH

Different types of Yoga, Role of Yoga in building holistic health

### [4] CASE STUDIES

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bha-van, Mumbai. 5 th Edition, 2014
2) Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3) Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
4) Fritz of Capra, Tao of Physics
5) Fritz of Capra, The Wave of life
6) VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation,Velliarnad, Arnakulam
7) GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi

Prakashan, Delhi 2016
**8)** RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan,Delhi 2016
**9)** P B Sharma (English translation), Shodashang Hridayan

## D. COURSE OUTCOME

At the end of the course, students should be able to,

- understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.
- learn holistic life stype of yogic science and wisdom.
- understand indian philosophical, linguistic and artistic traditions.

**B. TECH. SEMESTER – III (CE)**

SUBJECT: WEB DEVELOPMENT WORKSHOP

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 0 | 0 | 2 | 2 | 1 | - | - | 25 | 25 | 50 |

## A. COURSE OBJECTIVE

To learn basics to advanced concepts of Javascripts. To learn jQuery fundamentals To learn HTML, CSS, and JavaScript framework Bootstrap 5

## B. DETAILED SYLLABUS

### [1] JAVASCRIPT

Variable Naming Rules and JavaScript Data Types, let vs var, 'use strict', operators and expressions, Javascript – flow control (branching and looping)

### [2] JAVASCRIPT FUNCTIONS & ARRAYS

Javascript functions, function expression, and arrow functions. Javascript template literals, and tagged template literals, Javascript arrays, object literals and constructor functions, avascript: spread operator, destructuring arrays and objects, closure

### [3] DOM & BASIC JQUERY

### [4] BOOTSTRAP

Introduction to Bootstrap, Bootstrap Grid, Bootstrap Components, Bootstrap Plug-Ins

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Web Design with HTML, CSS, JavaScript and jQuery Set, by John Ducket, Wiley
**2)** Javascript: The Good Parts, first edition, by Douglas Crockford, O′Reilly
**3)** Bootstrap 4 quick start, by Jacob D. Lett, Bootstrap Creative


## D. COURSE OUTCOME

Students will be able to

- Develop familiarity with the JavaScript language.
- Learn to use best-practice idioms and patterns.
- Understand concepts commonly used in dynamic language programming, such as introspection, higher-order functions, and closures.
- Become adept at implementing client-side interfaces through the use of the DOM and jQuery
- Become familiar with common libraries and tools that are used in web application development at client side.

**B. TECH. SEMESTER – IV (CE)**

SUBJECT: DISCRETE MATHEMATICS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 0 | 4 | 4 | 60 | 40 | - | - | 100 |

Reference Code CS 401

## A. COURSE OBJECTIVE

The objective of this course is to teach students how to think logically and mathematically. The course stresses on mathematical reasoning and describes different ways in which mathematical problems could be solved. There are four thematic areas covered in this course: mathematical reasoning, combinatorial analysis, discrete structures, and mathematical modeling. Topics in this course include reccurence relation and generating functions,logic, set theory, counting, graph theory, trees, boolean algebra, and modeling computation.

## B. DETAILED SYLLABUS

### [1] SETS AND PROPOSITIONS

Combination, finite, uncountably infinite and infinite sets, mathematical induction, principles of inclusion and exclusion, propositions.

### [2] PERMUTATION, COMBINATION, DISCRETE PROBABILITIES

Rules of sums and products, permutations, combinations, generation, discrete probability, conditional probability, information.

### [3] RELATION AND FUNCTIONS

Relational model of data bases, properties of binary relations, equivalence relation, partitions, partial ordering, lattices, chains and antichains, functions and pigeon-hole principle.

### [4] GRAPHS

Basic terminology, multi- and weighted graphs, paths, circuits, shortest path, Eulerian path, Traveling Salesman problem, factors of a graph, planar graphs.

### [5] TREES

Trees, rooted trees, path length, prefix codes, binary search trees, spanning trees and cut- sets, minimum spanning trees, transport networks.

### [6] FINITE STATE MACHINE

FSM as models of physical systems, equivalent machines, FSM as language recognizer.

### [7] COMPUTABILITY AND FORMAL LANGUAGES

Russel's paradox and non-computability, ordered sets, languages, phrase structured grammars, types of grammars and languages.

### [8] DISCRETE NUMERICAL FUNCTIONS

Manipulations of numerical functions, asymptotic behavior, generating functions, combinatorial problems.

### [9] GROUP

Groups and sub-groups, generators, evaluation of powers, cosets, Lagrange's theorem, permutation group and Burnsides theorem, group codes, isomorphism, automorphism, homomorphism, normal subgroups, rings, integral domains and fields, ring homomorphism, polynomial rings and cyclic codes.

### [10] LATTICES AND BOOLEAN ALGEBRA

Lattices and algebraic systems, principle of duality, properties of algebraic systems, distributive lattices, boolean algebras, uniqueness, boolean functions and expressions, propositional calculus.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** "Elements of Discrete Mathematics", C.L. Liu, 2nd Ed., McGraw-Hill
**2)** "Modern Applied Algebra", Birkoff and Bartee, McGraw-Hill, CBS.
**3)** "discrete mathematics - a unified approach", stephen a. Wiitala, computer science series, mcgraw-hill.


## D. COURSE OUTCOME

Students will be able to:

- Solve counting problems based on set principles and operations.
- Apply counting principles to determine likelihood of the event under consideration.
- Demonstrate an understanding of relations and functions and be able to determine their properties.
- Model problems in Computer Science using graphs and trees.
- Model problems of counting using recurrence relations and generating functions
- Use finite-state machines to model computer operations

**B. TECH. SEMESTER IV (CE)**

**SUBJECT: DESIGN & ANALYSIS OF ALGORITHM**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS404

## A. COURSE OBJECTIVE

The subject is oriented towards importance of algorithm for solving any industry problem. It highlights how different algorithms for the same task affect the overall execution time. Various strategies to develop and analyze the algorithm were broadly covered in the subject. Use of suitable data structures in algorithm is also discussed. it also separates decision problems and optimization problems. It also covers recursive and non-recursive algorithms to solve the problem.

## B. DETAILED SYLLABUS

**[1] Introduction to algorithms**

**[2] Elementary Data structures**

**[3] Methods for solving recurrence relation for finding time complexity**

**[4] Overview of searching & sorting techniques**

**[5] The Greedy Methodology**

**[6] Dynamic Programming**

**[7] Graph Traversal & Searching**

**[8] Backtracking Techniques**

**[9] Branch & Bound Techniques**

**[10] Lower bound theory**

**[11] NP-Hard & NP-Complete problmes**

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia Pub.

**2)** Fundamentals of Algorithms by Brassard & Brately, PHI.

**3)** Introduction to Algorithms by Coreman, Tata McGraw Hill.

**4)** The art of Computer Programming Vol.I & III, Kunth, AddisionWesley.

## D. COURSE OUTCOME

- Develop efficient and effective computer algorithm.
- Analyze algorithms and estimate their worst-case and average-case behavior.
- This will help for development of efficient and optimized software and problem solving approach.
- Apply their theoretical knowledge in practice (via the practical component of the course).

**B. TECH. SEMESTER – IV (CE)**

SUBJECT: COMPUTER SYSTEM ARCHITECTURE

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS402

## A. COURSE OBJECTIVE

The objective of this course is to learn the structure and Functions of various components of the CPU. It is focused on various ways to represent the data and instructions, basic design of the ALU,Control Unit, Designing of the registers. To learn the basic concepts of pipelining and Interfacing of IO device and memory with the CPU.

## B. DETAILED SYLLABUS

### [1] BASIC FUNCTIONAL BLOCKS OF A COMPUTER

CPU, memory, input-output subsystems, control unit, datapath design, interconnection structure, register transfer language, register transfer, bus and memory transfers, arithmetic logic shift unit

### [2] DATA REPRESENTATION

Signed number representation, fixed and floating point representations, character representation, IEEE 754 standard of representation

### [3] BASIC COMPUTER ORGANIZATION AND DESIGN

Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory reference instructions, I/O instructions, design of accumulator logic.

### [4] DATAPATH DESIGN

Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier, carry save multiplier, etc. Division - non-restoring and restoring techniques, floating point arithmetic

### [5] CONTROL UNIT DESIGN

Hardwired control, micro programmed control, nano programmed control

### [6] PROGRAMMING THE BASIC COMPUTER

Introduction, machine language, assembly language, the assembler, program loops, programming arithmetic and logic operations, subroutines, I/O programming.

### [7] CENTRAL PROCESSING UNIT

Register organization, stack organization, instruction format, addressing mode, data transfer and manipulation, program control, RISC processors.

### [8] PIPELINING

Basic concepts of pipelining, throughput and speedup, pipeline hazards.

### [9] INPUT OUTPUT ORGANIZATION

Peripheral devices, I/O interface, asynchronous data transfer, modes of transfer, priority interrupt, DMA, I/O processors, serial communication

### [10] MEMORY ORGANIZATION

Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policy.

**[11] CASE STUDY :** 8085 MICROPROCESSOR

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Computer System Architecture by Morris Mano, 3rd Ed., PHI
**2)** Computer Architecture and Organization by John P. Hayes, Computer science series, McGRAW-HILL
**3)** Microprocessor Architecture, Programming and Applications With The 8085 by R.S. Gaonkar 5thEd., CBS Publisher
**4)** Computer Organization and Design: The Hardware/Software Interface by David A. Patterson andJohn L. Hennessy, Elsevier.
**5)** Computer Organization by Carl Hamachar, Zvonco Vranesic and Safwat Zaky, McGraw Hill.
**6)** Computer Organization and Architecture: Designing for Performance by William Stallings, Pear-son Education.


## D. COURSE OUTCOME

- The students will be able to: Design the ALU using the register level components.
- Students will be able to design the control unit for the basic instruction set.
- Students will be able to understand how the interrupts and DMA is used when dealing with the peripheral devices.
- Students will be able to understand the interfacing between various level of memories with the CPU.

**B. TECH. SEMESTER – IV (CE)**

**SUBJECT: JAVA TECHNOLOGIES**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS503

## A. COURSE OBJECTVE

The objective of this course is to equip the learners with the core and advanced features of contemporary Java which would enable them to work with complex programs related to managing data and processes over the network and also to make the students familiar with the concepts of hibernate and Spring Frameworks.

## B. DETAILED SYLLABUS

### [1] LANGUAGE FUNDAMENTALS

The Java Environment: Java Program Development, Java Source File Structure, Compilation Executions,Basic Language Elements: Lexical Tokens, Identifiers, Keywords, Literals, Com- ments, Primitive Data-types, Operators

### [2] CLASSES & OBJECTS IN JAVA

Class, Object and Object reference, Object Life time and Garbage Collection, Creating and Operating Objects, Constructor and initialization code block, Access Control, Modifiers, Nested class, Inner Class, Anonymous Classes, Abstract Class and Interfaces, Defining Methods, Method Overloading, Dealing with Static Members, Use of “this” reference, Use of Modifiers with Classes & Methods.

### [3] IMPLEMENTING INHERITANCE & POLYMORPHISM

Types of Inheritance in Java, Inheriting Data Members and Methods, Role of Constructors in inheritance, Overriding Super Class Methods, Use of “super”, Polymorphism in inheritance, Type Compatibility and Conversion, Implementing interfaces.

### [4] PACKAGE

Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages, Import and Static Import, Naming Convention for Packages

### [5] EXCEPTION HANDLING

Exceptions & Errors, Types of Exception, Control Flow In Exceptions, JVM reaction to Exceptions, Use of try, catch, finally, throw, throws in Exception Handling, In-built and User Defined Exceptions, Checked and Unchecked Exceptions

### [6] ARRAY & STRING HANDLING

Array basics, String Array, String class, StringBuffer and StringBuilder class, String Tokenizer Class and Object Class

## [7] MULTI-THREADED PROGRAMMING

Understanding Threads, Needs of Multi-Threaded Programming, Thread Life-Cycle, Thread Priorities, Synchronizing Threads, Inter Communication of Threads

## [8] INPUT/OUTPUT OPERATION IN JAVA

Streams and the new I/O Capabilities, Understanding Streams, The Classes forInput and Output, The Standard Streams, Working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File, Channel, Serializing Objects

## [9] COLLECTION FRAMEWORK & GENERICS

Collections of objects, Collections: Sets, Sequence, Map, Understanding Hashing, Use of Array List & Vector, Generics Class, Lamda Expression, Functional Reference, Method Reference, Optional Classes, Processing data with streams

## [10] NEW APIS (JAVA 8) AND JDBC CONCEPTS

Lambda Expressions, Method References, Default method, Stream API, Date Time API

Introduction to Java Database Connectivity(JDBC), Types of JDBC Drivers, Steps to createJDBC Application, JDBC API Classes and Interfaces

## [11] INTRODUCTION TO JAVAEE

Web Server, N-tier Architecture, Introduction to web Container and Structure of web Application

## [12] JAVA SERVLETS

A simple Web Application, HTTP Protocol, Servlet Interface, Servlet LifeCycle, Servlet Configuration and Exceptions, Servlet Request and Responses, Session Tracking with JavaServlet, Servlet Context, Servlet Listeners

## [13] JAVA SERVER PAGES

Introduction to JSP, its lifecycle, Scripting Elements, Comments, Implicit objects, JSP Directives, JSP Standard Actions and JSTL

## [14] HIBERNATE FRAMEWORK

Introduction to O-R Mapping Hibernate Basics, Hibernate Architecture, Hibernate Configurations, POJO (Plain Old Java Objects) classes and O/R Mapping Object Identifier, Hibernate mapping (One-to-One Association, One-to-Many Association Many-to-One Association, Many-to-Many Association, Collection Mapping, Component mapping), Inheritance Mapping, Hibernate Query Language, Criteria Queries, Hibernate in Web Application.

## [15] SPRING FRAMEWORK

Introduction, The IoC Container and Beans, The Application Context, Dependency

Injection, Data Validation and Type Conversion, Package Dependencies and Build Tool (Maven /Gradle), Spring Boot with Initializer, Test Driven development with Spring Boot, Aspect Oriented Programming, Spring Web MVC, Spring and Persistence, Securing a Web Application

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Core Java Volume I –Fundamentals, 8th Edition by Cay Horstmann and Gray Cornell, PearsonEducation

**2)** Java 8 in Action: Lambdas, Streams, and Functional-style Programming by Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft, Manning publications

**3)** Professional Java Server Programming by Subrimanyan & Cedric, SPD Publications

**4)** Spring in Action , 5th edition , by Craig Walls, MANNING Publications

**5)** Hibernate in Action by Christian Bauer and Gavin King, MANNING Publications

**6)** Thinking in Java by Bruce Eckel, 4thEd., Pearson Education.

**7)** Learning Java by By Patrick Niemeyer and Jonathan Knudsen, 4thEd., O‟reilly Media.

**8)** Head First Servlets and JSP, 2nd edition, by Bert Bates, Kathy Sierra & Bryan Basham, O'ReillyMedia.

**9)** J2EE Complete Reference, James Keogh, TMH.


## D. COURSE OUTCOME

At the end of the course, the students will be able to:

- Acquire quality knowledge of the features of core Java.
- Apply the advance concepts of Java programming with database connectivity.
- Design and develop platform independent applications using a variety of component based frameworks.
- Implement the concepts of Hibernate and Spring for the rapid development of enterprise applications.

**B. TECH. SEMESTER – IV (CE)**

**SUBJECT: VISUAL TECHNOLOGY**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS503

## A. COURSE OBJECTIVE

The objective of this course is to introduce event-driven programming language Visual C++. The course aims on developing application using document/view architecture, dialogue based applications and reusable component development. Emphasis of the course is on hands-on programming experience with Visual C++ in building real world data driven applications.

## B. DETAILED SYLLABUS

### [1] INTRODUCTION

Introduction to Windows programming, introduction to VC++ IDE

### [2] WINDOWS GUI PROGRAMMING

Messages (Message passing and handling), GDI Objects (Pen, Brush, etc.), Mouse Handling

, Keyboard Handling, Mapping Modes, Menu, Tool bar and Status bar, Scrolling and Split-ting views

### [3] DOCUMENT/VIEW ARCHITECTURE

Serialization ( storing and retrieving to and from disk)

### [4] MULTI-THREADED PROGRAMMING

### [5] DIALOG BASED APPLICATION

Model and Model-less dialogues, Windows dialog controls, Buttons, Edit box, Check box, Radio Button, combo box, list box, Animation control, spin control, slider control, Tree view control, List view control.

### [6] ACTIVE X CONTROL

Using Active X control, Creating Active X control

### [7] DATABASE CONNECTIVITY USING DAO

### [8] DLL DEVELOPMENT

## C. RECOMMENDED TEXT / REFERENCE BOOKS

**1)** Mastering Visual C++ 6.0, By: Michael J. Young.
**2)** Programming with microsoft visual c++ 6.0, by devid j. kruglicnski, george shepherd., scot wings.

## D. COURSE OUTCOME

- Create windows GUI based applications.
- Create Document / View Architecture and Multithreaded applications in VC++.
- Create Dialog based application using various controls.
- Create data driven applications and DLL development.

**B. TECH. SEMESTER – IV (CE)**

**SUBJECT: SOFTWARE ENGINEERING PRINCIPLE AND PRACTICES**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS-S

## A. COURSE OBJECTIVE

The objective of the course is to understand software engineering, types of software requirements, variuos traditional process models, agile process models, software testing etc. Students will also learn various UML diagrams and will learn various design guidelines. Students will learn how to prepare good softwarte requirement specification document. They will learn various types of software testing techniques. Concepts of SCM, version management, DevOps and various software development platforms will also be taught.

## B. DETAILED SYLLABUS

### [1] INTRODUCTION TO SOFTWARE ENGINEERING

### [2] PROCESS MODELS

Traditional Models, Unified Process models and Agile Models

### [3] PROCEDURAL MODELING

Requirement engineering: Requirement engineering Process, Eliciting requirements, SRS, Design concepts and principles, Architectural design, User interface design, Component level design, Deployment-level Design Elements

### [4] OBJECT ORIENTED MODELING

Classes, Object, UML Diagrams: Use case, Sequence, Class, State, Activity, Sequence, Component, and Deployment.

### [5] TESTING STRATEGY AND TACTICS

Software Testing strategies, White box testing, Basis path testing, Control structure testing, Black box testing, Object oriented testing.

### [6] AGILE SOFTWARE DEVELOPMENT

Scrum, Xtreme Programming, Continuous Integration and Continuous Delivery, Test driven development.

### [7] VERSION CONTROL AND SOFTWARE DEVELOPMENT PLATFORM

Version Control and change management, git, introduction to online tools and platforms, GitHub, Jira, DevOps, Azure, and Jenkin

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Software Engineering, Pressman, McGraw-Hill, 1992
**2)** Object oriented modeling and design with UML, M. Blaha and J. Rumbaugh
**3)** Agile Software Development with SCRUM, Ken Schwaber and Mike Beedle
**4)** Grady Booch, Object Oriented Analysis & Design, Benjamin/Cummings, 1994


## D. COURSE OUTCOME

- Understand software engineering concepts
- Understand various types of software requirements and prepare software requirement specification document
- Learn how to draw various diagrams and prepare design document
- Understand various agile principles and learn various agile process models
- Know software testing and various types of testing
- Learn the concepts of DevOps, SCM and various software development platforms.

**B. TECH. SEMESTER – IV (CE)**

SUBJECT: SOFTWARE PROJECT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 0 | 0 | 2 | 2 | 1 | - | - | 25 | 25 | 50 |

## A. COURSE OBJECTIVE

* Understand tools and technology required to develop software applications.
* Build a full stack web applications.

## B. DETAILED SYLLABUS

### [1] PROJECT BASED LEARNING

- Student at the beginning of a semester may be advised by his/her supervisor (s) for recommended courses.
- Students will work together in a team (at most three)
- Students are required to get approval of project definition from the department.
- After approval of project definition students are required to report their project work on weeklybasis to the respective internal guide.
- Project will be evaluated at least once per week in laboratory Hours during the semesterand finalsubmission will be taken at the end of the semester as a part of continuous evaluation.

## C. RECOMMENDED TEXT / REFERENCE BOOKS

NA

## D. COURSE OUTCOME

- Use REST framework for web application development
- Learn programming language (Python) for web application development.
- Learn to develop front end back end codes and interface it with the application.
- Testing of the web application.

BACHELOR OF TECHNOLOGY

# COMPUTER ENGINEERING

# SYLLABI BOOK

## 3rd Year B.Tech. Program

**With effect from 2022-23**

Department of Computer Engineering
Faculty of Technology
Dharmsinh Desai University
Nadiad – 387 001, Gujarat, India.

http://www.ddu.ac.in

## B. Tech. Semester V

| SUBJECTS | Teaching Scheme | | | Total | Credit | Examination Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Th | Tut | Pract | | | Th | Sess | TW | Prac | Total |
| **Microprocessor Fundamental and Programming** | **3** | **1** | **2** | **6** | **5.0** | 60 | 40 | 25 | 25 | 150 |
| **Open Elective – I (Web Application Development)** | **2** | **0** | **2** | **4** | **3.0** | 40 | - | 25 | 25 | 90 |
| **Operating Systems** | **4** | **0** | **2** | **6** | **5.0** | 60 | 40 | 25 | 25 | 150 |
| **Advanced Algorithms** | **4** | **0** | **2** | **6** | **5.0** | 60 | 40 | 25 | 25 | 150 |
| **Advanced Technologies** | **3** | **1** | **2** | **6** | **5.0** | 60 | 40 | 25 | 25 | 150 |
| **Smart Device Programming** | **0** | **1** | **2** | **3** | **2.0** | - | - | 25 | 25 | 50 |
| | 16 | 3 | 12 | 31 | 25.0 | 280 | 160 | 150 | 150 | 740 |

## B. Tech. Semester VI

| SUBJECTS | Teaching Scheme | | | Total | Credit | Examination Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Th | Tut | Pract | | | Th | Sess | TW | Prac | Total |
| **Professional Elective - II** | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| **Theory of Automata and Formal Languages** | 3 | 1 | 0 | 4 | 4.0 | 60 | 40 | - | - | 100 |
| **Open Elective – II (Web Service Development)** | 2 | 0 | 2 | 4 | 3.0 | 40 | - | 25 | 25 | 90 |
| **Machine Learning** | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| **Computer Networks** | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| **System Design Practice** | 0 | 1 | 2 | 3 | 2.0 | - | - | 25 | 25 | 50 |
| | 17 | 2 | 10 | 29 | 24.0 | 280 | 160 | 125 | 125 | 690 |

**B. TECH. SEMESTER – V (CE)**

**SUBJECT: MICROPROCESSOR FUNDAMENTALS & PROGRAMMING**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 3 | 1 | 2 | 6 | 5.0 | 60 | 40 | - | - | 100 |

Reference Code CS502

## A. COURSE OBJECTIVE

To introduce students with the architecture and operation of typical microprocessors and microcontroller. To familiarize the students with the programming and interfacing of microprocessors. To provide foundation for designing real world applications using microprocessors and microcontroller.

## B. DETAILED SYLLABUS

**[1] Introduction**

Basic micro-processor architecture, ALU, registers, system bus, Peripherals. Introduction to assembly language.

**[2] 8086 ASSEMBLY LANGUAGE PROGRAMMING TECHNIQUES**

Objectives, Program Development Steps, Constructing the Machine Codes for 8086 Instructions, Writing Programs for Use with an Assembler, Assembly Language Program Development Tools, Flags, Jumps and WHILE-DO Implementation, REPEAT-UNTIL Implementation and Examples, Debugging Assembly Language Programs

**[3] IF-THEN-ELSE STRUCTURES, PROCEDURES & MACROS**

Objectives, IF-THEN, IF-THEN-ELSE, & Multiple IF-THEN-ELSE Programs, Writing and Using Procedures, Writing and Using Assembler Macros.

**[4] 8086 INSTRUCTION DESCRIPTION & ASSEMBLER DIRECTIVES**

Instruction Description, Assembler Directives.

**[5] 8086 SYSTEM CONNECTIONS, TIMING AND TROUBLESHOOTING**

Objectives, 8086 Hardware Review, Addressing Memory and Ports in Microcomputer Systems, 8086 Timing Parameters, Troubleshooting a Simple 8086-based Microcomputer

**[6] Interfacing**

Interfacing RAM, ROM and I/O with the microprocessor

**[7] INTERRUPTS AND INTERRUPT SERVICE PROCEDURES**

Objectives, 8086 Interrupts and Interrupt Response, Hardware Interrupt Applications

**[8] GENERAL-PURPOSE PROGRAMMABLE PERIPHERAL DEVICES**

Basic Programming Concepts & Programmable Devices
•8259 - Programmable Interrupt Controller
•8251 - Programmable Interface device - Serial I/O
•8255 - Programmable Peripheral Interface
•8254 - Programmable Interval Timer
•8279 – Programmable Keyboard/Display Interface
•8237 - DMA Controller

**[9] Introduction to Microcontroller**

8051 architecture, pin diagram, instruction set, memory interfacing

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Microprocessors And Interfacing (Programming & Hardware), Douglas V. Hall, McGraw Hill

**2)** 8086 Prrogramming and Advance Processor Architecture, M. T. Savaliya, WIND Series, 2012

**3)** INTEL MICROPROCESSORS 8086/8088, 80186/80188, 80286, 80386, 80486, PENTIUM AND PENTIUM PRO PROCESSORBY BARRY B. BREY

**4)** Architecture, Programming & applications with 8085/8-8080A, R. S. Gaonkar

**5)** 8051 Microcontroller. by K.J.Ayela, Penron publication


## D. COURSE OUTCOME

After completion of the course, students are expected to be able to

- Visualize and understand different instruction formats and addressing modes
- Comprehend the key components of various architectures
- Demonstrate assembly language programming proficiency
- Develop interface logic for interconnection of peripheral devices with microprocessor and microcontroller
- Design solutions of real world applications in the relevant field

## B. TECH. SEMESTER – V (CE)
## SUBJECT: WEB APPLICATION DEVELOPMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 2 | 0 | 2 | 4 | 3.0 | 40 | - | 25 | 25 | 90 |

## A. COURSE OBJECTIVE

The objective of this course is to make the students familiar Web Application Development. The subject provides knowledge of .NET framework and .NET core architecture along with the knowledge of core C# language. The emphasis is given on building real world data driven applications. The ORM entity framework should be used while building web applications. The students will understand the complete application life cycle of a web application starting from designing to deployment on a local server.

## B. DETAILED SYLLABUS

**[1] .NET Framework**

Architecture, Assembly development, Page life cycle of ASP.NET web application, Introduction to Visual Studio Editor, Web application development using server controls, State management for ASP.NET web application, Data driven ASP.NET web application using ORM (EF)

**[2] Programming in C#**

Environment, Literals, Variables and Data Types, Operators and Expressions, Handling arrays, Manipulating strings, Classes and objects, Inheritance, Interfaces, Delegates, Lambda Expression, LINQ, Events, Exception handling, Asynchronous programming

**[3] .NET Core**

Middleware And Request Pipeline in ASP.NET Core, .NET Core MVC, MVC Pattern, Routing, Razor, Model Validation, Test Driven Development, Tag helpers, Debugging, Tracing and Logging.

**[4] Deployment**

Deployment of .NET application to IIS, Deployment of .NET application to Cloud server

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**(1)** Beginning ASP.NET 4.5 in C#. Author : Matthew Macdonald, Publisher : Apress

**(2)** Pro. ASP.NET Core MVC Sixth Edition, Author : Adam Freeman, Publisher : Apress

**(3)** Professional C# 7.0 and .NET Core 2.0, Author : Christian Nagel, Publisher : Wrox

**(4)** ASP.NET Core in Action, Author : Andrew Lock, Publisher : MANNING


## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- Develop assembly(dll/exe) applications

- Design and develop database driven web applications using .NET Framework
- Construct amplifiers with active loads along with the Study of frequency response of all amplifiers
- Design and develop dynamic, cross-platform web applications using .NET Core and MVC design patterns.
- Utilize EF Core ORM for powering .NET Core driven web applications.
- Host web application into IIS and cloud environments.

## B. TECH. SEMESTER – V (CE)
## SUBJECT: OPERATING SYSTEM

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS513

## A. COURSE OBJECTIVE

To introduce students with the basic concepts of operating systems. To make students aware about details of Process management and synchronization issues. To provide detailed understanding of process based deadlocks and various aspects of memory management. To familiarize students about file and disk management aspects

## B. DETAILED SYLLABUS

**[1] Introduction**

What is an OS?, Simple Batch Systems, Multi programmed Batched Systems, Time Sharing Systems, Personal-Computer Systems, Parallel Systems, Distributed Systems, Real-Time System

**[2] Computer-System Structure**

Computer-System Operation, I/O Structure, Storage Structure, Storage Hierarchy, H/W protection, General System Architecture

**[3] Operating Systems Structures**

System components, OS services, System calls, System programs, system structure, Virtual machines, System Design & implementation, System Generation

**[4] Processes**

Process concept, Process Scheduling, Operation on Processes, Cooperating processes, Interprocess Communication

**[5] CPU Scheduling**

Basic concepts, Scheduling criteria, Scheduling algorithms

**[6] Process Synchronization**

Background, The critical-section Problem, Synchronization H/W, Semaphores, classical problems of synchronization, Critical Regions, Monitors

**[7] Deadlocks**

System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from deadlocks, Combined Approach to deadlock handling

**[8] Memory Management**

Background, Logical versus Physical Address space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging

**[9] Virtual Memory**

Background, Demand Paging, Performance of Demand Paging, Page Replacement, Page-replacement algorithms, Allocation of frames, Thrashing, Other Considerations, Demand segmentation

**[10] File-System Interface**

File concept, Access methods, Directory Structure, Protection, Consistency semantics

**[11] File-System Implementation**

File-System Structure, allocation methods, Free-space Management, Directory Implementation, Efficiency and performance, Recovery

**[12] I/O Systems**

Overview, I/O H/W, Application I/O interface, Kernel I/O subsystem, Transforming I/O Requests to H/W operations. Performance

**[13] Secondary-Storage Structure**

Disk Structure, Disk scheduling, Disk Management, Swap-space management, Disk reliability

**[14] Distributed System Structures**

Network operating Systems, Distributed Operating Systems, Remote services, Robustness, Design issues

**[15] Distributed File Systems**

Features of good DFS, Naming and Transparency, Remote File Access, Stateful Versus stateless service, File replication, Example systems

**[16] Case studies on:**

1. UNIX operating system
2. LINUX operating system
3. Windows NT

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Operating Systems, internals and design principles by William Stallings, PHI

**2)** Operating System Concepts : Silbertschatz, Galvin, Addison Wesley.

**3)** Modern Operating System : Design and Implementation Tanenbaum, PHI

**4)** Operating system Concepts : Milan Malinkovic, TMI

## D. COURSE OUTCOME

After completion of the course students will develop

- Ability to understand detailed concepts of operating systems
- Detailed understanding of the ways in which processes are handled by the operating system
- Ability to understand and analyse different aspects of memory management
- In depth knowledge of file system structures, disk operations and various algorithms related to operating systems.

**B. TECH. SEMESTER – V (CE)**

**SUBJECT: ADVANCED ALGORITHMS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS514

## A. COURSE OBJECTIVE

The subject focuses on Advancement in Algrotihms along with its applicability and time complexity. It disucusses pattern searching algorithms. Gemetric algorithms highlights how to find convex Hull from the set of points in the 2-D plane and how to check itersection of two line segements in air-line traffic control. It elaborates the importance of Approximate algorithms for industry problems where exact solution is not possible. Obejctiveof Theory of reduction is to use solution of one problem for another problem

## B. DETAILED SYLLABUS

**[1] Randomized Algorithm :**
Probability and random variables, Probabilistic analysis, Randomized algorithms, Monte Carlo Algorithm, Las Vegas Algorithm, Primality Testing algorithms.

**[2] Flow Network :**
Max Flow Problem, Max Flow - Min Cut duality, Ford Fulkerson Algorithm, Various algorithms to solve Max-Flow problem, Applications of Network Flow problems.

**[3] String Algorithms**
Naive String Matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm

**[4] Computational Geometry :**
Line-Segment properties, Determine intersection between line segments, Finding Convex Hull, Finding Closest pair of points.

**[5] Reduction**
Theory of reduction, Linear time reduction, Polynomial time reduction, Identifying lower bound using reduction

**[6] NP-Hard and NP-Complete Problems**
Unsolvable problem classes, NP-Hard Problems, Proving a problem NP-Hard, NP-Complete Problems, NP-Completeness proof

**[7] Linear Programming :**
Standard and slack form, Formulating problem as linear programs, The simplex algorithm, Duality, basic feasible solutions.

**[8] Approximation Algorithm**

Approximation technique to solve hard problems, randomization and linear programming based approximation, Polynomial time approximation

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Introduction to Algorithms, Thomas H. Corman, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, Third addition, PHI Learning private ltd.
2) Fundamentals of computer algorithms, Second Edition, Ellis Horowitz, Sartaj Sahni, S. Rajasekaran, Universities Press
3) Fundamentals of Algorithmics, Gilles Brassard, Paul Bratley, PHI Learning private ltd
4) Algorithm Design, Pearson/Addison-Wesley, Jon Kleinberg, Eva Tardos, Addison-Wesley


## D. COURSE OUTCOME

- The students will be able to interprete and be able to apply the algorithms in various ways to solve industry problems
- Students can do performance comparisons of various algorithms for the same problem
- Students can do Mathematical model formulation of the industry problem using the principles of Operation Research
- Students can think in the direction of approximate solution when exact solution is hard or impossible to achieve.

**B. TECH. SEMESTER – V (CE)**

**SUBJECT: ADVANCED TECHNOLOGY**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 3 | 1 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS515

## A. COURSE OBJECTIVE

- The main goal of the subject is to learn advance concepts, technologies and tools in web application development.
- The emphasis is on developing cross platform web application which uses web services.

## B. DETAILED SYLLABUS

[1] **JSON:**
Introduction, advantages, syntax, datatypes, objects and schema

[2] **AJAX:**
Introduction, Browsers support, Action, XMLHttpRequest,

[3] **JQuery:**
Introduction, selectors, attributes, traversal, CSS, DOM, Events, AJAX and effects

[4] **Node.js:**
Introduction to Node.js, Using events, listeners, timers and callbacks, buffers, streams, file system, Express.js framework, Mongoose module, Working with Data and Socket services, Processes and Clusters

[5] **No SQL:**
Introduction to No SQL database, pros and cons of NoSQL, Types of NoSQL databases

[6] **MongoDB:**
Introduction, designing database, queries, projection, indexing, aggregation, replication and Sharding.

[7] **TypeScript:**
Introduction, types, variables, operators, functions, strings, arrays, tuples, union, interfaces, classes, objects, namespaces, modules.

[8] **Angular:**
Introduction, architecture, components, modules, directives, data and event binding, templates, pipes, forms, routing, dependency injection, services, testing, materials.

[9] **React.js**:
Introduction, ES6, JSX, components, state, lifecycle, props, forms, events, refs, keys, router, flux, redux, saas.

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) "Pro Angular" by Adam Freeman, 3rd Edition, Apress Publication

2) "Beginning Node.js, Express and MongoDB Development" by Greg Lim

3) "MongoDB in Action" by Kyle Banker, Peter Bakkum, et al., 2nd Edition, Manning Publication

4) "Beginning jQuery: From the Basics of jQuery to Writing your Own Plug-ins" by Jack Franklin and Russ Ferguson, 2nd Edition, Apress publication

5) "Learning React: Functional Web Development with React and Redux" by Alex Banks and Eve Porcello, O'reilly Publication

6) "Node.js in Action" by Alex Young, Bradley Meck et al., 2nd Edition, Manning Publication

7) "Pro React 16" by Adam Freeman, 1st Edition, Apress publication

8) "React Quickly: Painless web apps with React, JSX, Redux, and GraphQL" by Azat Mardan, Manning Publication

## D. COURSE OUTCOME

At the end of the course students will be able to

- Design rich and interactive user interface using Angular/React. Build dynamic web pages using Angular/React (client-side), Node.js (server side) and MongoDB (NoSql database).

## B. TECH. SEMESTER – V (CE)
## SUBJECT: SMART DEVICE PROGRAMMING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 0 | 1 | 2 | 3 | 2.0 | - | - | 25 | 25 | 50 |

Reference Code CS

## A. COURSE OBJECTIVE

The Objective of this course is to expose students to programming of various smart devices. This will help students to use the computational power of ubiquitous smart devices to solve real world problems. This will help students to create applications which can easily reach masses.Students will be able to write code once and use the same code to create applications for different platforms.

## B. DETAILED SYLLABUS

**[1] Programming Framework**
Introduction to Dart programming language and Flutter framework. Installation of Flutter

**[2] DART - Programming**
Data types, variables, operators and decision making (branching and looping)

**[3] DART - Programming**
Functions and classes, Nullability and Collections

**[4] Dart – Programming**
Asynchronous programming, concurrency and unit testing

**[5] FLUTTER**
Introduction to Widgets, Layouts and gestures, State management

**[6] FLUTTER**
Connectivity with the database and automated testing, Packages and access to REST APIs

**[7] FLUTTER**
Controlling smart devices (like lamp or fan) using applications developed with the Flutter framework. Deployment of the Flutter application.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Dart Apprentice, first edition, by Jonathan Sande & Matt Galloway
**2)** Quick Start Guide to Dart Programming, by Sanjib Sinha, Apress
**3)** Beginning App Development with Flutter, by Rap Payne, Apress
**4)** Flutter Apprentice, by Kevin D Moore, Michael Katz and Vincent Ngo


## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- write programs using Dart programming language
- develop applications using Flutter framework for android, ios, macos, windows and linux

platforms

- connect to database and access REST APIs from application developed using Flutter
- write automated test cases for testing their Flutter code and be able to deploy their application on various platforms
- control smart hardware devices like lamps and fans from Flutter application

**B. TECH. SEMESTER – VI (CE)**

**SUBJECT: ADVANCED COMPUTER ARCHITECTURE**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS610

## A. COURSE OBJECTIVE

- To get familiarity with 8087 Math Co-Processor and Maximum mode of 8086
- To understand advanced processor architectures like 80286, 80386 and Protected Virtual Addressing Mode, segmentation,paging.
- To understand Parallel Processing techniques like loop splitting, expression splitting using shared memory and multipleprocesses
- To learn about pipelining, its issues and solutions, parallel processor architectures.
- To learn Parallel algorithms like Bitonic sorting, Gauss Elimination for solving system of Linear equations and to evaluateperformance of the algorithms

## B. DETAILED SYLLABUS

- 8086 Maximum Mode Operation, Signal Description, 8087 Math Co-Processor, Architecture of 8087 Floating PointProcessor, Pin Functions of 8087,Register Set-Control Word Register, Status Word Register, Tag Word Register, Stack Registers, Instruction Set and Programming.
- 80286 Processor Architecture, Pin Functions, Register set-Programmer Invisible Registers, Features of 80286, Real Addressing Mode, Protected Virtual Addressing Mode-Protection Level Mechanisms for Code and Data, Segmentation in Protected Mode, Instruction Set and features of 80287.
- 80386 Processor Architecture, Pin Functions, Register set-General Purpose, Debug Registers, Test Registers, EFLAG, Control Registers Features of 80386, Real Addressing Mode, Protected Virtual Addressing Mode-Protection, Multitasking, Interrupt Handling, Segmentation, Paging Mechanism in PVAM, Instruction Set, Addressing Mode, Virtual 8086 Mode.
- Features of 80486 Processor, Cache Types-L1, L2 cache, TLB, M-Way Set Associative Cache Organization, Differences between 80386 and 80486. Pentium Processor Architecture and Features, Memory Management Unit of Pentium, New Instructions of Pentium, Features of Pentium PRO, Pentium2 and Pentium 4.

- Parallel Processing
  Introduction, Different Types of Parallelism, Pipelining, Hazards-Structural, Data, Control hazard, Super-pipelining, Super Scalar Architecture, BTB(Branch Target Buffer), BPB(Branch Prediction Buffer), Distributed Memory, Shared Memory, Symmetric Multiprocessing, Array Processors, Vector Processors, Systolic Arrays.

- Programming using Shared Memory

- Loop Splitting, Self Scheduling, Contention or Race Conditions in Parallel Computing, Solution to Contention using Spin Locks, Expression Splitting, Indirect and Block Scheduling, Barriers.

- Parallel Algorithm Design and Analysis- Sorting, Searching, Matrix Multiplication, Solving System of Linear Equations etc.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) INTEL MICROPROCESSORS 8086/8088, 80186/80188, 80286, 80386, 80486, PENTIUM AND PENTIUM PRO PROCESSOR BY BARRY B. BREY
2) Walter A. Tribal, The 80386, 486 and Pentium Processor
3) "Parallel Computers Architecture and Programming", V.Rajaraman, C. Siva Ram Murthy, PHI, New Delhi
4) Parallel Processing By Stevens Brawer
5) Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar "Introduction to Parallel Computing", Second Edition, Addison Wesley, 2003. ISBN: 0-201-64865.
6) Advance Microprocessor and Peripherals –by A K RAY, K M BHURCHANDI, Second-Edition, The McGraw-Hill
7) S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.
8) F.T.Leighton, "Introduction to Parallel Algorithms and Architectures: Arrays, Trees, Hypercubes", MK Publishers, San Mateo California, 1992.
9) Wilkinson, M.Allen,"Parallel Programming Techniques and Applications using networked workstations and parallel computers", Prentice Hall, 1999.
10) Michael J. Quinn, "Parallel computer theory and practice", McGraw Hill, Second Edition, 1994


## D. COURSE OUTCOME

- To be able to make programs using instructions of 8087

- To learn and implement shared memory multi-programming
- To learn about advanced processor architectures
- To learn about MPI (Message passing Interface) library and to make programs using that.
- To learn, analyze working of Parallel Algorithms and its issues, limitations, overheads etc.

## B. TECH. SEMESTER – VI (CE)
## SUBJECT: NETWORK & INFORMATION SECURITY

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS618

## A. COURSE OBJECTIVE

- To make students aware about the goals and issues of network and information security
- To teach various security algorithms and necessary mathematical concepts
- To make students aware about how to enhance the security while transmiting data over network and how security at different layers of Network Model are required to realize the overall security

## B. DETAILED SYLLABUS

**[1] Conventional Encryption**
Conventional Encryption Model, Steganography, Classical Encryption Techniques

**[2] Conventional Encryption Techniques**
Simplified Des, Block Cipher Principles, Data Encryption Standards, Differential And Linear Cryptography Principles, Block Cipher Design Principles, Modes Of Operations, Algorithms Like Triple Des, International Data Encryption Algorithm, Blowfish, Rc5, Cast-128, Rc2, Characteristics Of Advanced Symmetrical Block Cipher, Issues Of Conventional Encryption Like Traffic Distribution, Random Number Generation, Key Distribution

**[3] Public Key Cryptography**
Principles Of Public-Key Cryptography, RSA Algorithm, Key Management, Elliptic Curve Cryptography, Diffie-Hellman Key Exchange

**[4] Number Theory**
Prime And Relative Prime Numbers, Modular Arithmetic, Euler‟s Theorem, Euclid‟s Algorithm, Discrete Logarithm Tics

**[5] Message Authentication And Hash Functions:**
Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security Of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Ripemd-160, Hmac

**[6] Introduction To E-Commerce:**
Introduction To E-Commerce, Transactions On E-Commerce, Requirement Of Security On E-Commerce

**[7] Network Security**
Digital Signatures, Authentication Protocols, Digital Signature Standards, Application Authentication Techniques Like Kerberos, X.509 Directory Authentication Services, Active Directory Service Of Windows NT/Windows 2000

**[8] IP Security E-Mail Security**

IP Security Overview, Architecture, Authentication Header, Encapsulation Security Payload, Combining Security Association, Key Management, Pretty Good Privacy, S/Mime And Types

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Cryptography And Network Principles And Practice Fourth Edition, William Stallings, Pearson

## D. COURSE OUTCOMES

- Students will be able to understand basic Mathematical foundation required for various security mechanisms.
- Students will be able to use cryptographic algorithms to make their applications secure against network security threats
- Students will be able to analyze the security aspects and will be able to choose correct security mechanism and relevant algorithms for implementation
- Students will be able to use the concepts/algorithms to advance his/her career as network security engineer

## B. TECH. SEMESTER – VI (CE)
## SUBJECT: THEO. OF AUTOMATA AND FORMAL LANGUAGES

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 0 | 4 | 4.0 | 60 | 40 | - | - | 100 |

Reference Code CS614

## A. COURSE OBJECTIVE

Students will learn:

- Mathematical Proof Techniques
- Various models of Computation
- Basics of Parsing

## B. DETAILED SYLLABUS

**Major Topics:**
Formal languages, Automata, Computability, introduction to computational complexity, NP-completeness. Course contents

**[1] Review of Mathematical background**
Sets, functions, logical statements, proofs, relations, languages, Mathematical induction, strong principle, Recursive definitions

**[2] Regular Languages and Finite Automata**
Regular expressions, regular languages, applications, Finite automata, memory requirement in a recognizer, definition, representation, extended notation, string recognition, union, intersection and complement of regular languages. Non-deterministic finite automata, lambda transitions, equivalence, algorithms, examples. Kleen's theorem. Minimization of Finite automata. Non-regular and regular languages, criterion, Pumping Lemma, decision problems and decision algorithms, Regular languages in relation to programming languages.

**[3] Context-Free Languages and Push-Down Automata**
Context-free languages, definition, union, concatenation, examples etc. derivation tree and ambiguity. Simplified and Normal forms, Chomsky normal form. Push-Down Automata, definition, examples, deterministic PDA, two types of acceptances and their equivalence. Equivalence of CFG and PDA. Introduction to parsing, top-down and bottom-up parsing. Non-CFL and CFL, Pumping Lemma for CFL, intersection and complement.

**[4] Turing Machines**
Models of computation, TM definition, combining TMs, computing a function with

TMs. variations on Turing Machines, doubly infinite and more than one Tapes, non-deterministic and Universal TM, Recursively Enumerable languages, Unrestricted and context-sensitive grammars and their relation to TM, Linear Bounded Automata, Chomsky hierarchy, Unsolvable problems, Halting problem, Post's correspondence, applications to CFLs. Computability, Primitive recursive functions, computable functions, PR functions, bounded operations. Non- primitive recursive functions.

**[5] Introduction to Computational complexity**

Tractable problems, growth rate, time complexity of TM. NP-completeness

## C. RECOMMENDED TEXT / REFERENCE BOOKS

**1)** "Introduction to Languages and Theory of Computation", John C. Martin, McGraw-Hill

**2)** "Computation : Finite and Infinite", Marvin L. Minsky, Prentice-Hall

## D. COURSE OUTCOMES

- Students will be able to prove theorems using Principles of Mathematical Induction
- Students will be able to build models for various formal languages
- Students will be able to understand evolution of computational theory based on the models of computation
- Students will be able to understand how syntax checking works
  Students will understand importance of deterministic and non-deterministic models

## B. TECH. SEMESTER – VI (CE)
## SUBJECT: WEB SERVICE DEVELOPMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 2 | 0 | 2 | 4 | 3.0 | 40 | - | 25 | 25 | 90 |

## A. COURSE OBJECTIVE

The objective of this course is to familiarize the students with the concepts and principles of service orientation. We aim to cover SOAP-based and RESTful web services and to guide the students to implement them. The course will give detailed knowledge of concepts of micro-services architecture and make students aware about the concepts of application containers.

## B. DETAILED SYLLABUS

**[1] Principles of Service Orientation**

Common principles, interrelation between principles, comparing service orientation with object orientation.

**[2] Web services**

Web Services roles, Service Descriptions with WSDL and Messaging with SOAP, UDDI basics. Web service coordination, orchestration, and choreography. Windows Communication Foundation: Introduction, Operations, Service, data and message contracts.

**[3] Web API**

Introduction, controller, configuration, routing, parameter binding, action return type, media type formatters. message handlers, action filters, CRUD operation, Http client to consume Web API, dependency injection.

**[4] Micro services**

Introduction, architecture, features, monolithic vs. micro-services, principles, advantages.

[5] **Containers:**

Introduction, creation, configuration, commands. e.g. Docker, Podman, Coordinating containerized applications: Introduction, architecture, components, commands, configuring cluster. e.g. Docker Swarm, Kubernetes

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Thomas Erl, “Service-Oriented Architecture: Concepts, Technology, and Design”, Pearson Education.

2) Tugberk Ugurlu, Alexander Zeitler and Ali Kheyrollahi, “Pro. ASP .NET Web API”, Apress.

3) Sam Newman, “Building Microservices”, O’Reilly.

4) Sean P. Kane and Karl Matthias, “Docker: Up & Running”, O’Reilly.

5) Brendan Burns and Kelsey Hightower, “Kubernetes: Up and Running” , O’Reilly.

6) Kurtz, Jamie, Wortman, Brian, “ASP.NET Web API 2: Building a REST Service from Start to Finish”, Apress.

7) Ronnie Mitra and Irakli Nadareishvili, “Microservices: Up and Running”, O’Reilly.

## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- understand service orientation concepts and principles.
- design and develop service oriented applications in standard manner
- develop SOAP based and RESTful web services.
- design and development of micro-services and containers.

## B. TECH. SEMESTER – VI (CE)
## SUBJECT: MACHINE LEARNING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS622

## A. COURSE OBJECTIVE

- Learn basic principles and techniques of machine learnings
- Develop ability to solve real world problems which requires computational intelligence

## B. DETAILED SYLLABUS

**[1] Introduction**

Overview ,Supervised and unsupervised learning, Learning task, instances, features, labels, reward/loss, training, testing

**[2] Classification**

Overview of classification: setup, training, test, validation dataset, overfitting. Classification families: linear discriminative, non-linear discriminative, decision trees, probabilistic (conditional and generative), nearest neighbor

**[3] Decision tree classification**

Purity, Gini index, entropy, Algorithms for constructing a decision tree, Pruning methods to avoid over-fitting, Regression trees

**[4] Probabilistic classifiers**

Basics of Probability, Classifiers, LDA, QDA, Generative classifiers: Naive Bayes classification, Conditional classifier: Logistic

**[5] Regression**

Linear regression, Logistic regression

**[6] Hyper Plane Classifier and convex optimization**

Loss regularization framework for classification, loss functions: square, perceptron, logistic, hinge, regularizer. Review of convex optimization and unconstrained function

**[7] Support Vector Machine**

Max margin motivation: low density, high stability, Margin geometry to primal SVM formulation for separable training data, Dual formulation and role of alpha in a form of sparse local regression, Inseparable data, slack variables, hinge loss, upper bound on 0/1 training loss Handling non-linear regression by lifting data points to higher dimension,Polynomial, Gaussian, RBF kernels, Sequential minimal optimization (SMO) algorithm

**[8] Clustering**

Mixture model and Expectation maximization, K-Means Clustering, Distance based clustering, Density based clustering techniques

**[9] Ensamble learning**
Bagging and Boosting, Random forest, Adaboost

**[10] Dimensionality reduction**
Curse of dimensionality, Principal Component Analysis, Latent Semantic Analysis

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Machine Learning. T. Mitchell. McGraw-Hill, 1997.

**2)** Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017

**3)** Pattern recognition and machine learning by Christopher Bishop, Springer Verlag,2006.


## D. COURSE OUTCOMES

- Understand various supervised and unsupervised learning algorithms.
- Ability to analyze performance of Machine Learning algorithms.
- Understand the mathematical foundation required for solving problems using machine learning techniques.
- Ability to apply various machine learning techniques to solve the real world problems.

## B. TECH. SEMESTER – VI (CE)
## SUBJECT: COMPUTER NETWORKS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |

Reference Code CS611

## A. COURSE OBJECTIVE

- To develop an understanding of modern network architectures from a design and performance perspective.
- To develop an understanding of different components of computer networks, various protocols, technologies and their applications.

## B. DETAILED SYLLABUS

### [1] Introduction

Uses of computer Networks, Network Hardware-LAN,MAN,WAN, internetworks. Network Software - Design Issues, interfaces & Services, Connection Oriented & Connectionless services. Service primitives. Relationship of services to protocols. Reference Models - OSI & TCP/IP, their comparison & critiques.

### [2] The Physical Layer

Transmission Media – magnetic media, twisted pair, baseband & broadband, fiber optics. Wireless Transmission – radio, microwave, infrared & lightwave. Narrowband ISDN, Broadband ISDN & ATM. Cellular Radio- Paging systems, cordless telephones, analog & digital telephones.

### [3] The Data Link Layer

DLL Design issues, Error Detection & Correction. Elementary Data link Protocols - Utopia, Stop N Wait, Automatic Repeat Request. Sliding Window Protocols - 1 bit sliding window, Go Back N, Selective Repeat Protocols.

### [4] Medium Access Sublayer

Channel Allocation Problem - Static & Dynamic. Multiple Access protocols - ALOHA, CSMA, Collision Free Protocols, Limited contention protocols, WDMA protocol, wireless LAN protocols. IEEE standards 802 for LAN & MAN - 802.2, 802.3, 802.4, 802.6 & related numericals. Bridges - From 802.x to 802.y, transparent Bridges, Spanning Tree, Source Routing Bridges, remote bridge & problems. Comparison of 802 bridges, High Speed LANs - FDDI, fast ethernet.

### [5] The Network Layer

Network layer Design issues. Routing Algorithms. Congestion Control Algorithms - general policies, congestion prevention policies, traffic shaping, flow specifications, congestion control in VC subnets, choke packets, load shedding, jitter control and congestion control for malfunctioning. The network layer in the internet - the IP protocol, IP addresses & subnets

**[6] The Transport Layer**

The Transport Service, Elements of Transport Protocols, The Internet Transport Protocols - TCP service model, TCP protocol, TCP Segment Header, TCP Connection Management, TCP Transmission Policy, TCP Congestion Policy. UDP & overview of Socket. Performance Issues - Performance problems in Computer Networks (case study), Measuring Network Performance (case study).

**[7] The Application Layer**

Network Security - Traditional Cryptography, Two Fundamental Cryptographic Principles, Secret-Key Algorithms, Public- key Algorithms, Authentication protocols, Digital Signatures, Social Issues., E-mail (case study), SNMP (case study).

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Computer Networks - Andrew Tanenbaum, 3ed, PHI

**2)** Data & Computer Communications - William Stallings, 2ed, Maxell Macmillan Int.

**3)** Communication Networks, Fundamental Concepts & key Architecture - Leon-Garcia & Widjaj, Tata-McGraw Hill


## D. COURSE OUTCOMES

At the end of the course, students will be able to

- Analyse and troubleshoot various network parameters.
- Understand functionality of network devices.
- Comprehend functionality of various protocols and algorithms.
- Design basic computer network configurations.
- Recognize the technological trends of Computer Networking.

## B. TECH. SEMESTER – VI (CE)
## SUBJECT: SYSTEM DESIGN PRACTICE (MINI PROJECT)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 0 | 1 | 2 | 3 | 2.0 | - | - | 25 | 25 | 50 |

Reference Code CS621

## A. COURSE OBJECTIVE

Understand how to use Software Process life cycle in the development of the complete software.

## B. DETAILED SYLLABUS

- Student at the beginning of a semester may be advised by his/her supervisor (s) for recommended courses. Students will work together in a team (at most three) with any programming language.
- Students are required to get approval of project definition from the department.
- After approval of project definition students are required to report their project work on weekly basis to the respectiveinternal guide.
- Project will be evaluated at least once per week in laboratory Hours during the semester and final submission will be taken at the end of the semester as a part of continuous evaluation.

## C. RECOMMENDED TEXT / REFERENCE BOOKS

Not applicable

## D. COURSE OUTCOMES

- Students will be able to identify, analyse and define the scope of the project.
- They will decide suitable tools and technologies required for project development.
- Student will learn how to apply OOPS concepts, draw UML diagrams and perform black-box and white box testing.
- Students will be able to decide suitable User-interface for their project

**BACHELOR OF TECHNOLOGY**

# COMPUTER ENGINEERING

# SYLLABI BOOK

## 4th Year B.Tech. Program

**With effect from 2023-24**

Department of Computer Engineering
Faculty of Technology
Dharmsinh Desai University
Nadiad – 387 001, Gujarat, India.

http://www.ddu.ac.in

## B. Tech. Semester VII

| SUBJECTS | Teaching Scheme | | | Total | Credit | Examination Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Th | Tut | Pract | | | Th | Sess | TW | Prac | Total |
| Artificial Intelligence | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| Elective I | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| Elective II | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| Elective III | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| Compiler Construction | 4 | 0 | 2 | 6 | 5.0 | 60 | 40 | 25 | 25 | 150 |
| | 20 | 0 | 10 | 30 | 25 | 300 | 200 | 125 | 125 | 750 |

## B. Tech. Semester VIII

| SUBJECTS | Teaching Scheme | | | Total | Credit | Examination Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Th | Tut | Pract | | | Th | Sess | TW | Prac | Total |
| Project/Industrial Training | | | | | 14.0 | 0 | 0 | 100 | 300 | 400 |
| Seminar | | | | | 4.0 | 0 | 0 | 100 | 0 | 100 |
| Effective Technical Communication | 1 | 0 | 4 | 5 | 3.0 | 0 | 0 | 100 | 0 | 100 |
| | 1 | 0 | 4 | 5 | 21 | 0 | 0 | 300 | 300 | 600 |

**Elective I, II and III in 7th semester are offered from the list of the following subjects**

**PEC : Professional Elective Course**
**CS : Computer Science**
**S : System**
**A: Applications**
**D: Data Science**

| Coures Name | Category |
|---|---|
| Cloud computing and IoT | PEC : CS-S |
| Image Processing | PEC : CS-A |
| Big Data Analytics | PEC : CS-D |
| Embedded Systems | PEC : CS-S |
| Computer Graphics | PEC : CS-A |
| Advanced Computer Network | PEC : CS-S |
| Knowledge Discovery | PEC: CS-D |
| Mobile Application Development | PEC : CS-A |
| Distributed Operating Systems | PEC : CS-S |

## B. TECH. SEMESTER – VII (CE)
## SUBJECT: ARTIFICIAL INTELLIGENCE

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CE701

## A. COURSE OBJECTIVE

The main objective of this course is to make students aware about achievements and vast opportunities present in the fields of AI. The course covers importantly three main facets of AI designing: Search Technique, Knowledge Representation and Learning. The course additionally covers advanced topics in the field such as Fuzzy Logic, Game Playing, Natural Language Processing, Evolutionary Computations and Expert Systems.

## B. DETAILED SYLLABUS

**[1] Introduction to Artificial Intelligence**
Introduction problems, problem space, production systems, problem characteristics

**[2] Search Techniques**
Uniformed search techniques (best-first search, Depth-First search), Heuristic search techniques (General and test, Hill climbing, Simulated anncalling, A* algorithm, Constraint satisfaction, Means-end-analysis) Adverserial search techniques (Game playing, MINIMAX algorithm, alpha-Beta pruning)

**[3] Knowledge Representative**
Propositional Logic, predicate logic, Instance and isa relationship, semantic net, frames.

**[4] Fuzzy Logic**
Definition, need fuzzy set, fuzzy operators, fuzzy control systems, limitations

**[5] Inference techniques**
Representing knowledge using rules, procedure versus declarative knowledge, forward versus backward reasoning, unification, resolution.

**[6] Natural Language Processing**
Introduction NLP, NLU, phase of NLP (Morphological analysis, syntactic analysis, semantic analysis, discourse integration), introduction to Machine Translation.

**[7] Expert System**
ES architectures, representation and use of domain knowledge, expert system shells, knowledge acquisition.

**[8] PROLOG**
Facts and predicate, data types, goal finding, backtracking, simple object, compound objects, use of cut and fail predicates, recursion, lists, simple input/output.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Artificial Intelligence by Elaine Rich and Kevin Knight, TMH
**2)** Introduction to Turbo PROLOG by Carl Townsend, BPB
**3)** Artificial Intelligence : A Modern Approach by Stuart Russell and Peter Norvig, PHI
**4)** Artificial Intelligence and Expert System by D.W. Patterson, PHI
**5)** Introduction to Applied Fuzzy Logic by Ahmed Abraham, PHI


## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- Understand conceptual and contextual meaning of AI and views of AI.
- Analyze and represent an AI problem
- Aware of several logic based techniques for knowledge representation and inference.
- Create interactive programs using declarative programming language PROLOG.
- Represent problems with uncertain information with the use of fuzzy logic representation and solve using fuzzy inference mechanisms.
- Design intelligent systems using Game Playing, Expert Systems and Evolutionary algorithms

## B. TECH. SEMESTER – VII (CE)
## SUBJECT: EMBEDDED SYSTEMS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CE710

## A. COURSE OBJECTIVE

To introduce the concepts of an embedded system design, design methodology, programming language and to describe the real-time system concepts.

## B. DETAILED SYLLABUS

**[1] Programming languages for embedded systems**

Desirable characteristics of programming languages for embedded systems, low-level versus high-level language, main language implementation issues : control, typing, exdception handling, modularity and multithreading, major programming languages for embedded systems : Assembly, C/C++, Java and Esterel. Timing characteristics of embedded systems : hard, soft and firm systems : fail-safe and fail-operational systems, guaranteed- response, bes-effort, event and time-triggered systems, timing constraints in embedded systems.

**[2] Performance analysis of embedded sysems**

Software timing characterization and analysis methods.

**[3] Runtime and operational system design**

Real time and non-real time applications, task assignment and scheduling : characteristics of tasks, task assignments and multi-tasking, Static and dynamic scheduling under constrains.

**[4] Memory management and synchronization for embedded software :**

Mutual exclusion, deadlock, starvation and lockouts : priority assignments, inversion, event flags and signals, software optimization techniques under constraints : size, performance, embaddedibility metrics.

**[5] Compilation techniques for embedded software :**

Code generation, re- targetability, code optimization.

**[6] Examples of embedded and real-time software systems, real time applications.**

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Software design methods for concurrent and real-time systems by Gomaa, Addision-Wesley 1993.
2) Real-time systems by H. Kopetz, Kluwer 1997
3) Co-synthesis of hardware and software for Embedded Systems by R. Gupta, Khuwer 1995

**4)** Introduction to real-time software design by S. Allworht, Springer-Verlag, 1984.
**5)** Real Time Systems by C.M. Krishna, Mc-Graw Hill 1997
**6)** Code generation for Embedded Processors by Peter Marwedel, G. Goosens, Kluner Academic Pub. 1993.
**7)** Embedded system design : Aunified hardware software introduction by Frank Vahid and Tony Givargis,John Wiley & Sons
**8)** Additional reading from selected journal papers

## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- Understand the issues in designing embedded system
- Design customized single purpose processor
- Understand the concepts of real-time systems
- Solve problems of real-time task scheduling and resource sharing

## B. TECH. SEMESTER – VII (CE)
## SUBJECT: ADVANCED COMPUTER NETWORKS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CE713

## A. COURSE OBJECTIVE

To provide advanced topics of computer networking and to introduce network programming.

## B. DETAILED SYLLABUS

**[1] Introduction**
Introduction to internetworking, TCP/IP protocol stack, Internetworking concepts..

**[2] TCP/IP Protocols**
Addressing scheme ( classful and classless), subnetting and supernetting, Ipv6, ARP, RARP, ICMP, IGMP, RIP, OSPF, BGP, DNS, application layer protocols : FTP, TFTP, NFS.

**[3] Sockets interface**
Introduction to socket function, connect, accept, listen, bind function calls, TCP client server, concurrent server to server multiple clients..

**[4] I/O multiplexing**
I/O models : blocking, polling, signal driven, multiplexed. Select system call, multiplexed TCP server to serve clients, use of p select.

**[5] UDP socket**
UDP socket functions, difference : blocking, polling, signal driven, multiplexed. Select system call, multiplexed TCP server to serve clients, use of p select

**[6] Domain name server**
Introduction to DNS, resource record and resolver function, mapping between IP address and domain name.

**[7] IPv4 and IPv6 interperability**
Introduction, IPv4 client-server, IPv-6 address testing macro, source code portability.

**[8] Deamon process**
**Introduction to daemon process, syslog, creating a daemon process, i net daemon.**

**[9] Advance UDP socket**
**Receiving flags, destination address and interface info, adding reliability to UDP, concurrent UDP server.**

**[10] Broadcasting and multicasting**

Broadcast address structure, broadcast client-server, multicasting address structure, multicasting on WAN, multicasting v/s broadcasting, multicast example.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Unix network programming vol. 1 by W.R. Stevens
**2)** TCP/IP protocol suite by B.A. Forouzan
**3)** TCP/IP vol. 1 by D.E. Comer
**4)** TCP/IP Vol. 1 by W.R. Stevens


## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- Be familiar with several common programming interfaces for network communication.
- Have a detailed knowledge of the TCP/UDP Sockets
- Design and write client-server programs
- Use of unix network programming system calls for handling multiple client requests

## B. TECH. SEMESTER – VII (CE)
## SUBJECT: DISTRIBUTED OPERATING SYSTEMS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CE716

## A. COURSE OBJECTIVE

To give students knowledge of the principles, architectures, algorithms, programming models used in distributed systems. Also, to give detailed idea about on Distributed operating system concepts whichincludes Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.

## B. DETAILED SYLLABUS

**[1] Introduction to Distributed Systems**

**[2] Interprocess Communication and Coordination**

**[3] State Maintenance**

**[4] Distributed Mutual Exclusion Algorithms**

**[5] Election Algorithms**

**[6] Fault Tolerance and Distributed Agreement**

**[7] Database Techniques**

**[8] Check Point and Recovery**

**[9] Distributed Deadlock Detection**

**[10] Load Balancing & Scheduling**

**[11] Security**

## C. RECOMMENDED TEXT / REFERENCE BOOKS

**1)** "Distributed Operating Systems and Algorithms" by Randy Chow and Theodore Johnson, Addison Wesley, 1997

## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- understand issues of the Distributed Environment and different mechanisms to handle them
- Ability to demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
- Gain understanding of the various resource management techniques for distributed systems
- Ability to summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security

## B. TECH. SEMESTER – VII (CE)
## SUBJECT: IMAGE PROCESSING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CE714

## A. COURSE OBJECTIVE

The objective of the course is to understand the image formation and representation. To Learn various enhancement and restoration techniques in different domains. Learn about the various compression techniques.

## B. DETAILED SYLLABUS

**[1] Introduction**

**[2] Image Transformation Techniques**

**[3] Image Enhancement Algorithms**

**[4] Image Restoration Methods**

**[5] Image Compression Techniques**

**[6] Image Segmentation Schemes**

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** R.C.Gonzalez and R.E.Woods, "Digital Image Processing", Addison-Wesley Longman, Inc, 1999
**2)** A.K.Jain, "Digital Image Processing", PHL
**3)** M.Sonka, V.Hlavac, and R.Boyle – Image processing, Analysis and Machine vision, Thomson Asia pvt. Ltd, 1999.


## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- Apply various enhancement and restoration techniques in both spatial and frequency domain.
- Decide which technique would be suitable for a given application.
- Make decision based upon the requirement which compression technique to apply.
- Segment the images for further processing

## B. TECH. SEMESTER – VII (CE)
## SUBJECT: KNOWLEDGE DISCOVERY

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CE715

## A. COURSE OBJECTIVE

The objective of the course is to understand the digital data generated by various sources and to find implicit patterns from it which can be utilized for business intelligence. Students will be able to understand the problems in the digital data and will learn various data cleaning, data transformation, data reductions techniques. They will learn various machine learning algorithms to apply on the data which will help in decision making in industries..

## B. DETAILED SYLLABUS

**[1] Introduction**

An overview of data warehousing and data mining

**[2] Data Pre-processing**

Overview, Need for pre-processing
Issues related to efficient data handling (Extraction, Transformation, And updating of large databases (ADDED) Data Cleaning
Data Integration & Transformation Data Reduction
Discretization & Concept Hierarchy Generation

**[3] Data warehouse and OLAP technology**

Multi-dimensional Data Cubes
Star, Snow Flakes, & Fact Constellation Schema Concept Hierarchies
OLAP
Data Warehouse Architecture
Steps for design and construction of data warehouse A 3-tier data warehouse architecture
ROLAP, MOLAP, HOLAP.
Data Warehouse Implementation

**[4] Mining Frequent patterns, Association and Correlation Logic**

Basic Concepts,
Item set mining methods
Mining association rules
Correlation analysis

**[5] Classification & prediction**

An Overview & Basic Concepts Classification by decision tree induction Bayesian Classification

**[6] Cluster Analysis**

An Overview & Basic Concepts Partitioning methods Hierarchical methods
Density-Based methods Outlier analysis

**[7] Graph Mining**

Methods for Mining Frequent Subgraphs
Mining Variant and Constrained Substructure Patterns
Applications: Graph Indexing, Similarity Search, Classification and Clustering

**[8] Mining Multimedia, Text, and Web Data**

Multimedia Data Mining

- Similarity Search in Multimedia Data
- Multidimensional Analysis of Multimedia Data
- Classification and Prediction Analysis of Multimedia Data
- Mining Associations in Multimedia Data
- Audio and Video Data Mining

Text Mining

- Text Data Analysis and Information Retrieval
- Dimensionality Reduction for Text
- Text Mining Approaches

Mining the World Wide Web

- Mining the Web Page Layout Structure
- Mining the Web‟s Link Structures to Identify
- Authoritative Web Pages
- Mining Multimedia Data on the Web
- Automatic Classification of Web Documents
- Web Usage Mining

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Jiawei Han & Micheline Kamber, "Data Mining – Concepts & Techniques",2nd edition, Morgan Kaufmann Publishers

**2)** Data mining: multimedia, soft computing, and bioinformatics By Sushmita Mitra, Tinku Acharya, published by John Wiley and Sons

**3)** Introduction to Data Mining. Tan, Steinbach, Kumar. Addison-Wesley. 2006.


## D. COURSE OUTCOMES

At the end of the course students will :

- Be able to understand various sources of data generation and how to deal will heterogeneous data.
- learn various data cleaning, data transformation, data reductions techniques.
- learn various supervised and unsupervised algorithms
- learn various outlier detection techniques
- learn data warehousing concepts and they will also learn the concepts of text mining, web mining and multimedia miningDesign intelligent systems using Game Playing, Expert Systems and Evolutionary algorithms

## B. TECH. SEMESTER – VII (CE)
## SUBJECT: MOBILE APPLICATION DEVELOPMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CE717

## A. COURSE OBJECTIVE

The Mobile Application Development course is designed to teach students to develop mobile applications for the Android devices that use basic and advanced phone features. Students will also be able to deploy applications to the Android marketplace for distribution.

## B. DETAILED SYLLABUS

**[1] Getting started with mobility**

Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the mobile app development environment along with an emulator, a case study on Mobile app development

**[2] Building blocks of mobile apps**

App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity- states and life cycle, interaction amongst activities. Application functionality beyond user interface - Threads, Async task, Services – states and life cycle, Notifications, Broadcast receivers, Telephony and SMS APIs. Native data handling – on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet)

**[3] Sprucing up mobile apps**

Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, location awareness, and native hardware access (sensors such as accelerometer and gyroscope)

**[4] Testing mobile apps**

Debugging mobile apps, White box testing, Black box testing, and test automation of mobile apps, JUnit for Android, Robotium, MonkeyTalk

**[5] Taking apps to market**

Versioning, signing and packaging mobile apps, distributing apps on mobile market place

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Android – Wireless Application Development by Lauren Darcey and Shane Conder, 3rd Ed., Pearson Education
2) Beginning Android Application Development by Wei-Meng-Lee, Wiley Publication
3) Professional Android 4 Application Development by Reto Meier, Wiley Publication

## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- apply layout management and multi-layout definition techniques to create adaptable user interfaces for mobile applications that share a common data model.
- manage user data and multimedia on a mobile device via the Android framework libraries.
- use the sensors available on mobile devices to enhance user interaction and feedback.
- publish Applications to the Google Play Store.

## B. TECH. SEMESTER – VII (CE)
## SUBJECT: MACHINE LEARNING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CE701

## A. COURSE OBJECTIVE

This course introduces several fundamental concepts and methods for machine learning. The objective is to familiarize the audience with some basic learning algorithms and techniques and their applications, as well as general questions related to analyzing and handling large data sets. Several software libraries and data sets publicly available will be used to illustrate the application of these algorithms. The emphasis will be thus on machine learning algorithms and applications, with some broad explanation of the underlying principles.

## B. DETAILED SYLLABUS

**[1] Introduction**

Overview ,Supervised and unsupervised learning, Learning task, instances, features, labels, reward/loss, training, testing

**[2] Classification**

Overview of classification: setup, training, test, validation dataset, overfitting. Classification families: linear discriminative, non-linear discriminative, decision trees, probabilistic (conditional and generative), nearest neighbor.

**[3] Decision tree classification**

Purity, Gini index, entropy, Algorithms for constructing a decision tree, Pruning methods to avoid over-fitting, Regression trees

**[4] Probabilistic classifiers**

Basics of Probability, Classifiers, LDA, QDA, Generative classifiers: Naive Bayes classification, Conditional classifier: Logistic

**[5] Regression: Linear Regression, Logistic regression, Hyper plane**

**[6] Classifier and convex optimization**

Loss regularization framework for classification, loss functions: square, perceptron, logistic, hinge, regularizer. Review of convex optimization and unconstrained function

**[7] Support Vector Machine**

Max margin motivation: low density, high stability, Margin geometry to primal SVM formulation for separable training data, Dual formulation and role of alpha in a form of sparse local regression, Inseparable data, slack variables, hinge loss, upper bound on 0/1 training loss Handling non-linear regression by lifting data points to higher dimension,Polynomial, Gaussian, RBF kernels, Sequential minimal optimization (SMO) algorithm

**[8] Clustering**

Mixture model and Expectation maximization, K-Means Clustering, Distance based clustering, Density based clustering techniques

**[9] Ensamble learning**

Bagging and Boosting, Random forest, Adaboost

**[10] Dimensionality reduction**

Curse of dimensionality, Principal Component Analysis, Latent Semantic Analysis

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Machine Learning. T. Mitchell. McGraw-Hill, 1997.

**2)** Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017

**3)** Pattern recognition and machine learning by Christopher Bishop, Springer Verlag,2006.


## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- Familiarity with the concepts of machine learning.
- Modelling real world problems using machine learning techniques.
- Capability to implement machine learning algorithms (Using Python)

## B. TECH. SEMESTER – VII (CE)
## SUBJECT: BIG DATA AND ANALYTICS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CE720

## A. COURSE OBJECTIVE

The objective of the course is to understand digital data, data preprocessing, data warehousing and various supervised and unsupervised algorithms. Students will learn big data, sources of big data and various platforms to handle big data. They will also learn HADOOP and its components.

## B. DETAILED SYLLABUS

**[1] Types of Digital Data (Structured, Semi-Structured, Unstructured)**

**[2] Introduction to Big Data**.

**[3] Te Big Data Technology Landscape**
NoSQL – NewSQL
Hadoop- Introduction to Eco system

**[4] Hadoop – Distributed File System and Processing using MapReduce**

**[5] Introduction to Map Reduce Programming**

**[6] Introduction to Big Data Analytics**

**[7] Data Storage and Handling (Apache Cassandra/mongoDB)**

**[8] Querying Data using Hive/Pig like components**

**[9] Data Reporting Tools (i.e. Community Edition : Jasper Soft**

**[10] The realm of Data Science**

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Big Data and Analytics – Seema Acharya and Subhashini C – Wiley India
**2)** Hadoop: The Definitive Guide by Tom White
**3)** Big Data Analytics: Methods and Applications by B. L. S. Prakasa Rao (Editor), S. B. Rao (Editor)

## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- Learn various types of digital data and how to deal with them.
- Learn various data cleaning, data transformation, data reductions techniques.
- Students will learn various supervised and unsupervised algorithms
- Understand big data, sources of big data, characteristics of big data
- Students will learn HADOOP and its components.
- Learn concepts of mapreduce programming.

## B. TECH. SEMESTER – VII (CE)
## SUBJECT: COMPILER CONSTUCTION

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code CE718

## A. COURSE OBJECTIVE

The objective of this course is to get familiar with the different phases of a compiler, to learn algorithms for parsing and their usefulness in semantic analysis. This course will help to realize the need of run time environment support, symbol table organization, garbage collection, various machine independent code optimization techniques etc. Also, the course involves developing programs using LEX and YACC.

## B. DETAILED SYLLABUS

**[1] Introduction**

Language processor, Structure of compiler, the science of building compilers, Applications of language processors

**[2] Lexical analysis**

The role of lexical analyzer, input buffering, specification of tokens, recognition of tokens, lexical analyzer generator (lex)

**[3] Syntax analysis**

Top-down parsing, Bottom-up parsing, Introduction to LR parsing, More powerful LR parsers, Using ambiguous grammars, Parser generators (yacc)

**[4] Syntax directed translation (SDT)**

Syntax directed definitions (SDD), Evaluation order of SDD"s, Applications of SDT, SDT schemes

**[5] Intermediate code generation**

Variants of syntax tree, three-address code, types and declarations, translation of expressions, type checking

**[6] Runtime Environments**

Storage organization, stack allocation of space, access to non-local data on the stack, heap management

**[7] Code generation**

Issues in the design of code generator, the target language, addresses in the target code, basic blocks and flow-graphs, optimization of basic blocks, peephole optimization, register allocation and assignments

## C. RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Compiler: Principles, techniques and tools by Aho, Ullman and Sethi, 2nd Ed., Pearson Education

**2)** Theory and Practice of Compiler Writing, Jean-Paul Tremblay, Paul G. Sorenson, McGraw Hill


## D. COURSE OUTCOMES

- To know how a compiler tokenizes, parses the input program and how different phases of compiler are involved.
- To be able to develop programs using LEX (Tool for Automatic Lexical Analyzer) and YACC (tool for Automatic Parser Generator).
- Understanding how different code optimization techniques reduce time or space required for the runtime.
- Understanding the semantic aspects of compilation like how type insertion, checking, code generation etc. can be done

## B. TECH. SEMESTER – VIII (CE)
## SUBJECT: PROJECT/INDUSTRIAL TRAINING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 0 | 0 | 30 | 30 | 14 | - | - | 100 | 300 | 400 |

Reference Code AF801

## B. TECH. SEMESTER – VIII (CE)
## SUBJECT: SEMINAR

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| - | - | - | - | 4 | - | 100 | - | - | 100 |

Reference Code AF802

Each student has to give two seminars on project/ given topic during their project duration.

The students will undertake project work for the period of full semester. They should design/develop the hardware and/or software system. They may also undertake project involving study and analysis of hardware and system in the organization.

They are supposed to prepare and submit a project report as a part of their term work and give seminars on their project work. The students may be sent to the industry / organization for their project and they are to timely report to the Institute regarding monitoring and necessary guidance. The faculties should arrange visits at the places of projects.
They should arrange for demonstration of the project work, if any. They are to be examined based on viva and/or demonstration. The main purpose of industrial training is to acquaint students with the administrative and organizational details of a company.

They should know what are the basic rules followed in a company and how a employee should behave and work in the company.

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| | | | | | | | | | |

BB – 321 Taxation

## Section – I

**1 (A) Concepts of Direct and Indirect Taxes**

Definitions of – Assessee, Person, Assessment Year, Previous years, Gross total income, Agricultural income, casual income, Company, Indian Company, Dividend

**(B) Residential Status and Incidence of Taxation**

**(C) Income Exempt from Tax**

**2 Salary:**

Meaning, Basis of charge, Income included under this Head, Allowances and Valuation of Perquisites, Deductions and Retirement Benefits
(Note: Paper Setter shall have to mention whether the Assessee is a specified employee under the I. T. Act, 1961)

**3 (A) Income from House Property**

(Section 22 to 27)

**(B) Profit and Gains from Business and Profession:**

Income covered under this head, Allowable Deductions, Calculation of Depreciation and Disallowable Expenses.

## Section – II

**4 (A) Capital gains:**

Meaning of long term and short term capital assets, Computation of Long Term and Short Term Capital Gains, Exemptions available under Section 54, 54 B, 54 EC 54 ED, 54 F (Note: Relevant Cost Inflation Index Nos. must be provided by the Paper Setter.)

**(B) Income from Other Sources**

(Section 56 to 59)
(Note: TDS rate must be provided by the Paper Setter)

**5 (A) Clubbing of Income, Carry Forward and Setoff of Losses:**

**(B) Deduction**

From Gross Total Income under section 80 C, 80 CCC, 80 CCD, 80 D, 80 DD, 80 DDB, 80 E, 80 G, 80 U. (1) Filling of Tax Return under Prescribed Parameters and Time Schedule (2) Advance payment of Tax, Date, Percentage, Limit (3) TDS: Meaning,

Liability, Time Limit of Payment of TDS

**6 Indirect Taxes:**

**(A) Gujarat Valued Added Tax Act:**

Introduction: Definitions: (1) Business (2) Dealer (3) Goods (4) Manufacture (5) Person (6) Place of Business (7) Purchase Price (8) Raw Materials (9) Sale (10) Re–sale (11) Sale price (12) Taxable Turnover (13) Value of Goods

**Incidence of Tax:**

(Brief Idea) Registration Liability to pay Tax

**(B) Central Excise Act**:

Definitions: (1) Factory (2) Manufacture (3) Deemed (4) Manufacturing (5) Types of Duties (6) Manufactures Liability for Payment of duty (7) Exemption from Duty (8) Registration of Certain Persons, Concept of CENVAT, (9) Capital Consumption.

**(C) Introduction to Service Tax:**

Registration and payment Procedure

**(D) Basics of Custom Duty:**

Introduction, Definition of Goods, Territorial Waters of India, Indian Custom Water, Custom Station, Person in Charge, Procedure of Import and Export in brief, Exemption from Custom Duty , Types of Duty.

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Student Guide to Income Tax | V. K. Singhania | Taxmann |
| 2 | Direct Taxes | Dinkar Pagarl | S. Chand & Sons |
| 3 | Taxation | T. J. Rana & Others | B. S. Shah & Sons |

**Notes:**

(1) Provisions Applicable to the Relevant Academic Year shall be taken into Consideration. No Change made effective after 31st March immediately preceding the current academic year shall be considered.

(2) The Subject should be studied with Reference to an Ordinary Resident is Expected.

(3) Students are not expected to remember the Section Numbers, while setting a Question Paper the Topics/Aspect should be indicated rather than the section number.

BB – 322 Marketing Management

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1 **Fundamentals of Marketing**

Meaning of Marketing & Marketing Management, Core Marketing concepts, Scope of Marketing, Importance / Role of Marketing, Marketing management philosophies, Marketing Mix, Limitation of Marketing Concept

2 **Product Management**

Concept of product, Levels of products, The Product Hierarchy, Classification of products, Product Mix Decision

3 **Price:** Meaning, Factors affecting, Methods / Approaches of Pricing

**Section – II**

4 **Place**

Types of Channels, Functions of Marketing Channels, Types of Intermediaries, Functions of Wholesalers and Retailers

5 **Promotion**

**Advertising:** Meaning, Objectives, Benefits, Criticisms, Advantages and Limitations of different Medias

**Sales Promotion:** Meaning, Reasons for increasing use of Sales Promotion, Sales Promotion tools

**Personal Selling:** Concept, Characteristics of successful Sales Person, Situation, Conducive for Personal Selling

**Publicity and Public Relation:** Concept & Tools

6 **Market Segmentation, Targeting and Positioning**

What is Market Segmentation, Need for Market Segmentation & Benefits of Market, Segmentation, Bases of Segmenting Consumer Market, Target Marketing and Positioning

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Marketing Management: Global Perspective Indian Context | V S Ramaswamy and S Namakumari | Macmillan |
| 2 | Marketing Management: A south Asian Perspective | Philip Kotler, Kevin Lane Keller, Abraham Koshy & Mithileshwar Jha | Pearson Education – Prentice Hall |
| 3 | Marketing Management: Comprehensive Text, Best Practices and Corporate Insights | Arun Kumar and N Meenakshi | Vikash Publishing House, |
| 4 | Marketing Management: Text and Cases In Indian Context | K Kaunakaran | H. P. H., Bombay |
| 5 | Product Management | Chunawalla & Patel | H. P. H., Bombay |
| 6 | Marketing Management | S A Sherlekar | H. P. H., Bombay |
| 7 | Marketing Management: Text and Cases | S H H Kazmi | Excell Books |
| 8 | Marketing Management | Dr. C. B. Gupta | Sultan Chand & Sons |

BB – 323 Organizational Behavior

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1 **Fundamentals of Organizational Behavior:**

Concept, Nature, Characteristics, Importance, Models of Organizational Behavior, Relation of Organizational Behavior with other fields

2 **Conflict Management:**

Nature, Levels of Conflict, Traditional vis–à–vis Modern view of Conflict, Conflict Process

3 **Group Dynamics:**

Types, Nature, Emergence, Benefits, Problems of Informal Organization, Formal Organization, System Factor, Potential outcome of Formal Group processes

**Section – II**

4 **Motivation:**

Motives, Classification of Motives, Theories of work motivation: ERG, Equity, Expectancy theory, Appraising & Rewarding, Performance appraisal, 360 degree, Wage Incentives, Profit Sharing and gain sharing

5 **Leadership:**

Nature, Types of Skills, Leadership styles, Theories/ Approaches to Leadership: Hersey & Blanchard's Situational Model, Path–Goal Model, Managerial grid model, Fielder's contingency model, coaching

6 **Stress & Counseling:**

Concept, Sources of stress, Effect of stress, Strategies to cope up with stress & brief overview of counseling

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Organizational Behavior | Stephen Robbins | Pearson Education |
| 2 | Organizational Behavior | Keith Davis | Tata McGraw Hill, New Delhi |
| 3 | Organizational Behavior | K. Aswathappa | Himalaya Publication |
| 4 | Organizational Behavior | L. M. Prasad | S. Chand Publication |
| 5 | Organizational Behavior | M. N. Mishra | Vikas Publication |

BB – 324 Statistics For Management – I

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

## Section – I

**1 Probability:**

Basic concepts: Random Experiment, Events, Sample Space, Mutually Exclusive Events, Equally Likely Events, Independent Events, Dependent Events; Definition of probability of an Event, Statistical or Empirical definition of probability, Axiomatic or Modern approach to probability; Addition and Multiplication Rules of Probability, Conditional Probability, Bay's Rule (without proof), Applications

**2 Mathematical Expectation:**

Definition of Random Variable, Discrete Random Variables and Continuous Random Variables, Expected Value of Discrete Random Variable and its properties (without proof), Variance of Discrete Random Variable and its properties (without proof), Applications

**3 Sampling Methods:**

Basic concepts of Population and Sample, Characteristics of a good sample, Advantages of sampling, Size of a sample, Difference between population study and sample study, sampling methods: Simple random sampling and Stratified random sampling, Applications

## Section – II

**4 Linear Correlation:**

Definition, Meaning and interpretation, Properties, Importance of Correlation, Types of Correlation, Methods of studying Correlation: (a) Scatter diagram method (b) Karl Pearson's product moment method (c) Spearman's method of rank correlation; Coefficient of Determination and its interpretation; Probable error; Applications

**5 Linear Regression:**

Meaning and importance of Regression, Regression Lines and Regression Coefficients, properties and their uses, Equations of Regression Lines, Difference between Regression & Correlation, Applications

**6 Multiple – Partial Correlation and Regression:**

Multiple Correlations: meaning, multiple correlation coefficients; Partial correlation: meaning, partial correlation coefficients; Multiple Regression Equation of three variables only; Applications

**Reference Books:**


| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Statistics for Management | Levin and Rubin | Printice Hall of India Pvt. Ltd., New Delhi |
| 2 | Statistics (Theory, Methods and Application) | Sancheti and Kapoor | S. Chand and Sons |
| 3 | Introduction to Statistics | R. P. Hooda | Macmillan India Ltd. |
| 4 | Statistical Methods | S. P. Gupta | |
| 5 | Problems & Solutions in Statistics | V. K. Kapoor | |

BB – 325 Managerial Economics – I

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

**1 The nature and scope of Managerial Economics**

**(10%)** Definition of Managerial Economics, Relationships to Economic Theory, Relationships to the Decision Sciences, Relationship to the functional Areas of Business Administration Studies

**2 Demand and Demand Analysis: (15%)**

Meaning and importance in Managerial Economics; Types of Demand: Producers' Demand, Consumers' Demand - Demand for Durable Goods, Demand for Non Durable Goods; Firm's Demand Vs Industry's Demand; Derived Demand Vs Autonomous Demand; Sectoral Demand Vs Market Demand;

**Consumer's Equilibrium and Demand Curves: (25%)**

Indifference Curve, Budget line, Marginal Rate of Substitution and Consumers Equilibrium, Income Effect, Substitution Effect, Price Effect; Geffen goods and Normal Goods and Price - Consumption Curve; Consumer's Surplus

**Section – II**

**3 Elasticity of Demand: (20%)**

Meaning and definition; Measurement methods; Determinants of Elasticity of Demand; Importance of elasticity of demand; Income Elasticity of demand, cross elasticity of demand; Advertisement Elasticity

**4 Theory of Production: (30%)**

Meaning of Production, production function, firms objectives; Total, Average and Marginal product; Isoquants curves; isocost line; Producers equilibrium, Factor substitution, Returns to Scale and Laws of Returns, Labor intensive technology and Capital intensive technology

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Micro Economics for Management students | Ravindra H Dholakia & Ajay N Ozha | |
| 2 | Elementary Economics | K. K. Dewett & J. D. Varma | |
| 3 | A textbook of Economic Theory | A. W. Stonier & Hague D. C. | |
| 4 | Advance Economic Theory | M. L. Jhingam | |
| 5 | Micro Economic Theory | Dwivedi D. N. | |
| 6 | Managerial Economics | | B. S. Shah Prakashan |
| 7 | Elements of Economic Theory | | Sultanchand & co. |

BB – 326 Communication Skills – III

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Objective:**

✪ To equip the students with language proficiency necessary for business communication.

✪ To give students extensive practices in all possible ways in LSRW skills.

**Section – I**

**7 Text:** "The Post Office", by **Rabindranath Tagore**

**8 Business Communication:**

Role and Importance of Business Communication; Importance of Business Communication in Corporate life; Guidelines for Effective communication; Overcoming Barriers to Communication; Oral Communication: Listening & Group Communication

**9 Grammar:**

Direct Indirect Speech, Revision of Tenses, Infinitives & Gerund, Wh Questions

**Section – II**

**10 Writing:**

Secretarial Correspondence; Banking Correspondence; Questionnaire; Press Reports

**11 Vocabulary:**

Words liable to be confused (From the list appended); One word substitution (From the list appended); Idioms and Phrases (From the list appended); Business terms (From the list appended); Foreign words (From the list appended); Antonyms (From the list appended)

**12 Language Functions:**

Persuading, Expressing necessity & Obligation, Paying compliments, Advising, Restraining

**Reference Books:**

| No. | Title | Author |
|---|---|---|
| 1 | Effective Communication | Urmila Raj & S. M. Rai |
| 2 | Creative English Communication | N. Krishna Swami & T. Shrimana |
| 3 | Communication in English | R. P. Bhatnagar & R. T. Bell – Orient Longman |
| 4 | Essentials of Business Communication | Rajendra Pal & J. S. Korlahalli – S. Chand & Sons |
| 5 | Good English | G. H. Vallins – Roopa & Co. |
| 6 | Let's Talk English | M. I. Joshi |
| 7 | Contemporary English Grammar, Structure and Composition | David Green – Macmillan |
| 8 | English for Social Interaction | G. V. Vyavhare & N. V. Bose |
| 9 | An interactive Grammar of Modern English | Shivendra K. Verma & Hemalatha Nagarjan |

BB – 421 Industrial & Commercial Law

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

## Section – I

### 1 Indian Contract Act – 1872 (Part I)

**Introduction of Contract:** Meaning and concept of Contract, Essential elements of a valid contract, Classification of contract

**Offer and Acceptance:** Legal rules as to offer, Legal rules relating to acceptance, When offer comes to an end

**Consideration:** Meaning and concept of consideration, Legal rules as to consideration, Exception to the rule, A stranger to a contract cannot sue, A contract without consideration is void, exceptions.

**Capacity to Contract:** Position of a minor as regards his agreements, Persons of unsound mind

**Free Consent:** Free Consent, Coercion, Undue influence, Misrepresentation, Fraud and Mistake

### 2 Indian Contract Act – 1872 (Part II)

**Legality of Object:** When consideration or object is unlawful, Agreements opposed to public policy

**Performance of contract:** Requisites of a valid tender, By whom must contracts be performed?

**Discharge of a contract:** Modes of discharge of contract

**Remedies for breach of contract:** Rescission, Damages, Quantum merit, Specific performance, Injunction

**Quasi contract:** Concept, Kinds of quasi contract

**3 Negotiable Instrument:**

Negotiable instruments, Notes, Bills and Cheques, Parties to a Negotiable Instrument, Negotiation, Presentment of a Negotiable Instrument, Dishonor of a Negotiable Instrument

**Section – II**

**4 Sale of Goods:**

**Introduction:** Definition of sale and agreement to sale, Essentials of a contract of sale, Sale and agreement to sell- distinction

**Conditions and Warranties:** Meaning and definitions, Difference between condition and warranties, implied conditions and implied warranties, Caveat Emptor, Exceptions

**Transfer of Property:** Concept, Sale by non owner – exceptions, Contracts Involving sea routes

**Performance of Contract:** Rules as to delivery of goods, Rights and duties of a buyer

**Rights of an unpaid seller:** Rights of an unpaid seller against the goods, Rights of an unpaid seller against the buyer personally, Auction sale, Rules

**5 Factories Act 1948:**

Definitions and concepts, Provisions in relation to Health, Provisions in relation to Safety, Provisions in relation to Welfare, Working hours of Adult, Employment of young persons, Rules relation to annual leave with wages

**6 The Industrial Disputes Act 1947:**

Definitions and concepts, What is an industrial dispute?, Lay – off, Lock – out, Retrenchment, Strike, Unfair labor practices, Procedure for settlement of Industrial Disputes

**Reference Book:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Mercantile Law | N. D. Kapoor | S. Chand, New Delhi |
| 2 | Business Law | Prin. T. J. Rana & Others | B. S. Shah & Sons |

BB – 422 Project Management

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

**1 Identification of Project Opportunities and Project / Product Feasibility Report:**

Sources of Project Idea, Preliminary Screening, An Introduction to the general format and the information to be covered in the report, (Readymade project report obtained from sources like GIIC, GSFC, etc. may be provided to the students for the understanding of the format and the details to be provided

**2 Market and Technical Appraisal:**

Information required for market analysis, Sources of market information, Demand Forecasting, Technical Analysis: location and site, material product Technology, Site preparation, project Engineering Manpower projections

**3 Financial Projections:**

Preparation of the Projected Financial Statement, Projected Cash Flow and Funds Flow statement, Debt service Coverage Ratio.

**Section – II**

**4 Financing the Project:**

Study of the financial assistance available from financial institutions, Procedure for procurement of project loan, Submission loan application, Project appraisal sanction the loan and acceptance execution of agreement, Disbursement of loan etc.

**5 Project Monitoring and Control:**

Warning Signals and remedies required, Rehabilitation of sick project: Causes of sickness, package of rehabilitation, measures, offered by Financial Institution.

**6 Managing Growing Venture:**

Growth, objective and strategy, Managing growth, Accessing resource from external sources for financing growth including public issue, Merger, amalgamation, joint venture, collaboration and selling business

**Reference Books**

| No. | Title | Author |
|---|---|---|
| 1 | Project Management | Prasanna Chandra |

BB – 423 Computer – II

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

## Section – I

**1 Installation Management, Backup and Virus (10%)**

Introduction, Backup, Logical structure of disk, boot sector, partition table information Booting process, Symptoms of virus, various anti–virus software, Norton utility and its applications, Classification of virus, cure and protection from virus

**2 Networking and its concepts (20%)**

Concepts of network and its classification (Peer to peer and master–slave) protocol and its examples, LAN, WAN, MAN and their differences, Characteristics of LAN, LAN topologies – STAR, BUS, RING, TREE and their comparison LAN Access methods – CSMA/CD and Token Passing

Communication architecture – OSI model with 7 layers, LAN hardware ( types of cables, their comparison, N/w interface unit, server & its types, work station ) and software, LAN software operating system, WAN hardware–router, gateway & Bridge.

**3 Internet and its Applications (20%)**

Introduction, dedicated and dial – up connection, connecting to internet through telephone line; Working of internet, Tools and services on Internet, E–mail, Usenet and newsgroup, Transferring files with FTP, Browsing the internet Concepts of various terms – HTTP, FTP, Hacker, E–commerce, Chatting, talking, ISP etc. Downloading and uploading concepts, HTML and important Tages, E–mail generation concept.

**Electronic Commerce:**

Meaning, Features, Importance, Applications, Types of E–Commerce, Activities

## Section – II

**4 Data Base Management System: (50%)**

DBMS as Programming Language, Utilities and tools, Introduction to DBMS–RDBMS–Difference between DBMS and RDBMS, Defining database and Indexes, Defining a database, Normalizing database, Data integrity, Data consistency, Defining indexes

**Data Entry:** Introduction to all Data Types, Proving data defaults, Input Validation, Calculated fields, Control Object, Read Options

**Windows:** Defining, Activating, Removing, Modifying, Saving and restoring Windows

**Menus:** Menu terminology, Popup menus, Horizontal bar Menu, Menu Functions, HIDE / SHOW / RELEASE / DEACTIVE Menu and Popup

**Tables:** Table Relationships, Sorting, Filtering etc.

**Forms:** Create a Form using Wizard, Design View, Editing Records using a Form, Editing Forms, Form Controls, Command Buttons, Sub Forms

**Reports:** Crate a Report using Wizard, Design View, Apply the Tools, Printing etc.

**Queries:** Introduction to Queries, Create a Query using Wizards, Design View, Application of Wild Cards, Deleting a Query

**Practical List:**
**Database Management System (MS–Access)**

| No | Name of the Practical |
|---|---|
| 1 | Introduction to MS–Access, Intro to Database and Table |
| 2 | Creating a database using Access Wizard – Description of fields, data types, field properties, format etc., Save the database |
| 3 | Using Practical No. 2 Describe Type, Data types as input Mast, indexed, default valve, Validation Rule etc. |
| 4 | Create a table using design view for the fields Roll No, Name, Marks of CC, ECO, BOM, ACCT, TOTAL, Enter at least 10 Records, Edit the data and data types of the fields |
| 5 | Using Practical No. 4 – Add new 5 records; Show how to sort, filter the data; See the layout of the data |
| 6 | Designing a form using a form wizard of an existing database |
| 7 | Introduction to queries; Creating and modifying simple queries; Use of Multiple tables in queries; Performing calculating and Expressions in queries |
| 8 | Create a student Data table and generate the queries; To search a particular records for ; given roll no; To search all students having B COM Degree; To search all students whose surname is “Patel” |
| 9 | Create a Report – Using the field name like ENO, ENAME, Basic, DA, HRA, PF, Department, Net Salary; Find DA, HRA, PF, Net Salary; Arrange the Records in Ascending order; Select the details of the employees whose HRA is greater than 1000; Select the details of the employees whose department name=”Sales” |
| 10 | Create a Label – Using the field name like Shareholder No, NAME, ADD1, ADD2, CITY, PIN CODE |

**Practical:**

Students are required to complete all practical in the year as per the list of practical prescribed

by the University. Students are required to write the practical in the journals and produced the same at the time of practical examination duly signed by the concerned teacher and the Dean of the college.

BB – 424 Statistics For Management – II

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

**1 Probability Distributions:**

Meaning of Probability Distribution; Binomial Distribution: Probability Mass function, properties, Derivation of mean and variance and its Applications; Poisson distribution: Probability Mass function, properties, Derivation of mean and variance and its Applications; Normal Distribution: Probability Density function, properties and its applications

**2 Statistical Quality Control:**

Concepts of Quality, Quality Control and Statistical Quality Control, Causes of Variation in Quality, Meaning, uses and advantages of SQC, Theory of Control Charts, Theory of Runs, 3σ Control limits and Revised Control Limits, Types of Control Charts, Control Charts for Variables ($\bar{x}$ and R Charts) and their Interpretations, Control Charts for Attributes (*p*, *np* and C Charts) and their Interpretations

**Section – II**

**3 Testing of Hypothesis I:**

Basic concepts: Hypothesis, Null Hypothesis, Alternative Hypothesis, Statistic, Parameter, Sampling Distribution, Standard Error, Type I and Type II errors, Level of Significance, Degrees of Freedom, Acceptance Region, Critical Region; Testing of Hypothesis, Testing Procedure; Large Sample Tests; (a) Test for Variables: Test of mean, Test of differences between two means, Test of difference between two standard deviations (b) Test for Attributes: Test of proportion, Test of difference between two proportions

**4 Testing of Hypothesis II:**

Small Sample Tests (a) t Test of Mean, Test of difference between two means, Paired t test (b) F Test: Test of difference between two variances, Application of F test in ANOVA (One way and two way)

**5 Chi Square Test:**

Test of Independence, Test of Goodness of Fit, Test for Population Variance

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Statistics for Management | Levin and Rubin | Printice Hall of India Pvt. Ltd., New Delhi |
| 2 | Statistics (Theory, Methods and Application) | Sancheti and Kapoor | S. Chand and Sons |
| 3 | Introduction to Statistics | R. P. Hooda | Macmillan India Ltd. |
| 4 | Statistical Methods | S. P. Gupta | |
| 5 | Problems & Solutions in Statistics | V. K. Kapoor | |

BB – 425 Managerial Economics – II

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

**1 Demand Forecasting: (20%)**

Meaning, Level of Forecasting, Need of Forecasting, Purpose of Demand Forecasting, Methods of Demand Forecasting, Factors influencing Demand Forecasting

**2 Theory of Cost and Cost Curves (30%)**

Concepts of Cost, Accounting Cost and Economic Cost, Money Costs and Real Cost, Opportunity Cost, Private and Social Costs, Fixed cost, Variable Cost, Short Run cost of production (FC, VC, AFC, AVC, TC, AC, MC) Relationship between MC and Average Cost (AC), Long run average cost curve, Long run Marginal Cost curve (LMC)

**Section – II**

**3 Equilibrium and Market Structure (30%)** Revenue analysis in Market Structure, Equilibrium of Profit Maximization, Perfect Competitive Market Structure, Properties, Short Run and Long Run Equilibrium, Monopoly Market Structure, Properties, Short Run Equilibrium, Price Determination, Types, When and Where possible, Dumping and Regulation of Monopoly, Monopolistic Competition, Meaning Properties, Selling Cost, Advertising and Non Price Competition, Long Run Equilibrium through Price Variation, Excess Capacity, Oligopoly, Concept, Kinked Demand Curve

**4 Pricing Policies & its Need (20%)**

Meaning, Objectives, Types of Pricing (With Example): Cost plus Pricing, Target Pricing, MC Pricing, AC Pricing Skimming, Going Rate Pricing, Customary Pricing

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Micro Economics for Management students | Ravindra H Dholakia & Ajay N Ozha | |
| 2 | Elementary Economics | K. K. Dewett & J. D. Varma | |
| 3 | A textbook of Economic Theory | A. W. Stonier & Hague D. C. | |
| 4 | Advance Economic Theory | M. L. Jhingam | |
| 5 | Micro Economic Theory | Dwivedi D. N. | |
| 6 | Managerial Economics | | B. S. Shah Prakashan |
| 7 | Elements of Economic Theory | | Sultanchand & co. |

BB – 426 Communication Skills – IV

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Objective:**

✪ To equip the students with language proficiency necessary for business communication.
✪ To give students extensive practices in all possible ways in LSRW skills.

**Section – I**

**1 Communication:**
Methods of Communication, Channels of Communication,

**Creativity:**
What is creativity? Creativity, Invention &Innovation, The creative individual, The process of creating, Creativity from Manager

**2 Public Relations:**
Oral Communication, Interviews, Speeches, Presentations, Dialogue Skills

**3 Language Functions:**
Expressing Positive feelings, Expressing Negative feelings, Conversing, Suggesting, Complaining

**Section – II**

**4 Writing:**
Comprehension of Stock Market Report, Insurance Correspondence, Business Reports (Individual & Committee), Import – Export Correspondence

**5 Grammar:**
Common errors in the usage of English, Spelling rules, The Participles, Function words, (As soon as, So…that, Such…that, As…if, Since, Yet, Still, Though, As, Question Tag, Phrase preposition), Synthesis

**6 Vocabulary:**
Word Building in English, Business Phrasal Verbs (From the list appended), Prefix & Suffix (From the list appended), Business idioms (From the list appended)

**Reference Books:**

| No. | Title | Author |
|---|---|---|
| 1 | Effective Communication | Urmila Raj & S. M. Rai |
| 2 | Creative English Communication | N. Krishna Swami & T. Shrimana |
| 3 | Communication in English | R. P. Bhatnagar & R. T. Bell – Orient Longman |
| 4 | Essentials of Business Communication | Rajendra Pal & J. S. Korlahalli – S. Chand & Sons |
| 5 | Good English | G. H. Vallins – Roopa & Co. |
| 6 | Let's Talk English | M. I. Joshi |
| 7 | Contemporary English Grammar, Structure and Composition | David Green – Macmillan |
| 8 | English for Social Interaction | G. V. Vyavhare & N. V. Bose |
| 9 | An interactive Grammar of Modern English | Shivendra K. Verma & Hemalatha Nagarjan |

**Subject: Viva Voice Programme**

**(Effective from 2012–2013)**

For "Viva Voice Programme" at 4th Semester the candidate should satisfy the following requirements:

**1** Self Introduction
**2** Talk at public places
**3** General knowledge
**4** Vocabulary
**5** Mock interview

Students have to select any short play, drama or novel and have to prepare a book-review based on that.

At the end of the semester there will be Viva–Voce Examination for this subject that will carry 50 marks.

BB – 426 Practical Studies (BBA)

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

For "Practical Studies" at 4th Semester the candidate should satisfy the following requirements:

(A) A visit to an unit as recommended for visit purpose to be followed by a report marketing aspects of such unit and

(B) Submit a study report of the published annual reports (Covering two years) of a company

At the end of the semester there will be Viva–Voce Examination for this subject that will carry 100 marks. (Marketing 50 Marks and Finance 50 Marks)

BB – 521 Business Environment – I

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1. **Elements of Business Environment:**
   Basic concept of B. E., Need of B. E. in S. M. and policy making, Factor influencing in B. E., Economic and non – environment of business

2. **Social Environment:**
   Meaning, Business and Society, Professionalization, Business Ethics and Culture, Social Audit, Consumerism

3. **Monetary Policy:**
   Meaning, Role in B. E., Objectives, Tools, Limitations

**Section – II**

4. **Fiscal Policy:**
   Meaning, Objectives, Recent changes in Tax and its impact on B. E.

5. **Money and Capital Market:**
   Meaning, Capital Market in India and Reforms and Impact on B. E., Introduction to SENSEX, NSE, OTCEL, SEBI, Risk management in Financial Institutions, Role of Finance Commission, Recommendations of F. C.

6. **Budget:**
   Meaning, Importance, Impact on B. E., Union and State Budget

**Reference Books:**

| No. | Title | Author |
|---|---|---|
| 1 | International Economics | Prof. Elseworth |
| 2 | Public Finance | Prof. Dalton |
| 3 | Business Environment | Prof. Francis Cherunilam |
| 4 | Industrial Policy | Govt. of India Publications |

BB – 522 Production Management

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1. **Introduction to Production & Operation Management:**

   Meaning of Factory, Operation, manufacturing, production and Production Management; Cases of Operation & Production Management and examples of conversion processes used in production system; Production as a means of creating utility; Objectives, scope and problems of production Mgt.; Types of Production System; Recent trends in the field of Production / Operation Management.

2. **Industrial Safety:**

   Meaning, Problems caused by industrial accidents, causes of accident, prevention or control of accidents, accident prevention or control programs, ingredients of a successful safety programme.

3. **Plant Planning & Design:**

   Meaning, importance, objectives & scope of Plant Planning, plant utilities, plant lighting, Ventilation, air–conditioning, industrial sanitation & noise control

**Section – II**

4. **Industrial Purchasing:**

   Meaning & Importance of Industrial Purchasing, Functions / Duties of Purchasing Department, Purchasing Policies, Purchasing procedures, Vendor selection and rating

5. **Plant Location & Plant Layout Material Handling Equipments:**

   Concept of plant Location, Factors affecting Plant Location; City, Suburban & Rural Areas as a Plant Site; Industrial Estates; Selection of actual site decision; Meaning & Types of layout with merits & demerits; Meaning of Material Handling Equipments; Principles of Material Handling; Classification and Advantages of Material Handling Equipments

6. **Stores Management:**

   Storekeeping, types of materials stored, objectives of stores management, functions of storekeeping, location and layout of stores, storage system, classification and Codification stock valuation

**Reference Books:**

| No. | Title | Author | Publications |
|---|---|---|---|
| 1 | Total Quality Management: Principles, Practice & Cases | Dr. D. D. Sharma | Sultan Chand & Sons, New Delhi |
| 2 | Total Quality Management: Text & Cases | K. Shirdhara Bhatt | H. P. H. , Bombay |
| 3 | Production & Materials Management | K. Shirdhara Bhatt | H. P. H. , Bombay |
| 4 | Production & Materials Management | Chunnawalla & Patel | H. P. H. , Bombay |
| 5 | Production & Materials Management | S. N. Cherry | P. H. I., New Delhi |
| 6 | Production, Productivity and Cost Effectiveness | C. B. Gupta | Sultan Chand & Sons, New Delhi |

BB – 523 Advanced Marketing Management-I

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1. **Understanding the Marketing Environment:**

   Meaning, Purpose of Marketing Environment Analysis, Elements of Micro Environment & Macro Environment, Brief idea about Global Marketing Environment and Indian Marketing Environment

2. **Marketing Research & Marketing Information System:**

   Meaning of marketing information system and marketing research, Components or elements of Marketing Information System, Importance of marketing research, Scope of marketing research, Types of marketing research, Steps in marketing research

3. **Consumer Behavior:**

   Meaning of Consumer Behavior, Factors affecting Consumer Behavior, Buying Roles and Types of Buying Behavior, Stages in Buying Decision Process

**Section – II**

4. **Demand Measurement and Sales Forecasting:**

   Meaning and Importance, Measurement of Market Demand, Major concepts in Demand Measurement, Methods of Sales Forecasting

5. **Branding, Packaging & Labeling:**

   Meaning of Branding, Brand related terminology, Benefits of Branding, Branding Strategy, Packaging – Meaning, functions, benefits; Labeling – Meaning and importance

6. **Product Management:**

   Why do people buy products and services; Some buyers motivations for buying products and services; Environmental factors affecting product and brand management; Product planning ,meaning, functions & importance; Way of modifying existing product lines; Study of General Electric Model & Boston Consultancy Group Matrix; Brand Image, Brand Personality, Brand Equity

**Reference Books:**

| No. | Title | Author | Publications |
|---|---|---|---|
| 1 | Marketing Management: Global Perspective Indian Context | V. S. Ramaswamy And S. Namakumari | Macmillan |
| 2 | Marketing Management: A south Asian Perspective | Philip Kotler, Kevin Lane Keller, Abraham Koshy & Mithileshwar Jha | Pearson Education, Prentice Hall |
| 3 | Marketing Management: Comprehensive Text, Best Practices and Corporate Insights | Arun Kumar and N. Meenakshi | Vikash Publishing House |
| 4 | Marketing Management: Text & Cases in Indian Context | K. Kaunakaran | H. P. H., Bombay |
| 5 | Product Management | Chunawalla & Patel | H. P. H., Bombay |
| 6 | Marketing Management | S. A. Sherlekar | H. P. H., Bombay |
| 7 | Marketing Management: Text and Cases | S. H. H. Kazmi | Excel Books |
| 8 | Marketing Management | Dr. C. B. Gupta | Sultan Chand & Sons, New Delhi |

BB – 524 Advanced Marketing Management-II

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1. **New Product Development & Product Life Cycle:**
   Meaning of New Product; Stages of New Product Development; Reasons of failure of new products in the market; Consumer Adoption Process; Stages of Product Life Cycle and marketing strategies adopted by marketers in different stages.
2. **Advertising:**
   Meaning of Advertising; Increased importance of Advertising; Role of Advertising; Advertising – Support for Sales & Marketing; Stages & Form of Advertising; Six Ms of Advertising
3. **Marketing Research:**
   Sources of Data: Secondary Data: Types, advantages and disadvantages; Primary Data: types, sources, methods of primary data collection, Merits and demerits; Data collection instruments: Questionnaire: steps for preparing questionnaire, types of questions; Sampling: advantages and disadvantages; Sampling methods: probability and non probability (as advantages and disadvantages in brief, statistical understanding not required); Scaling; Hypothesis; Data processing: preparing raw data, editing, coding, tabulation and summary of data preparation of research report: presentation, contents, principles of report writing

**Section – II**

4. **Personal Selling and Sales Force Management:**
   Personal selling process; Sales Force Management; Sources of Recruitment for Salesmen; Training to Salesmen; Motivating to Salesmen; Remuneration to salesmen; Controlling to salesmen; Sales force Structure
5. **Distribution Channel & Logistics Management:**
   Marketing Channels - Structure, Functions and Significance; Types of intermediaries in distribution channel & their functions; Distributions strategies; Physical distribution – Meaning and Importance; Functions of marketing logistics
6. **Evaluating & Controlling Marketing Performance:**
   Annual Plan Control; Profitability Control; Efficiency Control; Strategic Control; the Marketing Controller Concept

**Reference Books:**

| No. | Title | Author | Publications |
|---|---|---|---|
| 1 | Marketing Management: Global Perspective Indian Context | V. S. Ramaswamy And S. Namakumari | Macmillan |
| 2 | Marketing Management: A south Asian Perspective | Philip Kotler, Kevin Lane Keller, Abraham Koshy & Mithileshwar Jha | Pearson Education, Prentice Hall |
| 3 | Marketing Management: Comprehensive Text, Best Practices and Corporate Insights | Arun Kumar and N. Meenakshi | Vikash Publishing House |
| 4 | Marketing Management: Text & Cases in Indian Context | K. Kaunakaran | H. P. H., Bombay |
| 5 | Product Management | Chunawalla & Patel | H. P. H., Bombay |
| 6 | Marketing Management | S. A. Sherlekar | H. P. H., Bombay |
| 7 | Marketing Management: Text and Cases | S. H. H. Kazmi | Excel Books |
| 8 | Marketing Management | Dr. C. B. Gupta | Sultan Chand & Sons, New Delhi |

BB – 525 Advanced Financial Management – I

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1. **Capital Structure:**
   Meaning, Characteristics, Factors influencing Capital Structure; Optimum Capital Structure; Theories of Capital Structure, NI & NOI Approach, Under & over Capitalization, Arbitrage Process

2. **Principles of Working Capital and Planning & Financing of Working Capital:** Introduction, Nature of Working Capital, Need of Working Capital, Determinants of Working Capital, Types of Working Capital, Strategies for Working Capital, Conservative Method, Aggressive Method, Computation of Working Capital, Trade off Profitability and Risks, Determining Financing Mix, Sources of Financing, practical problems

3. **Receivable Management:**
   Introduction, Meaning, Characteristics, Objectives, Cost of Receivable management, Benefits, modes of payment, factor influencing investment and receivable, credit policies, credit policies variables, evaluation of individual account, monitoring accounts receivables, practical problems

**Section – II**

4. **Fund Flow Statement:**
   Meaning of fund flow statement, uses of fund flow statement, fund flow statement and income statement, preparation of fund flow statement, treatment of provision for taxation and proposed dividend, statement in changes in financial position, practical problems

5. **Factoring:**
   Evolution of factoring, meaning, mechanism of factoring, types of factoring, significance of factoring in India, financial aspect of factoring, advantages and disadvantages, factoring in India, Indian experience

**Reference Books:**

| No. | Title | Author | Publications |
|---|---|---|---|
| 1 | Financial Management | Khan & Jain | Tata McGraw Hill |
| 2 | Financial Management | Ravi M Kishore | Tata McGraw Hill |
| 3 | Financial Management | Prassana Chandra | Tata McGraw Hill |
| 4 | Financial Management | Dr S N Maheshwari | Sultan Chand & Sons, New Delhi |
| 5 | Financial Management | G. Sudarshna Reddy | H. P. H., Bombay |

BB – 526 Advanced Financial Management – II

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1. **Dividend Decision:**
   Meaning of dividend, Types of dividend, Determinants of dividend policy, Bonus shares and stock splits, Legal procedural and tax aspects, Gordon Walter model (Theory only), Modigliani Miller Model (Theory only), factors influencing dividend policy .

2. **Micro Finance:**
   Introduction, Meaning of Micro credit, Grameen Credit, Banking Rates and Norms, Role of SHG, Advantages of finance through SHG'S, Role of NGO in Micro Credit, Micro Credit Lending Models, Micro Credit Loan Delivery Models, Recent Studies on Micro Credit, Legal Frame Work

3. **Capital Market:**
   Primary Market: Introduction, Efficiency, Capital market in India, IPO, Secondary public offer, Right issue, Private placement, Offer for Sale
   Secondary Market: Introduction, Function, Listing of securities, Terminologies

**Section – II**

4. **Money Market:**
   Meaning, Characteristics, money market v/s capital market, Features, Objectives Features of developed money market, importance, composition of money market, call money market, operations in call market, advantages and drawbacks, commercial bills market, Discount market, Treasury bill market, money market instruments, Commercial paper, Certificate of deposit, Participation certificate, structure of Indian money market.

5. **Cash Flow Statement:**
   Meaning of C. F. S., Preparation of C. F. S., Difference between F. F. S. & C. F. S. Utility of C. F. S. (as per AS – 3) , limitation of C.F.S, accounting standard 3(revised), cash flow statement, cash forecast, practical problem.

**Reference Books:**

| No. | Title | Author | Publications |
|---|---|---|---|
| 1 | Financial Management | Khan & Jain | Tata McGraw Hill |
| 2 | Financial Management | Ravi M Kishore | Tata McGraw Hill |
| 3 | Financial Management | Prassana Chandra | Tata McGraw Hill |
| 4 | Financial Management | Dr S N Maheshwari | Sultan Chand & Sons, New Delhi |
| 5 | Financial Management | G. Sudarshna Reddy | H. P. H., Bombay |

BB – 621 Business Environment – II

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1. **Industrial policy of India (1991):**
   Introduction, Appraisal, Current Industrial Scenario; Role of Industrial Finance, Importance and Sources, Industrial Sickness, Meaning, Causes and Remedies; Issues of Privatization: Meaning, Need, Benefits and Ways of Privatization, Obstacles in Privatization; Privatization in India, Public Sector Enterprises Meaning, Issues in public sector enterprise reforms, Need, Expansion, Performance, Problems, Limitations of P. E. and Criticisms of P. E. reforms

2. **Role of the Government:**
   Regulatory, Entrepreneurial, Planning, Promotional, Constitutional, Price and Distribution Controls, Objectives of price policy in India, Subsidization

**Section – II**

3. **International Environment:**
   Regulation and promotion of foreign trade; Exim Policy of India (Recent); Concepts of EOUs and EPZS; International Environment Problems; WTO introduction, Objectives, Benefits and Limitations, Impact on Business Environment; MNCs: Role and critical Appraisal Policy towards MNCs; Globalization: Meaning, Impact on Indian Business, Appraisal, Foreign Direct Investment (FDI): Introduction, Flows and its impact on Indian Economy. Constraints against its Flows and needs

4. **Managerial Environment and Agriculture:**
   Workers participation in Management: Problems and Provisions; Recent technological changes in Agriculture and its impact on Productivity; Agricultural Marketing as a Business and its implications to prices for farmers

**Reference Books:**

| No. | Title | Author |
|---|---|---|
| 1 | International Economics | Prof. Elseworth |
| 2 | Public Finance | Prof. Dalton |
| 3 | Business Environment | Prof. Francis Cherunilam |
| 4 | Industrial Policy | Govt. of India Publications |

BB – 622 Entrepreneurship Development and Small Business

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

## Section – I

### 1. Introduction:

Meaning of Entrepreneur, Entrepreneurship, Intrapreneurship; Perspectives of Entrepreneur / Entrepreneurship (Economist, Psychologist and Sociologist); Features and Functions of Entrepreneurship; Significance of Entrepreneurship in Economic Development; Motivation for becoming an Entrepreneurship; Barriers to Entrepreneurship; The Entrepreneurial Process; Life–sketch of various successful Indian Entrepreneurs

### 2. Entrepreneurial traits, Characteristics and Skills:

Characteristics of Entrepreneur; Qualities of Successful Entrepreneurs; Classification of Entrepreneurs; Role of Entrepreneurs; Types of skills required in Entrepreneurship; Comparison of Entrepreneurs, Intrapreneurs and Traditional Managers; Entrepreneurial competencies and skills; Traits of good entrepreneurs; Comparison between Male and Female Entrepreneurs

### 3. Role of support Institutions to Promote Small Scale Industries / Entrepreneurship:

Need for Institutional Support, Pattern, objectives and types of Incentives (Support), Institutional Support

## Section – II

### 4. Small Scale Industries:

Meaning, Characteristics of Small Industries, Importance of SSI, Advantages of SSI, Classification of Business Occupation in India, Structure of Small Scale Sector, Distinction between Medium and Large Scale Industries and Small Scale Industries, Size based classification of Industries, Problems of SSI, Sickness in SSI – Reasons and Remedies, Brief idea about The Micro, Small and Medium Enterprises Development Act – 2006

### 5. Rural Industries and Rural Artisans:

Meaning of Rural Industry and Rural Artisans, Benefits of Rural Industrialization, Types of Rural Industries, Strategy of Rural Industrialization, Major Challenges in the way of development of Rural Industries

### 6. Policies governing Small Scale Industries:

Procedure for Registration of Small Scale Industries, Setting up Small Scale Industries – Whom to Contact and For What, Objectives of policy governing Small Scale Industries, Salient features of new policy, Thrust areas of policy for small entrepreneurs.

### Reference Books:


| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Entrepreneurial Development – I, II & III | Vasant Desai | Himalaya Publishing House, Bombay |
| 2 | Entrepreneurship | Robert D Hisrich | The Tata McGraw Hill Publication, New Delhi |
| 3 | Small Scale Enterprises and Entrepreneurship Ecosystem | Vasant Desai | Himalaya Publishing House, Bombay |
| 4 | Small Scale Enterprises and Entrepreneurship | Vasant Desai | Himalaya Publishing House, Bombay |
| 5 | The Dynamics of Entrepreneurial Development and Management | Vasant Desai | Himalaya Publishing House, Bombay |
| 6 | Theories of Entrepreneurship | Vasant Desai | Himalaya Publishing House, Bombay |
| 7 | Entrepreneurial Development | Vasant Desai | Himalaya Publishing House, Bombay |
| 8 | Entrepreneurship Management | Vasant Desai | Himalaya Publishing House, Bombay |
| 9 | Entrepreneurial Development | C. B. Gupta | Sultan Chand & Sons, New Delhi |

BB – 623 Advanced Marketing Management – III

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

## Section – I

1. **Marketing of Services:**
   Meaning of Service; Reasons of growth in Service Industries; Difference between Service & Product; Characteristics of Services; Implications of service characteristics and ways of overcoming them; Classifications of Services; Marketing Mix for Services; Total Quality Management in Marketing of Services
2. **Events Marketing:**
   Meaning of Events and Events Marketing; Types/ categories of events and key elements of events; Importance of Events Marketing and Event Marketing Mix; SWOT analysis, the event team, Code of ethics and legal compliances
3. **Insurance Marketing:**
   Human Activities under the umbrella of Insurance; Marketing objectives for Insurance; Types of insurance; Challenges in Insurance Marketing; Insurance Marketing Strategies; Pre–requisites for Insurance Selling

## Section – II

4. **Rural Marketing:**
   Meaning of Rural Market & Rural Marketing, Rural Market Environment, Demand of products and services in Rural Areas, Difference between Rural and Urban Marketing, Rural Marketing Strategies, Problems of Rural Marketing, Future of Indian Rural Market
5. **Retail Marketing:**
   Functions of Retailing, Retail management Strategy, Retail management activity, Relationship management, Retail Organization structure, Retailing Scene in India, Reliance's Entry into retail Marketing, Growth of High Way Retailing, Profile of few leading retailers in India
6. **Businesses / Industrial Marketing:**
   Meaning, Characteristics of Business Buyer, Decision criteria in Industrial Purchasing, Special Marketing consideration in Industrial Marketing, Influences on Business Buyer Behavior, Marketing Mix

**Reference Books:**


| No. | Title | Author | Publications |
|---|---|---|---|
| 1 | Marketing Management: Global Perspective Indian Context | V. S. Ramaswamy And S. Namakumari | Macmillan |
| 2 | Marketing Management: A south Asian Perspective | Philip Kotler, Kevin Lane Keller, Abraham Koshy & Mithileshwar Jha | Pearson Education, Prentice Hall |
| 3 | Marketing Management: Comprehensive Text, Best Practices and Corporate Insights | Arun Kumar and N. Meenakshi | Vikash Publishing House |
| 4 | Marketing Management: Text & Cases in Indian Context | K. Kaunakaran | H. P. H., Bombay |
| 5 | Product Management | Chunawalla & Patel | H. P. H., Bombay |
| 6 | Marketing Management | S. A. Sherlekar | H. P. H., Bombay |
| 7 | Marketing Management: Text and Cases | S. H. H. Kazmi | Excel Books |
| 8 | Marketing Management | Dr. C. B. Gupta | Sultan Chand & Sons, New Delhi |

BB – 624 Advanced Marketing Management – IV

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1. **International Marketing:**
   Meaning; Difference between Domestic & Global Marketing; The Driving forces of Global Marketing; The Global Marketing Environment; Global Segmentation & Trading; Global Positioning & Branding; Global Advertising; Global Pricing; Entry Strategies for Global Companies; Problems in International Marketing
2. **Product Differentiation and Positioning:**
   Meaning, Product Differentiation, Service Differentiation, Personnel Differentiation, Channel Differentiation, Image Differentiation, Positioning
3. **Direct Marketing and Customer Satisfaction:**
   Meaning, Difference between Mass Marketing and Direct Marketing, Requisites for success of Direct Marketing, Methods of Direct Selling, Advantages and Disadvantages of Direct Marketing, Customer Satisfaction, Indian Industry and Customer Satisfaction

**Section – II**

4. **Marketing and Society: Social Responsibility and Marketing Ethics:**
   Social Criticism of Marketing, Marketing's impact on the society as a whole, Citizen and Public Actions to regulate marketing, Business actions towards Socially Responsible Marketing, Marketing Ethics, Principles for Public Policy Toward Marketing
5. **Marketing and Competitive Strategies:**
   **Concept of Competitive Strategies, Porter's Five Forces Model, Analysis of Competitors, Designing Competitive Strategies, Competitive Intelligence System**
6. **Consumerism & Consumer Protection:**
   Consumerism and consumer protection, Need and importance of consumer protection, Consumer exploitation or problems, Methods of consumer protection, Measures for Consume Protection, Brief idea about laws applicable to marketing activities, Brief idea about Consumer Protection Act – 1986, Voluntary Consumer Organizations in India

**Reference Books:**

| No. | Title | Author | Publications |
|---|---|---|---|
| 1 | Marketing Management: Global Perspective Indian Context | V. S. Ramaswamy And S. Namakumari | Macmillan |
| 2 | Marketing Management: A south Asian Perspective | Philip Kotler, Kevin Lane Keller, Abraham Koshy & Mithileshwar Jha | Pearson Education, Prentice Hall |
| 3 | Marketing Management: Comprehensive Text, Best Practices and Corporate Insights | Arun Kumar and N. Meenakshi | Vikash Publishing House |
| 4 | Marketing Management: Text & Cases in Indian Context | K. Kaunakaran | H. P. H., Bombay |
| 5 | Product Management | Chunawalla & Patel | H. P. H., Bombay |
| 6 | Marketing Management | S. A. Sherlekar | H. P. H., Bombay |
| 7 | Marketing Management: Text and Cases | S. H. H. Kazmi | Excel Books |
| 8 | Marketing Management | Dr. C. B. Gupta | Sultan Chand & Sons, New Delhi |

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BB – 625 Advanced Financial Management – III

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

1. **Indian Financial System:**
   Functions of financial system, financial concepts, financial intermediaries, financial instruments, financial rate of return, Development of financial system in India, Multiplicity of financial instruments legislative support, Weakness of Indian financial system

2. **Financial Services:**
   Meaning, Classification, Fund based activities, Non fund based activities, financial innovation, Innovation financial instruments, Challenges, Present scenario

3. **Mutual Fund:**
   Introduction, Meaning of various terms, Types of fund, Importance and risk, Mutual fund in industry in India

**Section – II**

4. **Insurance:**
   Introduction, principles of insurance, types of policies, major insurance roles, a brief history of life history insurance segment, a brief history of general insurance business in India , regulation of insurance companies, claims, practical problems.

5. **Capital Budgeting:**
   Introduction, Need of capital budgeting, Types of capital budgeting decisions, Capital budgeting techniques: Payback, NPV, PI, ARR, IRR – excluding examples of replacement of assets; Meaning of capital rationing, risk and uncertainty, sensitivity analysis, decision tree.

**Reference Books:**

| No. | Title | Author | Publications |
|---|---|---|---|
| 1 | Indian Financial System | Vasant Desai | H. P. H., Bombay |
| 2 | Financial Market and Services | Gorden Natrajan | H. P. H., Bombay |
| 3 | Financial Management | Khan & Jain | Tata McGraw Hill |
| 4 | Financial Management | Ravi M Kishore | Tata McGraw Hill |
| 5 | Financial Management | Prassana Chandra | Tata McGraw Hill |
| 6 | Financial Management | Dr S N Maheshwari | S. Chand & Sons, New Delhi |

BB – 626 Advanced Financial Management – IV

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

## Section – I

1. **Merchant Banking:**

   Introduction, definition, origin, merchant banking in India, merchant banks and commercial banks, services of merchant banks, Qualities required of merchant banks, merchant bankers as lead managers, guidelines, merchant bankers commission, merchant bankers in the market making process, progress of merchant banking in India, problems, scope of merchant banking in India.

2. **Venture Capital:**

   Introduction, evolution, mechanism of venture capital, venture capitalist, types of venture capitalist firms, benefits of venture capital, venture capital v/s debt, venture capital fund v/s mutual funds, types of investors, venture capital fund stages, venture capital scenario in India, Decline in investment, problem with venture capital in India.

3. **Banking and Non Banking Services:**

   Importance of functions of banks, Development of banking in India, Scheduled Commercial banks, Cooperative banking, Basic Terminologies – CRR, SLR, Bank Rate, Repo Rate, Reverse Repo Rate , CRAR, Non banking finance companies, Development banking

## Section – II

4. **Leasing and hire purchasing**

   Meaning, evolution, Types of leasing, advantages, disadvantages, Rationale of leasing, Mechanics of leasing, lease market in India, Leasing as finance decision (Basic Sums).

   **Hire Purchase:**

   Introduction, features, evolution, Legal aspects, Hire purchases & credit sale, Hire purchases & installment sale, Hire purchases & leasing, Bank credit for hire purchases

5. **Derivatives**

   Meaning, definition, kinds of financial derivatives, Forwards , features of forward, financial forward, Futures, feature of futures, types of futures, commodity futures, financial futures, forward vs. futures , advantages of forward and futures, Options, features of option , share option, currency option, benefits, Swap, features of swap, kinds of swap, advantages , importance of derivatives, Inhibiting factors, derivatives in India, Recent Development

**Reference Books:**

| No. | Title | Author | Publications |
|---|---|---|---|
| 1 | International Finance | V. A. Avdhani | Himalaya Publication |
| 2 | Financial Management | Khan & Jain | Tata McGraw Hill |
| 3 | Financial Management | Ravi M Kishore | Tata McGraw Hill |
| 4 | Financial Management | Prassana Chandra | Tata McGraw Hill |
| 5 | Financial Management | Dr S. N. Maheshwari | S. Chand & Sons, Delhi |
| 6 | Indian Financial System | Vasant Desai | H. P. H., Bombay |
| 7 | Financial Market and Services | Gorden Natrajan | H. P. H., Bombay |
| 8 | Merchant Banking and Financial Services | Dr. K. Ravichandran | H. P. H., Bombay |

BB 141 - Business Communication

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**1.Text :**
Developining English Skills – P. K. Thakkar, T. J. Purani, S. D. Desai O U Press, New York

2.Communication:
Meaning, Definitions, Communication Cycle (Process of Communication), Objectives of Communication, Channels of Communication, Downward Channel, Upward Channel

3. Vocabulary:
Abbreviations, One Word Substitution (Every semester new words will be introduced), Idioms and Phrases (Every semester new introduced) Commercial Terms (From the List Appended)

**4. Grammar:**
Use of Modal Auxiliaries, Tenses (Present and Past), The Participle, Figures of Speech

**5. Writing:**
Parts of Business letter (Regular and Occasional) (1) Letter Head (2) The Date (3) The Inside Address (4) The Salutation (5) The Body of the letter (6) The Complimentary Close (7) The Signature (8) Enclosure (9) Post Script
**Seven C's:** Clarity, Correctness, Conciseness, Courtesy, Completeness, Coherence, Compactness
**Business letters:** Inquiry letters & its replies.
Essay writing: Unseen current and World affairs, Topics of General Interest.

**6 LSRW Skills :**
**Listening** Comprehension or dialogues
**Speaking** on the given topic or conversation in group
**Reading** comprehension based on News English Newspaper, magazines, etc.
**Writing** on the topics given by using English Language.

**Reference Books:**

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| No. | Title | Author |
|---|---|---|
| 1 | Effective Communication | Urmila Raj & S. M. Rai |
| 2 | Creative English Communication | N. Krishna Swami & T. Shrimana |
| 3 | Communication in English | R. P. Bhatnagar & R. T. Bell – Orient Longman |
| 4 | Essentials of Business Communication | Rajendra Pal & J. S. Korlahalli – S. Chand & Sons |
| 5 | Good English | G. H. Vallins – Roopa & Co. |
| 6 | Let's Talk English | M. I. Joshi |
| 7 | Contemporary English Grammar, Structure and Composition | David Green – Macmillan |
| 8 | A Practical English Grammar | A. J. Thomson & A. V. Martinet |
| 9 | English for Social Interaction | G. V. Vyavhare & N. V. Bose |
| 10 | An interactive Grammar of Modern English | Shivendra K. Verma & Hemalatha Nagarjan |
| 11 | A Teacher's Grammar of English | K. R. Narayanswamy (Orient Longman) |
| 12 | Developing Communication Skills | Krishna Mohan & Meera Benerji (MacMillan) |
| 13 | Principles and Practice of Business Communication | Rhoda A. Doctor & Aspi H. Doctor (A. R. Shah & Company, Mumbai) |

BB – 142 Fundamentals of Management

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

| | | |
|---|---|---|
| 1 | **Nature and Scope of Management:**<br>● Definition and Meaning,<br>● Significance and Objectives<br>● Management as a process, profession, Science or Art.<br>● Brief idea about Management Thinkers ( Henry Fayol, Peter Drucker, Michael Porter, Peter Senge, C.K.Prahalad)<br>● Difference between Management & Administration<br>● Functions at various levels of management. | |
| 2. | **Planning:**<br>● Meaning and Nature of planning<br>● Types of planning<br>● Brief idea of Planning premises Constraints of planning / Barriers to effective planning<br>● Planning process with emphasis on objectives<br>● Meaning & Importance of Forecasting. | |
| 3. | **Organizing:**<br>● Definition And Meaning<br>● Concept of organizing & Organization<br>● Steps in organizing<br>● Principles of organizing<br>● Types of Organization (Line, Functional, Line and staff, Committee, Depart mentation)<br>● Span of Control. | |
| 4. | **4.Directing :**<br>● Definition and Meaning<br>● Nature and scope of directing.<br>● Importance<br>● Guiding principles<br>**Motivation:**<br>● Definition and Meaning<br>● Importance of Motivation<br>● Motivation Theories by (Maslow, Herzberg, Douglas McGregor, Theory X & Y) | |

| | | |
|---|---|---|
| 5. | **Leadership & Controlling**<br>● Definition and Meaning<br>● Importance of Leadership<br>● Leadership theories (Trait Theory, Behavioral Theory, Situational Theory).<br>● Leadership Styles (Democratic, Autocratic, Laissez- Faire).<br>**Communication:**<br>● Definition and Meaning<br>● Importance of Managerial communication.<br>**Controlling:**<br>● Definition and Meaning,<br>● Importance of controlling<br>● Process of control<br>● Types of Control | |
| 6. | **New Concepts in Management.**<br>Introduction to Following Concepts:<br>● Outsourcing<br>● Learning Organization<br>● Business Process Reengineering<br>● Green Management<br>● Workforce Diversity | |

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Principles & Practice of Management | L. M. Prasad | S. Chand & Sons, New Delhi |
| 2 | Introduction to Management | Study Materials | I. C. F. A. I., Hyderabad |
| 3 | Management | J. A. F. Stonner | P. H. I., New Delhi |

BB – 143 Micro Economics-I

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

| | |
|---|---|
| 1 | **Unit 1 : Introduction to Economics:**<br>Definitions, of economics ,- Adam Smith, -Prof. Robbins- nature and scope of economics -Positive and normative science |
| 2. | **Unit 2 : theory of demand**<br>**Law of demand determinants of demand , shift in demand curve**<br>+<br>**Supply theory Law of supply determinants of supply , shift in supply curve** |
| 3. | **Unit 3 :utility:**<br>concept of utility, -law of diminishing marginal utility, -law of equimarginal utility,- derivation of demand curve |
| 4. | **Unit 4 :Market:**<br>Meaning of market types of market perfect, monopoly, monopolistic, and oligopoly |
| 5. | **Unit 5 :Theory of distribution I :**<br>-Marginal productivity theory of distribution ,meaning and concept of<br>-rent.( theory of rent Ricardian and modern ) , |
| 6. | **Unit 6 :Theory of distribution II**<br>-Wage theory meaning method real & nominal wage ,<br>-Profit theory by Schumpeter and Knight theory of profit,<br>-Interest ; meaning net & gross interest |

**Reference Books:**

| No. | Title | Author |
|---|---|---|
| 1 | Micro Economics for Management Students | Ravindra H Dholakia & Ajay N Oza |
| 2 | A Text book of Economics Theory | A. W. Stoner & Hague D. C. |
| 3 | Elements of Economics Theory | K. P. M. Sundaram |
| 4 | Micro Economics Theory | D. N. Dwivedi |
| 5 | Value & Capital | Prof. Hicks |
| 6 | Principals of Economics | B. S. Shah Prakashan |

BB 144 - Business Mathematics and Quantitative Techniques

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Section – I**

**1 Set Theory:**

Sets, Subsets, Equality of two sets, Null set, Universal set, Complement of a set, Union and intersection of sets – Difference of two sets, Venn diagram, De Morgan's laws, Cartesian product of two sets, Laws of algebra of two sets, Applications of set theory.

**2 Function:**

Definition, Domain, Co-domain, Range, Types of functions, Equal functions, Real functions, Odd and Even functions, Different functions and their graph, Some functions in Commerce and Economics, Break-Even point, Applications

3 **Limit and Continuity (without involving trigonometric functions):**

Preliminary idea of function and its properties, Limit of a function, Limits of sums, Products and Quotients of functions and their uses in evaluating limits. Continuity of f(x), where f (x) is a polynomial of x, rational function of two polynomials of x.

**Section – II**

**4 Matrix algebra**

Definition of a Matrix, Equality, Transpose of a Matrix, Types of Matrices, Addition, Subtraction of Matrices, Scalar Multiplication with a Matrix, Multiplication of two Matrices , Orthogonal Matrix, Determinant, Difference between determinant and matrix, Adjoint of a Matrix, Inverse of a Matrix, Solution of linear equations in two variables using inverse Matrix

**5 Permutation and Combinations:**

Fundamental rule of counting, Meaning and Properties of Permutation, Permutation of n–different things, Permutation of similar things, permutation when things are repeated, Circular Permutations, Restricted Permutation, Meaning and properties of Combination, Restricted Combination, Examples of Permutation and Combination.

**6 Derivative and its Applications**

Definition of derivative, working rules of derivatives (without proof), Derivatives of explicit, Composite and implicit functions (without involving trigonometric functions). Second order derivative

Maximum and Minimum values of a function, Applications of derivative in economic theory, Market equilibrium, price and income elasticity of demand and supply, Marginal revenue and Marginal cost. Marginal revenue and Price elasticity of demand, Maximization of total revenue and profit, Minimization of cost

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Business Mathematics | Sancheti & Kapoor | S. Chand, New Delhi |
| 2 | Mathematics for Management | M. Raghavachari | Tata McGraw Hill |
| 3 | Elements of Business Mathematics | R. S. Soni & Others | Pitambar Publishing Co. |
| 4 | Business Mathematics | Allen R. G. D. | Macmillan, New Delhi |
| 5 | Business Mathematics | J. K. Singh,<br>Deepti Rani | Himalaya Publishing House |
| 6 | Quantitative analysis for Management | Render, Stair, Hanna & Badri | Pearson Publications |
| 7 | Quantitative Techniques for Management | Vohra N. D. | Tata McGraw Hill Publications |

BB – 145 Fundamentals of Accountancy

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**Introduction to Accounting:**

- Nature of accounting
- Definitions
- Objectives
- Functions and Scope
- Advantage and Limitations of Accounting
- Branches of Accounting
- Basic Accounting Term.

**Business Transaction and Accounting Cycle:**

- Meaning of Accounts
- Classification of Accounts
- Rules of Debit and Credit
- Journal
- Ledgers
- Trial Balance
- Accounting Principles
- Convections and Concepts
- Theory of Revenue and Expenditure

| | |
|---|---|
| | **Inventory Valuation:**<br>● Meaning<br>● Method of Inventory System<br>● Periodic and Perpetual Inventory<br>● AS 2<br>Example of Inventory Valuation- FIFO, LIFO, Weighted Average. |
| 4. | **Final Accounts of Sole Proprietor:**<br>● Preparation of Trading Account<br>● Profit and Loss Account<br>● Balance Sheet |
| 5. | **Accounting With Tally:**<br>● Tally History and Journey<br>● Introduction of GST<br>● Creation of Accounting Master<br>● Creation of Inventory Master<br>● Voucher Entry of Accounting<br>● Voucher Entry of Inventory<br>● Invoicing<br>● Report Generation like Trading Account, Profit and Loss Account, Trial Balance, Balance Sheet, Ledger, Stock Summary, Etc. |
| 6. | **Preparation of Company Final Accounts:**<br>● Vertical form of Profit and Loss Account<br>● Balance Sheet<br>(As per Companies Act, 2013-Schedule VI) |

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Modem Accountancy I & II | M. Hanif & A. Mukherjee | Tata McGraw Hill |
| 2 | Financial Accounting | P. C. Tulsion | S. Chand |
| 3 | Problems and Solutions in Accountancy | S. N. Maheshwari | S. Chand |

BB – 146 IT Tools and Applications

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

**SECTION: I**

**1. Fundamentals of Computer**

(A) Basic Introduction:

What is Computer? – Types of Computer – Types of Digital Computer - Basic Digital structure of Computer. Characteristics – Components -limitation – New technology

Introduction of Input Devices:

Different devices - Keyboard, Mouse, Scanners, MICR, OMR, OCR, Touch Screen, Touch Pad, Light Pen, Speech Input Devices etc.

Introduction of Output Devices:

Printer, Screen, Plotter

Memory Organization:

Memory System: Primary and Secondary Memory, RAM, ROM, PROM, EPROM, EEPROM etc.

Storage Devices and Media:

Hard Disk and its types

(B) Software: Introduction to Software: Types and Functions of Software, Introduction to Operating System and its Types.

**2. Application and Uses of Office Automation:**

Today's office, need for office automation, Functions and uses of Office Automation. Tools of office Automation ex., Intro. to digital payment

**3. Introduction to Windows 2007 and advantages:**

(A) Graphical User Interface (GUI) :

Basic Introduction Pointing devices, Windows, Menu, Dialog Boxes, Icons, Desktops,

GUI based Commands:

To create, move, Delete, Cut & Copy. Rename, Printing, Use of Recycle Bin etc

(B) Windows Accessories: Application of Accessories - Notepad, Paint, System Tools etc.

**SECTION: II**

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**(Basic Application of Word Processor, Presentation and Spread Sheet Programme)**

**4. Introduction to Word Processor**

Introduction to Text Editor

Basic Commands of Text Editor, Word Processor – Notepad, Word Pad, Cut, Copy & Paste, Paragraph, Margin etc.

Introduction to Word Processor

Basic Commands – Formatting Tools Bar, Page Setup, Paragraph setting, Table Command – Options, Calculations using Table

**5. Introduction to Power Point Presentation**

Basic Introduction –

How to create Slide – Cut – Copy – Paste etc. Manipulations of Slide – Preview of Slide with Options – Insert Audio, Graphics, and Video etc.

**6. Introduction to Spread Sheet Programme**

Basic Introduction –

Characteristics, Advantages – Functions, Applications.

Introduction to Basic Command – Formula Bar, Name Box, Cell, Address, Reference etc.

Basic Functions

a). Mathematical : Factorial, Integer, Abs, Celling, Round, Truncate

b). Statistical: Min, Max, Sum and various Sum functions, Average etc.

c). String: Left, Right, Len, Proper, Substitute, Exact, Concatenate etc.

## Reference Books :

| No. | Title | Author |
|---|---|---|
| 1 | Fundamental of Computer and Its Application – Part 2 | Dr. A. M. Patel, Pankaj Pandya, Dhiren Desai |
| 2 | Internet the Complete Reference | Young |
| 3 | Ste–By–Step Microsoft Excel–2007 | Curtis D. Frye (Microsoft Press) |
| 4 | Introduction to Computer Fundamentals with Microsoft Office | TejasThakkar,Sejal Shah |
| 5 | **Online References :**<br>www.tutorialpoint.com<br>www.javapoint.com<br>www.w3school.com | -- |

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AE – 111 Environmental Studies

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

As per UGC guidelines current syllabus prescribe by Dharmsinh university subject code AE211 Environmental Studies.

BB – 147 Value Education

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

## SECTION – I

**UNIT – I : Concept of Human Values,** Value Education Towards Personal Development Aim of education and value education; Evolution of value oriented education; Concept of Human values; types of values; Components of value education. Personal Development: Self-analysis and introspection; sensitization towards gender equality, physically challenged, intellectually challenged. Respect to - age, experience, maturity, family members, neighbours, co-workers. Character Formation Towards Positive Personality: Truthfulness, Constructivity, Sacrifice, Sincerity, Self-Control, Altruism, Tolerance, Scientific Vision.

**UNIT – II :** Value Education Towards National and Global Development National and International Values: Constitutional or national values - Democracy, socialism, secularism, equality, justice, liberty, freedom and fraternity.

**UNIT – III :** Social Values - Pity and probity, self-control, universal brotherhood. Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith. Religious Values - Tolerance, wisdom, character. Aesthetic values - Love and appreciation of literature and fine arts and respect for the same. National Integration and international understanding.

## SECTION – II

**UNIT –IV :** Impact of Global Development on Ethics and Values Conflict of cross-cultural influences, mass media, cross-border education, materialistic values, professional challenges and compromise. Modern Challenges of Adolescent Emotions and behavior;

**UNIT – V :** spirituality: Comparison and competition; positive and negative thoughts. Adolescent Emotions, arrogance, anger, instability, selfishness, defiance and management of all emotions.

**UNIT - VI :** Theraupatic Measures Control of the mind through a. Simplified physical exercise b. Meditation – Objectives, types, effect on body, mind and soul c. Yoga – Objectives, Types, Asanas d. Activities: (i) Moralisation of Desires (ii) Neutralisation of Anger (iii)Eradication of Worries.

Books:

[1] T. Anchukandam and J. Kuttainimathathil (Ed) Grow Free Live Free, Krisitu Jyoti Publications, Bangalore (1995)

[ 2] Mani Jacob (Ed) Resource Book for Value Education, Institute for Value Education, New Delhi 2002. [3] DBNI, NCERT, SCERT, Dharma Bharti National Institute of Peace and Value Education, Secunderabad, 2002.

[ 4] Daniel and Selvamony - Value Education Today, (Madras Christian College, Tambaram and ALACHE, New Delhi, 1990)

[ 5] S. Ignacimuthu - Values for Life - Better Yourself Books, Mumbai, 1991. 6.

.

M.M.M.Mascaronhas Centre for Research Education Science and Training for Family Life Promotion - Family Life Education, Bangalore, 1993. WEBSITES AND

e-LEARNING SOURCES:
www.rkmissiondhe/.org/education.html/
www.clallam:;org/lifestyle/education.html /
www.sun.com/../edu/progrmws/star.html/
www.infoscouts.com
www.secretofsuccess.com
www.1millionpapers.com http://militarlyfinance.umuc.edu/education/edu-network.html/

BB – 241 Communication Skills for Manager

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

| |
|---|
| **1. Importance of English and its International Value:** Barriers to effective communication, Barriers to effective listening, Characteristics of good communication, Channels of Communication: (1) External Communication (a) Outward (b) Inward (2) Internal Communication (3) Horizontal Channel |
| 2. Grammar: Prepositions, The Gerund, Parts of Speech, The Adjective, Noun |
| **3. Text- "Wings of Fire"** By A . P. J. Kalam |
| **4. Writing:** Order letters and Cancellation of Order letters Letter of Complaints and Adjustments, Agency Correspondence, Application Writing, Precise Writing, Letters to the Editor (public interest) |
| **5. Vocabulary**: Confusing Words (New list per semester), One word substitution (New list per semester), Idioms and Phrases (New list per semester), Synonyms (New list per semester), Antonyms (New list per semester), Homonyms |

.

**6. Book Review:**

Nature of book review, Characteristics and purpose of book review, Critical analysis Guidelines: Book not less than 100 pages; it may be biography /Auto–biography; Play, Novel or a book of general knowledge related to general interest

**LSRW Skills** tested and a book is prescribed in the syllabus with exercise work.

**Reference Books:**

| **No.** | **Title** | **Author** |
|---|---|---|
| 1 | Effective Communication | Urmila Raj & S. M. Rai |
| 2 | Creative English Communication | N. Krishna Swami & T. Shrimana |
| 3 | Communication in English | R. P. Bhatnagar & R. T. Bell – Orient Longman |
| 4 | Essentials of Business Communication | Rajendra Pal & J. S. Korlahalli – S. Chand & Sons |
| 5 | Good English | G. H. Vallins – Roopa & Co. |
| 6 | Let's Talk English | M. I. Joshi |
| 7 | Contemporary English Grammar, Structure and Composition | David Green – Macmillan |
| 8 | A Practical English Grammar | A. J. Thomson & A. V. Martinet |
| 9 | English for Social Interaction | G. V. Vyavhare & N. V. Bose |
| 10 | An interactive Grammar of Modern English | Shivendra K. Verma & Hemalatha Nagarjan |

BB -242 Cost & Management Accounting

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

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| | |
|---|---|
| 1. | **Elements of Costing:**<br><br>● Definition<br>● Objectives<br>● Advantages,<br>● Limitations<br>● Comparison with Financial Accounts<br>● Cost Classification<br>● Methods of Costing(Unit, Job, Contract, Process, Operating, Multiple only Theory)<br>● Types of Costing (Uniform, Historical, Marginal, Absorption, Standard, Direct Only Theory)<br>● Cost Unit and Element of Cost |

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|---|---|
| 2. | **Material:**<br><br>● Meaning of Material (Direct and Indirect)<br>● Determining Various Stock Level (Maximum, Minimum, Ordering, Danger, Reordering, Safety)<br>● Economic Ordering Quantity (E.O.Q)<br>● Inventory Turnover Rate<br>● ABC Method<br>● Wastage (Normal and Abnormal)<br><br>**Labour:**<br><br>● Direct and Indirect Labour<br>● Labour Turnover Rate (Separation Method, Replacement Method and Joint Method)<br><br>**Overheads:**<br><br>● Classification of Overheads<br>● Segregation of Semi Variable Overheads<br>● Allocation of Overheads to Various Departments. |
| 3. | **Unit Costing:**<br><br>● Introduction<br>● Elements of Cost<br>● Classification of Expenses<br>● Performa of a Cost Sheet<br>● Work in Progress<br>● Example of Cost Sheet<br>● Tender Price |

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|---|---|
| 4. | **Introduction of Management Accounting:**<br><br>● Introduction to Management Accounting<br>● Meaning<br>● Objectives<br>● Limitations<br>● Difference between Financial, Cost and Management Accounting, Tools of Management Accounting (Only Theory). |
| 5. | **Marginal Costing:**<br><br>● Meaning<br>● Advantages<br>● Limitations<br>● Break-Even Analysis (Assumption, B.E.P., PV Ratio, Margin of Safety)<br>● Meaning of Key Factor<br>● Computation of Optimum Product/ Sales Mix (Computation of Product/Sales Mix on the bases of one Key Factor Only) (Simple Practical Problems Should be asked)<br><br>**Absorption Costing:**<br><br>● Meaning<br>● Difference between Absorption and Marginal Costing<br>● Example of Income determination under Absorption Costing and Marginal Costing. (One Year Information). |

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|---|---|
| 6. | **Budget and Budgetary Control:**<br><br>● Meaning of Budget<br>● Budgeting and Budgetary Control<br>● Advantages and Limitations of Budgeting<br>● Types of Budgets (Only Theory)<br>● Simple Practical Problem to be asked for preparation of Cash Budget and Flexible Budget. |

**Reference Books:**

| No. | **Title** | **Author** |
|---|---|---|
| 1 | Cost & Management Accounting with Problems and Solutions | Ravi M. Kishor, Taxmann Publication |
| 2 | Cost Accounting | Nigam & Sharma |

BB – 243 Micro Economics- II

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

| | |
|---|---|
| 1 | **Unit 1 :National income;**<br>-definition of income, GDP & GNP & NNP<br>-Concepts of income<br>Personal, disposable, per capita income, transfer payments,<br>-definition of national income & their problems |
| 2. | **Unit 2 : Money and banking:**<br>Definition of money and functions of money – money and near money{M1 , M2, M3, M4} types of banks functions of commercial banks- credit creation – leakages and limitation of credit creation- functions of central bank |
| 3. | **Unit 3 :Theory of income and employment:**<br>classical approach of employment- say's law of market and its limitations -Keynes approach<br>-Consumption function & investment function – Propensity to consume and save – Keynes income and employment theory |
| 4. | **Unit 4 :Theories of interest and investment**<br>Classical theory ; Loanable fund theory, Liquidity preference theory, Modern theory of interest,<br>Investment, Multiplier & accelerator |
| 5. | **Unit 5 :Business cycles :**<br>Concept of business cycle – phases of business cycle.<br>Inflation Types causes and effects<br>deflation & stagflation |
| 6. | **Unit 6 : International Trade:**<br>Meaning and comparative cost theory and absolute cost theory<br>-balance of trace and balance of payment and difference between them- Exchange rate(concept) |

**Reference Books:**

| No. | Title | Author |
|---|---|---|
| 1 | Micro Economics for Management Students | Ravindra H Dholakia & Ajay N Oza |
| 2 | A Text book of Economics Theory | A. W. Stoner & Hague D. C. |
| 3 | Elements of Economics Theory | K. P. M. Sundaram |
| 4 | Micro Economics Theory | D. N. Dwivedi |

BB – 244 Operation Research

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| | | | | | | | | | |

**Section – I**

**1 Introduction to Operations Research**

Definitions of O.R., Nature and Scope of O.R., Phases of O.R., Different types of Models in O.R., Applications and scope of O.R, Techniques and Tools of O.R, Limitations of O.R.

**2 Linear Programming**

Meaning, Nature, Uses and limitations of Linear Programming, Definitions-Solution, Constraints, Feasible solution, Basic feasible solution, Objective function. Formulations of L.P. Problem .Graphical method for solving L. P. P., Examples

**3 Network Analysis: (CPM & PERT)**

Concept of Network, Network Diagram, Concepts connected with a Network, Labelling Method, Critical Path Method, Determination of Floats: Total Float, Free Float and Independent Float, Project Evaluation and Review Technique (PERT), Applications of CPM and PERT.

**Section – II**

**4 Theory of Games**

Introduction, Study of Two Person Zero–sum Game Problems, Games with and without Saddle point, Principles of Dominance, Algebraic method, Graphical method.

**5 Transportation Problem**

General Mathematical Formulation of Transportation Problem. Initial Basic Feasible Solution using North–West corner rule, Matrix– Minima Method, Vogel's Approximation Method, Unbalanced Transportation Problem.

**6 Assignment Problem**

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General Mathematical Formulation of Assignment Problem, Hungarian Method of solving Assignment Problem. Unbalanced Assignment Problem.

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Introduction to Operations Research: Theory and applications | Sharma J. K. | McMillan Publications |
| 2 | Operations Research – An Introduction | Taha H. A. | PHI Publications |
| 3 | Introduction to Operations Research | Hiller and Lieberman | Tata McGraw Hill Publications |
| 4 | Quantitative Techniques for Management | Vohra N. D. | Tata McGraw Hill Publications |
| 5 | Problems and Solutions in Operations Research | Kapoor V. K. | Sultan Chand & Sons |

BB – 245 Organizational Behaviour

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

| | |
|---|---|
| 1 | **Fundamentals of Organizational Behavior:**<br>● Definition and Meaning<br>● Concept<br>● Nature<br>● Characteristics<br>● Importance<br>● Models of Organizational Behavior<br>● Relation of Organizational Behavior with other fields |
| 2. | **Conflict Management:**<br>● Nature<br>● Levels of Conflict<br>● Traditional vis–à–vis Modern view of Conflict<br>● Conflict Process |
| 3. | **Group Dynamics:**<br>● Types<br>● Nature<br>● Emergence<br>● Benefits<br>● Problems of Informal Organization<br>● Formal Organization<br>● System Factor<br>● Potential outcome of Formal Group processes |
| 4. | **Motivation and Leadership**<br>● Motives- Meaning and classification<br>● Theories of work motivation (ERG, Equity, Expectancy theory).<br>● Performance appraisal meaning and types. (MBO, Self-appraisal, peer reviews).<br>**Leadership:**<br>● Definition and meaning.<br>● Theories/ Approaches to Leadership: ( Hersey & Blanchard's Situational Model, Path–Goal Model, Managerial grid model, Fielder's contingency model) |

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|---|---|
| 5. | **Stress & Counseling:**<br>● Concept<br>● Sources of stress<br>● Effect of stress<br>● Strategies to cope up with stress & brief overview of counseling |
| 6. | **Organizational development**<br>● Introduction to OD<br>● Definition and meaning<br>● Growth and relevance<br>● History and evolution<br>● Theories of planned change<br>● Types of planned change |

**Reference Books:**

| **No.** | **Title** | **Author** | **Publication** |
|---|---|---|---|
| **1** | Organizational Behavior | Stephen Robbins | Pearson Education |
| **2** | Organizational Behavior | Keith Davis | Tata McGraw Hill, New Delhi |
| **3** | Organizational Behavior | K. Aswathappa | Himalaya Publication |
| **4** | Organizational Behavior | L. M. Prasad | S. Chand Publication |
| **5** | Organizational Behavior | M. N. Mishra | Vikas Publication |

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

## SECTION: I

**Unit I : Introduction to Network and its Types**

Introduction to Computer Network – Types – Introduction to Local Area Network – Types of LAN, Components of LAN – Introduction to LAN Topology – MAN – Advantages and Dis-Advantages of MAN – WAN – Advantages and Dis-Advantages of WAN.

**Unit II : Introduction to Internet and its Application**

Introduction, Working of Internet - Browser, Search Engine - Types of Internet connection – Internet Application – Introduction to Internet Service Provider - Components of Internet – Internet Protocol –TCP/IP,FTP,HTTP,PPP etc,Intro. to Firewall, E-mail and its Application, HTML and important Tages

**Unit III : Internet, Intranet and Extranet**

Introduction to Intranet and Extranet – Advantages, Dis-Advantages, Limitation and Difference between Internet, Intranet and Extranet

## SECTION: II

**Unit IV : Advance Features of Ms-Excel**

Introduction – Linking Worksheets – Relative, Absolute and Mixed Referencing – Filter Command and its Options – Conditional Formatting with Options – If then Analysis commands – Pivot table Command.

**Unit V : Different Functions with Examples and its Applications**

Introduction – Meaning – Types of Functions

a). Mathematical Function ( SUM,SUMIF,SUMSQ,ROUND,CELLING,FLOOR)

b). Statistical (AVEDEV, AVERAGE, AVERAGEA,BINOMDIST,CHIDIST,CHITEST,CORREL,GROWTH, MEDIAN, MODE, RANK, VAR, STDEV )

c) Database function (DSUM,DMIN,DMAX,DAVERAGE)

d) Business function ( PMT, PV, NPV ) with Examples.

**Unit VI :**

In built packages application with Example, Solver with case study –Analysis Tool Pack – (Data Analysis: Correlation, Types of Regression)

**Reference Books :**

| No. | Title | Author |
|---|---|---|
| 1. | Internet the Complete Reference | Young |
| 2. | Windows – 2007 No Experience Required | Crawford |
| 3. | Step-By-Step Microsoft Excel – 2007 | Curtis D.Frye ( Microsoft Press) |

Web Materials : 1). www.tutorialpoints.com . 2) www.geeksforgeeks.org
3). www. w3school.com 4). www.javapoint.com

BB – 248 E-Commerce

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | Total |
| 4 | - | 60 | 40 | - | - | 100 | 4 | - | 04 |

## SECTION: I

**Unit-I: E-commerce and its Technological Aspects:**
Overview of developments in Information Technology and Defining E-Commerce: The scope of E commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, Produce a generic framework for E-Commerce, Architectural framework of Electronic Commerce, Web based E Commerce Architecture.

**Unit-II Consumer Oriented E Commerce:**
E-Retailing: Traditional retailing and e retailing, Benefits of e retailing, Key success factors, Models of e retailing, Features of e retailing. E services: Categories of e-services, Web-enabled services, matchmaking services, Information-selling on the web, e entertainment, Auctions and other specialized services. Business to Business Electronic Commerce

**Unit-III Electronic Data Interchange:**
Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI Implementation, EDI Agreements, EDI Security. Electronic Payment Systems, Need of Electronic

## SECTION: II

**Unit IV Payment System:**
Study and examine the use of Electronic Payment system and the protocols used, Study Electronic Fund Transfer and secure electronic transaction protocol for credit card payment. Digital economy: Identify the methods of payments on the net – Electronic Cash, cheques and credit cards on the Internet.

**Unit-V Security in E Commerce:**
Threats in Computer Systems: Virus, Cyber Crime Network Security: Encryption, Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server.

**Unit-VI Issues in E Commerce:**
Understanding Ethical, Social and Political issues in E-Commerce: A model for Organizing the issues, Basic Ethical Concepts, Analyzing Ethical Dilemmas, Candidate Ethical principles Privacy and Information Rights: Information collected at E-Commerce Websites, The Concept of Privacy, Legal protections Intellectual Property Rights: Types of Intellectual Property protection, Governance.

**Suggested Reading:**
1. Elias. M. Awad, “Electronic Commerce", Prentice-Hall of India Pvt Ltd.
2. RaviKalakota, Andrew B. Whinston, "Electronic Commerce-A Manager's guide", Addison-

.

Wesley.
3. . . E-Commerce Theory and Pracitce: Mrs. Kranti S.Patil, Dr Pankaj T.Nikam, Dr.Sweta Shrma.

4. Elias M Award, “Electronic Commerce from Vision to Fulfilment”, 3rd Edition, PHI,
5. Judy Strauss, Adel El-Ansary, Raymond Frost, “E-Marketing”, 3RDEdition, Pearson Education.
**Price: 8.95 $**

| BBA (HM) SEM - I | |
|---|---|
| SUBID | SUBNAME |
| HM101 | Front office – I |
| HM102 | House Keeping – I |
| HM103 | Food and Beverage Service – I |
| HM104 | Food and Beverage Production – I |
| HM105 | Communication Skills – I |
| HM106 | Financial Accounting For Managers |
| HM107 | Principles of Management |
| HM108 | Tourism Management – I |

| BBA (HM) SEM – II | |
|---|---|
| SUBID | SUBNAME |
| HM201 | Front office – II |
| HM202 | House Keeping – II |
| HM203 | Food and Beverage Service – II |
| HM204 | Food and Beverage Production - II |
| HM205 | Communication Skills – II |
| HM206 | Principles OF Economics |
| HM207 | Human Resource Management |
| HM208 | Tourism Management- II |

| BBA (HM) SEM – III | |
|---|---|
| SUBID | SUBNAME |
| HM301 | Front office – III |
| HM302 | House Keeping – III |
| HM303 | Food and Beverage Service - III |
| HM304 | Food and Beverage Production - III |
| HM305 | Communication Skills – III |
| HM306 | Computers in Hotel – I |
| HM307 | Human Resource Management – II |
| HM308 | Nutrition |

| BBA (HM) SEM – V | |
|---|---|
| SUBID | SUBNAME |
| HM501 | Front office – IV |
| HM502 | House Keeping – IV |
| HM503 | Food and Beverage Service – IV |
| HM504 | Food and Beverage Production - IV |

| | |
|---|---|
| HM505 | Food Science |
| HM506 | Basics of Computers – II |
| HM507 | Sales and Marketing – I |
| HM508 | Finance – I |

| BBA (HM) SEM – VI | |
|---|---|
| SUBID | SUBNAME |
| HM601 | Front office – V |
| HM602 | House Keeping – V |
| HM603 | Food and Beverage Service – V |
| HM604 | Food and Beverage Production – V |
| HM605 | Hotel Law |
| HM606 | Engineering and Maintenance |
| HM607 | Sales and Marketing – II |
| HM608 | Finance – II |

**BBA (HM) SEMESTER – I**

**SUBJECT: FRONT OFFICE – I**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

**A. COURSE OVERVIEW**

To make students knowledgeable about all fundamentals & basics of Front Office as a separate entity within.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **COs** |
|---|---|---|---|
| 1 | Introduction: the hospitality origin and growth, tourism industry, importance of tourism, industries related to tourism | 4 | CO1 AND CO5 |
| 2 | Evolution and growth of the hotel industry in the world: Ancient era, Grand tour, Modern Era | 4 | CO1 |

| | | | |
|---|---|---|---|
| 3 | Evolution and growth of the hotel industry in India: Ancient and Medieval Era, Colonial Era, Modern Era | 3 | CO1 |
| 4 | Hotel : Definition and core areas with an overview | 4 | CO2 |
| 5 | Classification of Hotels: Types of hotel on the basis of Location: Downtown, sub-urban, motel, resort, floatels, resort, | 4 | CO1 AND CO5 |
| 6 | Types of hotel on the basis of Clientele: convention hotel, commercial hotel | 3 | CO1 AND CO5 |
| 7 | Types of hotel on the basis of Theme: heritage, ecotels, spa, boutique | 4 | CO1 AND CO5 |
| 8 | Types of hotel on the basis of target market : suite, B&B, timeshares, casino, condominiums, corporate lodging | 4 | CO1 AND CO5 |
| 9 | Types of hotel on the basis of level of service: budget hotels, midscale hotels, luxury hotels | 3 | CO1 AND CO5 |
| 10 | Types of hotel on the basis of length of stay: transient hotel, residential hotel, semi-residential hotel | 3 | CO1 AND CO5 |
| 11 | Front office organisation: Function areas (department introduction and importance for any hotel) | 4 | CO2 |
| 12 | Sections and layouts of various areas like; Reservation, Reception, Information Desk, Cash and Bills, Travel desk, Communication Section and Uniformed services | 4 | CO2 |
| 13 | Organisation structure or hierarchy of front office staff | 3 | CO3 |
| 14 | Duties and responsibilities of front office personnel like Front office manager, Reservation Assistant, Receptionist, Cashier, Telephone operator, Bell boy, and Door attendant | 5 | CO3 |
| 15 | Qualities of front office personnel | 4 | CO4 |
| 16 | Basic Front office terminologies | 4 | CO4 |

**C. TEXT BOOKS**

Hotel Front Office Operations and Management – Jatashankar Tiwari – Oxford Publication

## D. REFERENCE BOOKS

Front Office Operations and Management – Sudhir Andrews – McGraw Hill Publication
Front Office Training Manual – Sudhir Andrews – McGraw Hill Publication
Front Office Procedures – Kasavana / Brooks

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Understand the evolution, meaning, categorization and classifications of hotel. |
| CO2 | Comprehension | Understand the various sections and layouts of Front office in the hotel. |
| CO3 | Application | Know the attributes and hierarchy of Front office staff. |
| CO4 | Synthesis | Basic terminologies of FRONT OFFICE |
| CO5 | Analysis | Role of Front office in enhancing guest experience |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – I**

**SUBJECT: HOUSE KEEPING – I**

| Teaching Scheme (Hours/week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

**A. COURSE OVERVIEW**

To make students knowledgeable about all fundamentals & basics of Housekeeping department.

**B. COURSE CONTENT**

| Sr.No | Major Topics | Lecture + Practical | COS |
|---|---|---|---|
| 1 | Introduction to House keeping department | 1 | CO1 |
| 2 | Importance of Housekeeping | 2 | CO2 |
| 3 | Responsibility of Housekeeping Department | 3 | CO1 |
| 4 | Organizational Structure | 2 | CO2 |
| 5 | Housekeeping Personnel | 4 | CO2 |
| 6 | Personal Attributes of HK Staff | 2 | CO1 |
| 7 | Layout of Department | 2 | CO2 |
| 8 | Coordination with other departments | 4 | CO2 |
| 9 | The Professional Housekeeper | 3 | CO3 |
| 10 | Planning Housekeeping Operations and daily routines and systems including The Planning Process | 6 | CO3 |
| 11 | House keeping Day | 4 | CO3 |
| 12 | Standard Contents of a Furniture | 4 | CO4 |
| 13 | Guest room Furniture and Accessories | 3 | CO4 |
| 14 | Guest room Fixtures and Fittings | 5 | CO4 |
| 15 | Placement of Guest Supplies | 4 | CO4 |

| | | | |
|---|---|---|---|
| 16 | Importance of Guest Rooms to a Guest | 4 | CO5 |
| 17 | Type of guest rooms | 3 | CO5 |
| 18 | Guest Room Status | 2 | CO5 |
| 19 | Guest Floor Rules | 2 | CO5 |

**C. TEXT BOOKS**

Hotel Housekeeping Operations and Management – G. Raghubalan, Smritee Raghubalan – Oxford Publication.

**D. REFERENCE BOOKS**

Textbook of Housekeeping Management and Operations – Sudhir Andrews – McGraw Hill Publication.

Training Manual of Housekeeping – Sudhir Andrews – McGraw Hill

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | Basics of house keeping department |
| CO2 | Comprehension | Importance and organization of House keeping |
| CO3 | Application | Daily, routine and other activities on guest floor of house keeping |
| CO4 | Synthesis | Understanding Standard contents of a guest room |
| CO5 | Analysis | Know various Room types and their amenities |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – I**

**SUBJECT: FOOD AND BEVERAGE SERVICE – I**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

## A. COURSE OVERVIEW

The course designed is to educate the students with regards to the basics of the food and beverage service operations.

## B. COURSE CONTENT

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Hotel and service Industry | 2 | CO1 |
| 2 | Sectors of the Food Service Industry | 2 | CO1 |
| 3 | Food and Beverage Areas | 1 | CO1 |
| 4 | Coordination of Food and Beverage with other Departments | 2 | CO1 |
| 5 | Duties and Responsibilities of food and beverage staff | 2 | CO1 |
| 6 | Competencies of food and beverage personnel | 3 | CO2 |

| | | | |
|---|---|---|---|
| 7 | Dos and Don’ts of a waiter | 4 | CO2 |
| 8 | Ancillary Areas : Introduction | 4 | CO2 |
| 9 | Still room | 3 | CO2 |
| 10 | Silver room or plate room | 3 | CO2 |
| 11 | Hotplate | 4 | CO2 |
| 12 | Spare linen store | 2 | CO3 |
| 13 | Wash up/ kitchen stewarding | 3 | CO3 |
| 14 | Dispense bar | 2 | CO3 |
| 15 | Automatic vending | 4 | CO3 |
| 16 | Types of Menu | 4 | CO3 |
| 17 | Menu Planning | 2 | CO3 |
| 18 | New menu trends | 1 | CO4 |
| 19 | Types of meal | 2 | CO4 |
| 20 | Breakfast | 1 | CO4 |
| 21 | Afternoon tea | 1 | CO4 |
| 22 | High tea | 1 | CO4 |
| 23 | French classical menu | 3 | CO5 |
| 24 | Indian menu | 2 | CO5 |
| 25 | Cover and Accompaniments | 2 | CO5 |

**C. TEXT BOOKS**

Food and Beverage – Dennis Lillicrap and Cousins (Orient Longman)
Food and Beverage Service – A Training Manual – Sudhir Andrews – Tata McGraw Hill

**D. REFERENCE BOOKS**

Textbook of Food and Beverage Service – SN Bagchi & Anita Sharma – Aman Publications
Food and Beverage: F&B Simplified – Vara Prasad & Gopi Krishna – Pearson

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Develop general knowledge on the origins and development of food service in hotels, restaurants and institutions |
| CO2 | Comprehension | Identify trends likely to affect food service in coming years |
| CO3 | Application | Identify a variety of managerial, production, and service positions that are typical of the food service industry and describe the rules these positions play in providing food service |
| CO4 | Synthesis | Develop the knowledge about ancillary areas related with different outlets |
| CO5 | Analysis | Describe managerial responsibilities as they relate to food service functions including menu planning, and preparation |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – I**

**SUBJECT: FOOD AND BEVERAGE PRODUCTION – I**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 3 | 6 | 5 | 40% | 26.67% | -- | 33.33% | 100% |

## A. COURSE OVERVIEW

The course designed is to educate the students with regards to the basics of the food and beverage kitchen operations.

## B. COURSE CONTENT

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Introduction to professional cookery | 3 | CO1 |
| 2 | Origin of Cookery | 4 | CO1 |
| 3 | Development of attitude and professional behavior | 3 | CO1 |
| 4 | Personal Hygiene | 4 | CO2 |
| 5 | Classical Brigade | 4 | CO2 |
| 6 | Kitchen organization and layout | 3 | CO2 |
| 7 | Aims and objectives of cooking food | 4 | CO3 |
| 8 | Methods of cooking | 4 | CO3 |
| 9 | Equipment and fuel | 3 | CO3 |
| 10 | Basic commodities : Vegetables, Fruits, Salads, Rice, Cereals and Pulses, Eggs, Stocks, Sauces | 5 | CO4 |
| 11 | Basic commodities used in bakery and pastry : Introduction | 4 | CO4 |
| 12 | A. Flour | 2 | CO4 |

| | | | |
|---|---|---|---|
| 13 | B. Structure of wheat grain | 1 | CO4 |
| 14 | C. Types of flours | 2 | CO5 |
| 15 | D. Gluten free flour | 1 | CO5 |
| 16 | E. Raising agents | 1 | CO5 |
| 17 | F. Fats and oils | 2 | CO5 |
| 18 | G. Usage of fats and oils in cooking and baking | 3 | CO5 |
| 19 | H. Rendering the fat | 2 | CO1 & CO2 |
| 20 | I. Clarifying butter | 2 | CO1 & CO2 |
| 21 | J. Milk and dairy products | 3 | CO1 & CO2 |

**C. TEXT BOOKS**

Theory of Cookery – Krishna Arora – Frank Brothers

**D. REFERENCE BOOKS**

Modern Cookery (Vol. 1&2) – Thangam E Phillip – Orient Longman
Food Production Operations – Parvinder S. Bali – Oxford University Press

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | Understand the basic operations of a hotel's kitchen with regard to safety procedures and hygiene followed by chefs also an idea about the basic hierarchy in the kitchen and their role in the brigade with regard to their skills and experiences |
| CO2 | Comprehension | Identify different types of equipments and their uses in the kitchen |
| CO3 | Application | Familiarize various cooking methods |
| CO4 | Synthesis | Identify types of fruits and vegetables, their selection, storage and uses in cookery |

| | | |
|---|---|---|
| CO5 | Analysis | To learn various types of stocks and sauces |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – I**

**SUBJECT: COMMUNICATION SKILLS – I**

| Teaching Scheme (Hours/week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | | 60% | 40% | -- | -- | 100% |

**A. COURSE OVERVIEW**

This course will help to understand and explain importance of business communication.

**B. COURSE CONTENT**

| Sr.No | Major Topics | Lecture + Practical | Cos |
|---|---|---|---|
| 1 | Need, purpose and nature of business communication | 1 | CO1 |
| 2 | Barriers of communication | 2 | CO1 |
| 3 | Overcoming a barriers | 2 | CO1 |
| 4 | Essentials of grammar | 3 | CO1 |
| 5 | Applied grammar and uses | 2 | CO1 |
| 6 | Common errors and misappropriations | 2 | CO1 |
| 7 | Jumbled sentences | 1 | CO2 |
| 8 | Indianisms | 1 | CO2 |
| 9 | Basics of Phonetics | 1 | CO2 |
| 10 | Building advance vocabulary | 2 | CO2 |
| 11 | Levels and types of listening skills | 2 | CO2 |
| 12 | Listening barriers | 2 | CO3 |
| 13 | Guidelines of effective listening | 2 | CO3 |
| 14 | Definition, importance and inevitability of non-verbal communication | 2 | CO3 |
| 15 | Body movements | 2 | CO3 |
| 16 | Facial expression | 1 | CO3 |
| 16 | Posture | 2 | CO4 |
| 17 | Eye contact | 1 | CO4 |
| 18 | Use of space | 2 | CO5 |
| 19 | Importance of Vocal behaviour | 1 | CO5 |
| 20 | Hepatics | 2 | CO5 |

**C. TEXT BOOKS**

Idli, Orchid and Will Power – Vitthal Kamath

Dare to Dream: The Life of M S Oberoi – Bachi J Karkaria – Peguin

**D. REFERENCE BOOKS**

English for the Hotel Industry – Aysha Vishwamohan Pearson Education

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | To distinguish between various level of organizational communication and to surpass communication barriers while developing an understanding of communication as a process in an organization |
| CO2 | Comprehension | To demonstrate his/her ability to error free expression while making an optimum use of correct business vocabulary and grammar |
| CO3 | Application | To stimulate critical thinking by developing writing skills |
| CO4 | Synthesis | To demonstrate the importance of good listening skills |
| CO5 | Analysis | To demonstrate verbal and non-verbal communication ability through presentation |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 3 | 2 | 1 | 3 | 2 | |
| **CO2** | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | |
| **CO3** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | 2 | 3 | 2 | |
| **CO4** | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | |
| **CO5** | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | |
| **Avg.** | 2.4 | 2.2 | 2 | 2.6 | 2.2 | 2.4 | 2.2 | 2.2 | 2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2 | 2.2 | 2.2 |

**BBA (HM) SEMESTER – I**

**SUBJECT: FINANCIAL ACCOUNTING FOR MANAGERS**

| Teaching Scheme (Hours/week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | -- | -- | 100% |

**A. COURSE OVERVIEW**

To make students knowledgeable about all fundamentals & basics of accounting.

**B. COURSE CONTENT**

| Sr.No | Major Topics | Lecture + Practical | Cos |
|---|---|---|---|
| 1 | Introduction to Financial Accounting and its scope | 4 | CO5 |
| 2 | Concepts of Financial accounting, Limitations of financial accounting. | 3 | CO2 |
| 3 | Classification of Accounts and Mechanism of accounting | 3 | CO2 |
| 4 | Various Subsidiary books | 3 | CO1 |
| 5 | Bank Reconciliation | 3 | CO1 |
| 6 | Trial Balance | 4 | CO3 |
| 7 | Passing Adjustment Entry | 3 | CO3 |
| 8 | Making Profit and Loss account and Balance sheet | 4 | CO4 |
| 9 | Profit and loss account and balance sheet of Proprietary concern | 3 | CO3 |
| 10 | Profit and loss account and balance sheet of partnership concern | 3 | CO3 |
| 11 | Profit and loss account and balance sheet of Limited Company | 3 | CO4 |

**C. TEXT BOOKS**

Financial Accounting for managers - S. K. Bhattacharya, John Dearden - Vikash Publishing House Private Limited

## D. REFERENCE BOOKS

Advanced Accounts - N C Shukla, TC Grewal and S C Gupta - S Chand and Co. Ltd.
Financial Accounting and Management - Prof. T J Rana - B S Shah Prakashan

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Demonstrate accounting concepts and conventions and their implications on the accounting system. Create financial statements of sole proprietorship. |
| CO2 | Comprehension | Present financial statements according to the provisions of the Indian Companies Act. Analyse financial statements and apply comparative and common size techniques. |
| CO3 | Application | Analyse financial statements and apply various ratios to and interpret the company's financial performance. |
| CO4 | Synthesis | Differentiate between funds flow statements and cash flow statements. Analyse funds flow statement and cash flow statement according to accounting standard 3. |
| CO5 | Analysis | Demonstrate various accounting standards and Explain the concept of IFRS |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| CO2 | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | |
| CO4 | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO5** | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2.4 | 2.2 | 2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.4 | 2.26 |

**BBA (HM) SEMESTER – I**

**SUBJECT: PRINCIPLES OF MANAGEMENT**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100a5 |

**A. COURSE OVERVIEW**

This course focuses on the basic concept of Management.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Introduction to Management | 7 | CO5 |
| 2 | Planning and Decision making | 7 | CO2 |
| 3 | Organizing | 7 | CO3 |
| 4 | Leading | 7 | CO4 |
| 5 | Management in 21st Century | 8 | CO1 |

**C. TEXT BOOKS**

Stoner James A F, Freeman R Edward & Gilbert Jr Daniel R "Management" New Delhi Prentice-Hall of India

**D. REFERENCE BOOKS**

Management Theory and Practice by C.B. Gupta. S. Chand Publication.
Principles and Practice of Management by V. S. P. Rao and P.S. Narayana. Konark publication

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Explain the various concepts and theories of management |
| CO2 | Comprehension | Demonstrate different leadership styles and skills required for working in groups and teams |
| CO3 | Application | Teach the basic functions of management like planning, organizing, leading and controlling |
| CO4 | Synthesis | Explain the various culture and quality aspects related to business. |
| CO5 | Analysis | Evaluating the practical approach for the real business situation. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 3 | 2 | 1 | 3 | 2 | |
| CO2 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | |
| CO3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | 2 | 3 | 2 | |
| CO4 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | |
| CO5 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | |
| Avg. | 2.4 | 2.2 | 2 | 2.6 | 2.2 | 2.4 | 2.2 | 2.2 | 2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2 | 2.2 | 2.2 |

**BBA (HM) SEMESTER – I**

**SUBJECT: TOURISM MANAGEMENT – I**

| Teaching Scheme (Hours/week) | Credits | Examination Scheme |
|---|---|---|

| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
|---|---|---|---|---|---|---|---|---|---|
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

## A. COURSE OVERVIEW

This course focuses on the basic concept of tourism industry.

## B. COURSE CONTENT

| Sr.No | Major Topics | Lecture + Practical | Cos |
|---|---|---|---|
| 1 | Meaning of tourism | 1 | CO1 |
| 2 | Tourism industry | 1 | CO1 |
| 3 | Significance of tourism | 1 | CO1 |
| 4 | Tourism system | 1 | CO1 |
| 5 | Five A's of tourism | 1 | CO2 |
| 6 | Developments in the history of tourism | 2 | CO2 |
| 7 | Tourism in India : Post independence | 1 | CO2 |
| 8 | Modern tourism | 2 | CO2 |
| 9 | Purpose of tourism | 1 | CO2 |
| 10 | Travel motivators | 2 | CO3 |
| 11 | Types of tourism | 4 | CO3 |
| 12 | Definition and characteristics of tourism product | 3 | CO3 |
| 13 | Nature of tourism product | 2 | CO3 |
| 14 | Types of tourism product | 2 | CO4 |
| 15 | Economic impacts of tourism | 2 | CO4 |
| 16 | Environmental impacts of tourism | 1 | CO4 |
| 17 | Socio cultural impacts of tourism | 1 | CO4 |
| 18 | Cultural and political impacts of tourism | 2 | CO4 |
| 19 | The Demonstration effect | 2 | CO5 |

| | | | |
|---|---|---|---|
| 20 | Measures to regulate tourism impact | 2 | CO5 |
| 21 | Tourism legislation | 2 | CO5 |

## C. TEXT BOOKS

International Tourism Management – A. K. Bhatia – Sterling

Tourism: Operations and Management – Sunetra Roday, Archana Biwal and Vandana – Oxford Publication

## D. REFERENCE BOOKS

Tourism: Principles and practices – Sampad Kumar Swain & Jitendra Mohan – Oxford Publication.

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Importance of tourism as an industry |
| CO2 | Comprehension | Purpose of tourism |
| CO3 | Application | Types of tourism |
| CO4 | Synthesis | Impacts of tourism on various areas |
| CO5 | Analysis | Laws related to tourism |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| CO2 | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | |
| CO4 | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO5** | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2.4 | 2.2 | 2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.4 | 2.26 |

**BBA (HM) SEMESTER – II**

**SUBJECT: FRONT OFFICE – II**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

## A. COURSE OVERVIEW

To make students knowledgeable about all fundamentals & basics of Front Office

To introduce the Front Office Systems with the latest developments in the field of Hospitality trade which hold significance to the future managers.

## B. COURSE CONTENT

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **COS** |
|---|---|---|---|
| 1 | Telecommunication: Introduction | 4 | CO1 |
| 2 | Types of Exchanges | 4 | CO1 & CO2 |
| 3 | Other communication Equipments | 3 | CO1 & CO2 |
| 4 | Organization and Job Description of Telecommunication Department | 4 | CO2 |
| 5 | Skills and Competencies of the Telephone Operator | 4 | CO2 |
| 6 | General Duties of a Telephone Operator | 3 | CO2 |
| 7 | Room Tariff : Introduction | 4 | CO3 |
| 8 | Room Rate Designation | 4 | CO3 |
| 9 | Types of Meal plans | 3 | CO3 |
| 10 | Guest Relation Executives: Introduction | 3 | CO4 |

| | | | |
|---|---|---|---|
| 11 | Organisation of GRE | 4 | CO4 |
| 12 | Important Departments for GRE | 4 | CO4 |
| 13 | General Duties and Responsibilities of GRE | 3 | CO4 |
| 14 | The Guest Cycle : An Introduction | 1 | CO5 |
| 15 | The Guest Cycle : Pre – arrival | 4 | CO5 |
| 16 | The Guest Cycle : Arrival | 4 | CO5 |
| 17 | The Guest Cycle: Stay | 2 | CO5 |
| 18 | The Guest Cycle : Departure and Post departure | 2 | CO5 |

**C. TEXT BOOKS**

Front Office Operations and Management – Sudhir Andrews
Front Office Training Manual – Sudhir Andrews – McGraw Hill Publication
Hotel Front Office Operations and Management – Jatashankar Tiwari – Oxford Publication

**D. REFERENCE BOOKS**

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Identification of various equipments used in Front office |
| CO2 | Comprehension | Professional Telephone etiquettes |
| CO3 | Application | Importance of Tariff card and it's uses |
| CO4 | Synthesis | Importance and duties of Guest Relation executives |
| CO5 | Analysis | Importance and phases of guest cycle |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| CO2 | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | |
| **CO4** | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2.4 | 2.2 | 2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.4 | 2.26 |

**BBA (HM) SEMESTER – II**

**SUBJECT: HOUSE KEEPING – II**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

## A. COURSE OVERVIEW

To make students knowledgeable about all fundamentals & basics of Housekeeping.

To introduce the Housekeeping systems with the latest developments in the field of Hospitality Industry which hold relevance to the future managers.

## B. COURSE CONTENT

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Cleaning Guestrooms | 4 | CO1 |
| 2 | Types and Nature of Soil | 4 | CO1 |
| 3 | Standards of Cleaning | 3 | CO1 |
| 4 | The Science of Cleaning | 4 | CO2 |
| 5 | The Cleaning Process | 4 | CO2 |
| 6 | Information on Housekeeping Inventories | 3 | CO2 |
| 7 | House keeping inventories: Cleaning Equipments | 4 | CO2 |

| | | | |
|---|---|---|---|
| 8 | Housekeeping Inventories: Cleaning Agents | 4 | CO3 |
| 9 | Housekeeping Inventories: Guest Supplies | 3 | CO3 |
| 10 | Housekeeping Inventories: Linen | 3 | CO3 |
| 11 | Care and cleaning of Different surfaces (Metals, Glass, Ceramics, Wood, Stone) | 4 | CO3 |
| 12 | Importance of house keeping control Desk | 4 | CO3 |
| 13 | Forms, Formats, Records, and Registers maintained at control Desk | 3 | CO4 |
| 14 | Handling Room transfers | 5 | CO4 |
| 15 | Leave application Procedure | 4 | CO5 |
| 16 | Gate pass procedure | 4 | CO5 |

## C. TEXT BOOKS

Hotel Housekeeping Operations and Management – G. Raghubalan, Smritee Raghubalan – Oxford Publication.

## D. REFERENCE BOOKS

Textbook of Housekeeping Management and Operations – Sudhir Andrews – McGraw Hill Publication.
Training Manual of Housekeeping – Sudhir Andrews – McGraw Hill

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Types and Routine of House keeping services |
| CO2 | Comprehension | Methods of cleaning different surfaces |
| CO3 | Application | To know about various house keeping cleaning equipments, agents and guest supplies |
| CO4 | Synthesis | Leave application and gate pass procedure |
| CO5 | Analysis | Various Forms, formats and registers maintained at housekeeping control desk |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – II**

**SUBJECT: FOOD AND BEVERAGE SERVICE - II**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

**A. COURSE OVERVIEW**

The course designed is to educate the students with regards to the basics of the food and beverage service operations.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Types of Service | 3 | CO1 |
| 2 | Factors Influencing the Type of Service | 2 | CO1 |
| 3 | Room Service Organization | 4 | CO1 |
| 4 | Types of room Service | 2 | CO1 |

| | | | |
|---|---|---|---|
| 5 | Equipments Used in Room Service | 2 | CO1 |
| 6 | Room Service Tray Layout | 2 | CO1 |
| 7 | Procedure for Service | 3 | CO2 |
| 8 | Room Service Errand Card & Doorknob Menu | 2 | CO2 |
| 9 | Innovations/ Modern Changes | 3 | CO2 |
| 10 | Functions of a Control System | 2 | CO2 |
| 11 | Methods of a Control System | 4 | CO2 |
| 12 | Methods of Recording Order of Sale | 2 | CO2 |
| 13 | Kitchen Order Token/Ticket | 2 | CO3 |
| 14 | Billing & Methods of Payment | 2 | CO3 |
| 15 | Sales Summary Sheet | 2 | CO3 |
| 16 | Computerized Pre-check | 3 | CO3 |
| 17 | Cultivation of Tobacco | 3 | CO3 |
| 18 | Cigarette | 3 | CO3 |
| 19 | Cigar | 3 | CO4 & CO5 |
| 20 | Other Tobacco Products | 2 | CO4 & CO5 |
| 21 | History & Definition of Cheese | 2 | CO4 & CO5 |
| 22 | Classification of Cheese | 3 | CO4 & CO5 |
| 23 | Cheese Production | 3 | CO4 & CO5 |
| 24 | Storage of Cheese & Portioning and Serving of Cheese | 1 | CO4 & CO5 |

**C. TEXT BOOKS**

Food and Beverage: F&B Simplified – Vara Prasad & Gopi Krishna – Pearson

**D. REFERENCE BOOKS**

Food and Beverage – Dennis Lillicrap and Cousins (Orient Longman)
Food and Beverage Service – A Training Manual – Sudhir Andrews – Tata McGraw Hill
Textbook of Food and Beverage Service – SN Bagchi & Anita Sharma – Aman Publications

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Understand the difference among various services like French Service, English service, American Service, Russian Service |
| CO2 | Comprehension | Understand the food and beverage outlet's revenue control systems |
| CO3 | Application | Identify the various room service management techniques that can be adapted in the hotel |
| CO4 | Synthesis | Understand about the tobacco products like cigar and cigarettes |
| CO5 | Analysis | Understand the various types of cheese used in kitchen and service areas |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| CO2 | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | |
| CO4 | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | |
| CO5 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Avg.** | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2.4 | 2.2 | 2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.4 | 2.26 |

**BBA (HM) SEMESTER – II**

**SUBJECT: FOOD AND BEVERAGE PRODUCTION - II**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 3 | 6 | 5 | 40% | 26.67% | -- | 33.33% | 100% |

**A. COURSE OVERVIEW**

This syllabus is intended towards training of students in the basics of the food and beverage Production.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Classification Of Soups | 2 | CO1 |
| 2 | Preparation Of Thin Soups | 2 | CO1 |
| 3 | Preparation Of Thick Soups | 2 | CO1 |
| 4 | Making Of Good Soup | 1 | CO1 |
| 5 | Modern Trends Of Presenting Soups | 2 | CO1 |
| 6 | Physical And Chemical Characteristics Of Meats | 2 | CO1 |
| 7 | Selecting And Grading Meat | 3 | CO2 |
| 8 | Processing Of A Whole Animal | 3 | CO2 |
| 9 | Classification Of Meats | 4 | CO2 |
| 10 | Cuts Of Lamb | 2 | CO2 |
| 11 | Cuts Of Beef | 2 | CO2 |
| 12 | Cuts Of Pork | 2 | CO2 |
| 13 | Classification And Preparation Of Poultry | 3 | CO2 |

| | | | |
|---|---|---|---|
| 14 | Game Cooking | 1 | CO3 |
| 15 | Yield Tests | 2 | CO3 |
| 16 | Classification Of Fish | 3 | CO3 |
| 17 | Classification Of Shellfish | 2 | CO3 |
| 18 | Cuts Of Fish | 1 | CO3 |
| 19 | Classical Preparation Of Fish | 1 | CO4 |
| 20 | Selection And Storage Of Seafood | 2 | CO4 |
| 21 | Cooking Of Seafood | 2 | CO4 |
| 22 | Philosophy Of Indian Food | 3 | CO4 |
| 23 | Impact Of Ayurveda On Indian Cooking | 3 | CO4 |
| 24 | Influence Of The Invaders And Travellers On Indian Cuisine | 1 | CO4 |
| 25 | Regional And Religious Influences On Indian Cuisine | 2 | CO5 |
| 26 | Equipment Use In Cooking | 2 | CO5 |
| 27 | Techniques Employed In Indian Cooking | 3 | CO5 |
| 28 | Concepts Of Slow Food And Organic Food | 2 | CO5 |

**C. TEXT BOOKS**

Food Production Operations – Parvinder S. Bali – Oxford University Press

**D. REFERENCE BOOKS**

Theory of Cookery – Krishna Arora – Frank Brothers
Modern Cookery (Vol. 1&2) – Thangam E Phillip – Orient Longman

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Identify different kitchen ingredients such as cereals, pulses, fats and oils etc |

| | | |
|---|---|---|
| CO2 | Comprehension | Plan and design various menus with an understanding of different types of menus |
| CO3 | Application | Describe different meat with their characteristics, selection, storage, and uses |
| CO4 | Synthesis | Describe different fish with their characteristics, selection, storage, and uses |
| CO5 | Analysis | Create awareness about Indian cuisine |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – II**

**SUBJECT: COMMUNICATION SKILLS – II**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

## A. COURSE OVERVIEW

This course will help students to understand how to present professional presentations and discussions.

## B. COURSE CONTENT

| Sr.No | Major Topics | Lecture + Practical | Cos |
|---|---|---|---|
| 1 | Dynamics of Professional Presentations : Introduction | 2 | CO1 |
| 2 | Combating Stage Fright | 2 | CO1 |
| 3 | Preparing PowerPoint Slides for Presentations | 2 | CO1 |
| 4 | Describing Objects/Situations/People | 1 | CO1 |
| 5 | Individual and Group Presentation | 1 | CO1 |
| 6 | Delivering Just a Minute Sessions | 2 | CO1 |
| 7 | Difference between GD and Debate | 1 | CO2 |
| 8 | Number and Duration | 2 | CO2 |
| 9 | Personality Traits to be evaluated | 1 | CO2 |
| 10 | Dynamics of Group Behaviour/Group Etiquettes and Mannerisms | 2 | CO2 |
| 11 | Types of GD | 1 | CO2 |
| 12 | Opening an GD | 2 | CO2 |
| 13 | Summarizing a Discussion | 1 | CO3 |
| 14 | Art of Persuasion | 2 | CO3 |
| 15 | Making speeches interesting | 1 | CO3 |
| 16 | Delivering Different types of speeches. | 2 | CO3 |
| | Purpose of General Conversations | 1 | CO3 |
| | Features of a Good Conversation | 2 | CO3 |
| | Short Conversations | 1 | CO4 |

| | | | |
|---|---|---|---|
| | Telephonic Skills | 2 | CO4 |
| | Debate | 1 | CO5 |
| | Situational Dialogues and Role Plays | 2 | CO5 |

## C. TEXT BOOKS

Idli, Orchid and Will Power – Vitthal Kamath
Dare to Dream: The Life of M S Oberoi – Bachi J Karkaria – Peguin
English for the Hotel Industry – Aysha Vishwamohan Pearson Education

## D. REFERENCE BOOKS

The Functional Aspects of Communication Skills – Dr. D Prasad – Katson Books

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | To demonstrate the dynamics of professional presentation |
| CO2 | Comprehension | Develop the skills related to group discussions |
| CO3 | Application | Demonstrate the different interview techniques and necessary qualities to clear the interview |
| CO4 | Synthesis | To Develop the Public Speaking skills |
| CO5 | Analysis | Identify and demonstrate the purpose and features of conversations, dialogues and debates |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| CO2 | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – II**

**SUBJECT: PRINCIPLES OF ECONOMICS**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

**A. COURSE OVERVIEW**

This course focuses on the basic concept of Management.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **COS** |
|---|---|---|---|
| 1 | Demand Analysis | 8 | CO5 |
| 2 | Elasticity Of Demand | 7 | CO2 |
| 3 | Cost Of Production | 7 | CO2 |
| 4 | Supply | 7 | CO1 |
| 5 | Market Structure | 7 | CO1 |

**C. TEXT BOOKS**

Economics for Hotel & Catering Students – By Howard & Hugle

## D. REFERENCE BOOKS

Introduction to Economics – Caiseneross
Managerial Economics – Jean
Economics of Hotel Management – AM Sheela

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Define the basic concepts of Managerial Economics. This course will enable students to describe the situations of certainty, uncertainty and risk and the constraints therein in corporate situations. |
| CO2 | Comprehension | Discover the reasons for success or failure of a product in the market by studying the various factors affecting demand for the product. Students will also be able to illustrate when an individual consumer or market attains a state of equilibrium. Students will be able to forecast demand using different methods. The course shall help students illustrate the concept of elasticity for pricing products, and for setting the budget for product promotions. |
| CO3 | Application | Identify the least cost-output relationship and determine the relationship between the output and the cost in the short run and the long run period of operation. Students will be able to determine the level of output beyond which profits will be generated. |
| CO4 | Synthesis | Estimate and optimizing the performance of the company in different market structures in terms of profits using the Concepts of marginal revenue and marginal cost, and equilibrium price and output. The course shall help students in formulating pricing and non- pricing strategies to deter competition. |
| CO5 | Analysis | Describe the methods for measurement of national income and inflation and to enumerate the policies to counter trade cycles. Students will be able to inspect the causes of a trade cycle and suggest remedies. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| **CO2** | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| **CO3** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | |
| **CO4** | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 1 | |
| **CO5** | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **Avg.** | 2.4 | 2.4 | 2.6 | 2.2 | 2.6 | 2 | 2.4 | 2.2 | 2.4 | 2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.31 |

**BBA (HM) SEMESTER – II**

**SUBJECT: HUMAN RESOURCE MANAGEMENT - I**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

## A. COURSE OVERVIEW

This course aims to make students aware of the concepts of HRM, and their importance and relevance in the hospitality industry.

## B. COURSE CONTENT

| Sr.No | Major Topics | Lecture + Practical | COs |
|---|---|---|---|
| [1] | **Introduction to HRM:** In search of definition, Brief outline of Indian Labor Movement, Growth Drivers | **7** | CO1 |

| | | | |
|---|---|---|---|
| | of the Indian Service Sector, Why Managing HRM is gaining is more importance, Hospitality Industry – characteristics and implications, HR Roles, Relationship between HR and Organizational Performance, HR Challenges, Functions of HR Managers, Competency of HR Managers | | |
| [2] | **Manpower Planning:** Importance of Manpower planning, Factors, Manpower planning process, Managing workforce surplus and shortfall, What should manpower planning offer?, Human Resource Information System and manpower planning | **7** | CO1,<br>CO3 |
| [3] | **Recruitment:** Introduction, Sources, What to look for in prospective candidates, When to recruit, Recruitment Policy, Company Brand and Recruitment, How to Prepare for the Interview, Legality and Recruitment | **7** | CO4 |
| [4] | **Training and Development:** Importance of Training, Training Function and the Size of the Hotel, Training Need Identification Process, Hospitality Industry and Relevant Training in India, Training Evaluation, Training Methods, Trainers' Qualification and Experience, Training – Cost or Investment, Organizational Culture and Training | **7** | CO5 |
| [5] | **Performance Appraisal:** Purpose of Performance Appraisal System, Performance Appraisal System, Usage of Performance Appraisal, Difficulties Associated With Performance Process, The 360 Degree Feedback System and Its Content, Feedback Partners, Effective Performance Appraisal System | **8** | CO1,<br>CO2 |

**C. TEXT BOOKS**

Biswas Malay (2012), *"Human Resource Management in Hospitality". Oxford University Press.*

**D. REFERENCE BOOKS**

Sudhir A. (2009). *Human Resource Management, A Textbook for the Hospitality Industry.* Tata McGraw-Hill Companies

David K. Hayes, Jack D. Ninemeier (2015). *Human Resources Management in the Hospitality Industry*, 2nd Edition. Wiley

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Develop an ability to see if the HR Processes are working well in a hotel or a hospitality firm |
| CO2 | Comprehension | Develop Skill to be able to see interconnection between various processes of HRM |
| CO3 | Application | Develop competency to be able develop various HR Processes |
| CO4 | Synthesis | Develop skill so that two or more processes of HR can be clubbed to get better benefits |
| CO5 | Analysis | Ability to see through the HR system and its implications on Business |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – II**

**SUBJECT: TOURISM MANAGEMENT - II**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

**A. COURSE OVERVIEW**

This course focuses on the basic concept of tourism industry

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **COs** |
|---|---|---|---|
| 1 | Air transport | 1 | CO1 |
| 2 | Air transport in India | 2 | CO1 |
| 3 | Security of aircraft and passengers | 1 | CO1 |
| 4 | International air travel classes | 1 | CO1 |
| 5 | Road transport | 1 | CO1 |
| 6 | Rail transport | 2 | CO1 |
| 7 | Water transport | 1 | CO1 |
| 8 | Transport as an attraction | 1 | CO2 |
| 9 | Need for tourism organisation | 1 | CO2 |
| 10 | International tourism organisations | 2 | CO2 |
| 11 | Government organisations in India | 2 | CO2 |
| 12 | Private sector organisations in India | 2 | CO2 |
| 13 | The travel agent | 1 | CO3 |
| 14 | Types and functions of travel agencies | 3 | CO3 |

| | | | |
|---|---|---|---|
| 15 | Setting-up a travel agency | 2 | CO3 |
| 16 | Sources of income for travel agency | 1 | CO3 |
| 17 | Types of tour operators | 2 | CO3 |
| 18 | Types of package tours | 2 | CO4 |
| 19 | Guides and escorts | 1 | CO4 |
| 20 | Basic information Required for itinerary planning | 2 | CO5 |
| 21 | Planning the itinerary | 2 | CO5 |
| 22 | Resources for planning itineraries | 1 | CO5 |
| 23 | Costing of a tour | 2 | CO5 |

**C. TEXT BOOKS**

Tourism: Operations and Management – Sunetra Roday, Archana Biwal and Vandana – Oxford Publication

**D. REFERENCE BOOKS**

International Tourism Management – A. K. Bhatia – Sterling

Tourism: Principles and practices – Sampad Kumar Swain & Jitendra Mohan – Oxford Publication.

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | Various modes of transportation |
| CO2 | Comprehension | Difference between Travel agent and Tour operator |
| CO3 | Application | Types of tourism organizations |
| CO4 | Synthesis | Understand the difference between Tour guide and escort |
| CO5 | Analysis | How to make a itinerary |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| **CO2** | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| **CO3** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | |
| **CO4** | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2.4 | 2.2 | 2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.4 | 2.26 |

**BBA (HM) SEMESTER – III**

**SUBJECT: FRONT OFFICE – III**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

## A. COURSE OVERVIEW

To make students knowledgeable about all fundamentals & basics of Front Office

To introduce the Front Office Systems with the latest developments in the field of Hospitality trade which hold significance to the future managers.

## B. COURSE CONTENT

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Co-ordination of front office with different departments | 9 | CO1 |
| 2 | Convention and Tour group Businesses | 8 | CO2 |
| 3 | Importance of reservations | 7 | CO3 |

| | | | |
|---|---|---|---|
| 4 | Types of Reservations | 5 | CO3 |
| 5 | Modes of Reservations | 6 | CO3 |
| 6 | Sources of reservations | 8 | CO4 |
| 7 | Reservation reports | 8 | CO3 |
| 8 | Hotel and Guest Security | 9 | CO5 |

**C. TEXT BOOKS**

Front Office Training Manual – Sudhir Andrews – McGraw Hill Publication
Hotel Front Office Operations and Management – Jatashankar Tiwari – Oxford Publication

**D. REFERENCE BOOKS**

Front Office Procedures – Kasavana / Brooks
Check-in Check-out Managing Hotel Operations – Gary Vallen/Jerome J. Vallen - Pearson

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Understand the inter and intra departmental communication of the front office department |
| CO2 | Comprehension | Importance, modes and tools of reservation |
| CO3 | Application | Define the procedure, types and sources of reservation |
| CO4 | Synthesis | Know the procedure of amending/revising a reservation |
| CO5 | Analysis | Importance of Hotel and Guest security in recent times |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| CO2 | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO4** | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2.4 | 2.2 | 2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.4 | 2.26 |

**BBA (HM) SEMESTER – III**

**SUBJECT: HOUSE KEEPING - III**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

**A. COURSE OVERVIEW**

To make students knowledgeable about all fundamentals & basics of Housekeeping.

To introduce the Housekeeping systems with the latest developments in the field of Hospitality Industry which hold relevance to the future managers.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Textile Terminology | 2 | CO1 |
| 2 | Classification and Identification of Textile Fibres | 4 | CO1 |
| 3 | Yarn | 3 | CO1 |
| 4 | Fabric Construction | 4 | CO1 |
| 5 | Blends and Unions | 4 | CO1 |
| 6 | Textile Finishes | 3 | CO1 |
| 7 | Use of textile in Hotels | 4 | CO1 |
| 8 | Linen and Uniform Room | 4 | CO2 |
| 9 | Storage of Linen | 3 | CO2 |

| | | | |
|---|---|---|---|
| 10 | Linen Exchange | 3 | CO2 |
| 11 | Par Stock | 4 | CO2 |
| 12 | Linen Control | 4 | CO2 |
| 13 | Linen quality and Life Span | 3 | CO2 |
| 14 | Discards and Their Use | 5 | CO3 |
| 15 | Laundry Equipments | 4 | CO4 |
| 16 | Laundry Agents and Aids | 4 | CO4 |
| | Stain Removal | 2 | CO5 |

**C. TEXT BOOKS**

Hotel Housekeeping Operations and Management – G. Raghubalan, Smritee Raghubalan – Oxford Publication

**D. REFERENCE BOOKS**

Textbook of Housekeeping Management and Operations – Sudhir Andrews – McGraw Hill Publication.

Training Manual of Housekeeping – Sudhir Andrews – McGraw Hill

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Knowledge on various Fabrics, fibers and Textiles |
| CO2 | Comprehension | Process of laundry operations |
| CO3 | Application | Knowledge on different types of stains and their removal methods |
| CO4 | Synthesis | Operation of linen room, uniform room and sewing room |
| CO5 | Analysis | Integrated pest management and waste disposal |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – III**

**SUBJECT: FOOD AND BEVERAGE SERVICE- III**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

**A. COURSE OVERVIEW**

The course designed is to educate the students with regards to the basics of the food and beverage service operations.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Classification of Non Alcoholic Beverages | 1 | CO1 |
| 2 | Tea | 1 | CO1 |
| 3 | Coffee | 2 | CO1 |
| 4 | Other Non-Alcoholic Beverages | 1 | CO1 |
| 5 | Classification of Alcoholic Beverages | 1 | CO2 |
| 6 | Fermented Alcoholic Beverages | 2 | CO2 |

| | | | |
|---|---|---|---|
| 7 | Fermented and Distilled Alcoholic Beverages | 3 | CO2 |
| 8 | How is Alcohol Obtained | 1 | CO3 |
| 9 | Types of Distillation | 2 | CO3 |
| 10 | Alcoholic Proof | 1 | CO3 |
| 11 | Classification of Wines | 1 | CO3 |
| 12 | Viticulture | 1 | CO4 |
| 13 | Grapes & Principle Grape Varieties | 3 | CO4 |
| 14 | Vine Pests and Diseases | 2 | CO4 |
| 15 | Faults in Wines & Naming of Wines | 1 | CO4 |
| 16 | Vinificaiton | 1 | CO4 |
| 17 | Factors Affecting the Quality of Wine | 3 | CO5 |
| 18 | Storage of Wines | 1 | CO5 |
| 19 | Methods of making Champagne | 1 | CO5 |
| 20 | Other methods of making sparkling wine | 1 | CO5 |
| 21 | Sparkling wines of from other Regions/Countries | 1 | CO5 |
| 22 | Storage of sparkling wine | 1 | CO5 |
| 23 | Port | 1 | CO5 |
| 24 | Sherry | 1 | CO4 |
| 25 | Madeira, Marsala & Malaga | 2 | CO4 |
| 26 | Guidelines of pairing wine and food | 1 | CO5 |

**C. TEXT BOOKS**

Food and Beverage Service – A Training Manual – Sudhir Andrews – Tata McGraw Hill
Food and Beverage: F&B Simplified – Vara Prasad & Gopi Krishna – Pearson

**D. REFERENCE BOOKS**

Food and Beverage – Dennis Lillicrap and Cousins (Orient Longman)
Textbook of Food and Beverage Service – SN Bagchi & Anita Sharma – Aman Publications

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Understand about the non-alcoholic beverage |
| CO2 | Comprehension | Understand the classification of alcoholic beverage |
| CO3 | Application | Explain the main steps involved in the production of wine and it's classification |
| CO4 | Synthesis | To learn the different wine producing areas specifically with laws of wine production |
| CO5 | Analysis | To demonstrate and understand the food and wine pairing technique |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| **CO2** | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| **CO3** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | |
| **CO4** | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2.4 | 2.2 | 2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.4 | 2.26 |

**BBA (HM) SEMESTER – III**

**SUBJECT: FOOD AND BEVERAGE PRODUCTION - III**

| Teaching Scheme (Hours/week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 3 | 6 | 5 | 40% | 26.67% | -- | 33.33% | 100% |

A. **COURSE OVERVIEW**
B. **COURSE CONTENT**

| Sr.No | Major Topics | Lecture + Practical | Cos |
|---|---|---|---|
| 1 | Types Of Industrial And Institutional Establishments | 1 | CO1 |
| 2 | Industrial Catering And Army Mess | 1 | CO1 |
| 3 | Hospital Catering | 1 | CO1 |
| 4 | Off Premise Catering | 1 | CO1 |
| 5 | Central Processing Units | 1 | CO1 |
| 6 | Transport Catering | 1 | CO1 |
| 7 | Principles Of Indenting For Volume Feeding | 1 | CO2 |
| 8 | Purchase Systems And Specifications | 2 | CO2 |
| 9 | Storage For Bulk | 1 | CO2 |
| 10 | Inventory Control In Stores | 2 | CO2 |
| 11 | Control Procedures To Check Pilferage And Spoilage | 1 | CO2 |
| 12 | Portion Sizes And Portion Control For Volume Feeding | 2 | CO2 |
| 13 | Modifying Recipe For Volume Catering | 1 | CO2 |
| 14 | Challenges Of Volume Catering | 2 | CO3 |
| 15 | Souring Agents , Coloring Agents And Thickening Agents | 1 | CO3 |

| | | | |
|---|---|---|---|
| 16 | Tenderizing Agents, Flavouring And Aromatic Agents And Spicing Agents | 2 | CO3 |
| 17 | Hyderabadi Cuisine | 3 | CO3 |
| 18 | Awadhi Cuisine | 3 | CO3 |
| 19 | Bengali Cuisine | 3 | CO4 |
| 20 | Goan Cuisine | 3 | CO4 |
| 21 | Kashmiri Cuisine | 3 | CO4 |
| 22 | Kerala Cuisine | 3 | CO4 |
| 23 | Marathi Cuisine | 3 | CO4 |
| 24 | Parsi Cuisine | 3 | CO4 |
| 25 | Punjabi Cuisine | 3 | CO5 |
| 26 | Rajasthani Cuisine | 3 | CO5 |
| 27 | Tamil Nadu Cuisine | 3 | CO5 |
| 28 | Origin And History Of Indian Sweets | 3 | CO5 |
| 29 | Ingredients Used In Indian Sweets | 3 | CO5 |
| 30 | Regional Influences On Indian Sweets | 1 | CO5 |
| 31 | Equipments Used In Preparing Indian Sweets | 1 | CO5 |
| | | | |

**C. TEXT BOOKS**

Food Production Operations - Parvinder S. Bali - Oxford University Press

**D. REFERENCE BOOKS**

Quantity Food Production Operation - Parvinder S. Bali - Oxford University Press
Modern Cookery (Vol. 1&2) - Thangam E. Phillp - Orient Longman

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|

| | | |
|---|---|---|
| CO1 | Evaluate | Describe volume cookery with it's planning, purchasing and indenting required for mass production |
| CO2 | Comprehension | Enumerate and describe the factors that affect regional eating habits in various parts in India |
| CO3 | Application | Describe regional cuisine of India |
| CO4 | Synthesis | Understand festivals and regional delicacies of Indian sweets with their history and classification |
| CO5 | Analysis | Explain various basic gravies used in preparation of Indian Dishes |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| **CO2** | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| **CO3** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | |
| **CO4** | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2.4 | 2.2 | 2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.4 | 2.26 |

**BBA (HM) SEMESTER – III**

**SUBJECT: COMMUNICATION SKILLS - III**

| **Teaching Scheme (Hours/week)** | **Credits** | **Examination Scheme** |
|---|---|---|

| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
|---|---|---|---|---|---|---|---|---|---|
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

A. **COURSE OVERVIEW**
B. **COURSE CONTENT**

| Sr.No | Major Topics | Lecture + Practical | Cos |
|---|---|---|---|
| 1 | Art of Negotiations | 1 | CO1 |
| 2 | A. Definition | 1 | CO1 |
| 3 | B. Different Styles of Negotiations | 2 | CO1 |
| 4 | Tips of Win-win negotiations | 1 | CO1 |
| 5 | Paragraph Writing | 1 | CO1 |
| 6 | A. Structure of a paragraph | 1 | CO1 |
| 7 | Construction of a paragraph | 2 | CO1 |
| 8 | Business Letters and Resumes | 1 | CO2 |
| 9 | A. Importance | 1 | CO2 |
| 10 | B. Elements | 1 | CO2 |
| 11 | C. Layout | 1 | CO2 |
| 12 | D. Business letters-elements | 2 | CO2 |
| 13 | E. Types of Business letter | 2 | CO2 |
| 14 | Resume preparations | 1 | CO2 |
| 15 | Email and Blog Writing | 1 | CO3 |
| 16 | A. Reasons for popularity | 1 | CO3 |
| 17 | B. Common pitfalls | 2 | CO3 |
| 18 | C. Guiding principles for composition | 1 | CO3 |
| 19 | D. Maintaining common etiquette | 2 | CO4 |
| 20 | Blog writing | 1 | CO4 |

| | | | |
|---|---|---|---|
| 21 | Other business writings | 1 | CO4 |
| 22 | A. Itinerary Writing | 2 | CO4 |
| 23 | B. Memo | 1 | CO5 |
| 24 | C. Notice Agenda and Minutes | 2 | CO5 |
| 25 | D. Menu Writing | 2 | CO5 |
| 26 | Advertising | 2 | CO5 |

**C. TEXT BOOKS**

**D. REFERENCE BOOKS**

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | To draft effective business letters and resumes |
| CO2 | Comprehension | To stimulate critical thinking by developing the negotiation skills |
| CO3 | Application | To participate in paragraph and essay writing activity |
| CO4 | Synthesis | To learn the skills of E-mail writing |
| CO5 | Analysis | To develop other business writing skills like memo, notices, agendas, minutes of meeting |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – III**

**SUBJECT: COMPUTERS IN HOTEL - I**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

**A. COURSE OVERVIEW**

It gives basic introduction of uses and types of computer systems.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Introduction to Computers | 1 | CO1 |
| 2 | A. Evolution of Computers | 1 | CO1 |
| 3 | B. Data and Information | 1 | CO1 |
| 4 | C. Numbering system in a computer system | 1 | CO1 |
| 5 | D. Components of a computer system | 1 | CO1 |
| 6 | E. Basic Computer Organization | 1 | CO1 |
| 7 | Classification of computers | 1 | CO1 |
| 8 | Software concepts and operating systems | 1 | CO2 |

| | | | |
|---|---|---|---|
| 9 | A. Classification of Software | 1 | CO2 |
| 10 | B. Operating system | 1 | CO2 |
| 11 | C. Classification | 2 | CO2 |
| 12 | D. Major Operating system | 1 | CO2 |
| 13 | Programming Language | 1 | CO2 |
| 14 | Internet | 1 | CO2 |
| 15 | A. History | 1 | CO3 |
| 16 | B. Equipment needed to connect to internet | 1 | CO3 |
| 17 | C. Basic internet services | 1 | CO3 |
| 18 | D. Uses of Internet | 1 | CO3 |
| 19 | E. Basic components of world wide web | 1 | CO3 |
| 20 | F. Network and data communication | 1 | CO3 |
| 21 | G. Terminology used in networks | 1 | CO4 |
| 22 | H. Network topology | 1 | CO4 |
| 23 | I. Classification of software | 1 | CO4 |
| 24 | J. Wireless Technology | 1 | CO4 |
| 25 | K. E-commerce | 1 | CO4 |
| 26 | L. Internet security | 1 | CO4 |
| 27 | Antivirus software | 1 | CO4 |
| 28 | Introduction to DBMS | 1 | CO4 |
| 29 | Database | 1 | CO4 |
| 30 | Database Management | 1 | CO5 |
| 31 | Database Management System | 1 | CO5 |
| 32 | Database Types | 1 | CO5 |
| 33 | Database Users | 1 | CO5 |
| 34 | Main Components of DBMS | 1 | CO5 |

| | | | |
|---|---|---|---|
| 35 | Microsoft Visual Foxpro 6.0 | 1 | CO5 |

**C. TEXT BOOKS**

**D. REFERENCE BOOKS**

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Understand Classification of computers with their main components |
| CO2 | Comprehension | Understand major operating systems |
| CO3 | Application | Understand types of internet |
| CO4 | Synthesis | Understand Database management systems |
| CO5 | Analysis | Understand Microsoft Visual Foxpro |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – III**

**SUBJECT: HUMAN RESOURCE MANAGEMENT - II**

| Teaching Scheme (Hours/week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

## A. COURSE OVERVIEW

This course aims to make students aware of the concepts of Organizational Behaviour, and its importance and relevance in the hospitality industry. As the hospitality industry is totally dependent on behaviour of employees for providing service.

## B. COURSE CONTENT

| Sr.No | Major Topics | Lecture + Practical | Cos |
|---|---|---|---|
| [1] | **Introduction to Organizational Behaviour:** Meaning and Definition of OB, Key elements of OB, Scope of OB, Need for studying OB, Contributing disciplines to OB | **6** | CO1<br>CO5 |
| [2] | **Personality:** Concept and determinants of Personality, Types of Personality, Theories of Personality, Type Theory, Trait Theory, The Big 5 Model, How Personality Develops?, How Personality influences OB? | **6** | CO4 |
| [3] | **Perception:** Meaning and Definition of Perception, Perception v/s Sensation, Perceptual Process, Factors Affecting Perception, How to Improve Perception? | **6** | CO2 |
| [4] | **Learning:** Meaning and Definition, Determinants of learning, Learning Theories, Classical Conditioning, Operant Learning, Cognitive Theory, Learning Principles, Reinforcement, Punishment | **6** | CO1,<br>CO3 |
| [5] | **The Group and Group Dynamics:** Definition and Characteristics of Group, Why do people form and join Groups?, Types of Groups, Stages of Group Development, Group Behavior, Group Norms, Group Cohesion**,** Group Role | **6** | CO4 |

| | | | |
|---|---|---|---|
| [6] | **Organizational Conflicts:** Meaning & Definition of Conflict, Sources of Conflict, Types of Conflicts, Aspects of Conflicts, Conflict Process, Conflict Management | **6** | CO3 |

**C. TEXT BOOKS**

Robbins, S. P., Judge, T. A., & Vohra, N. *Organizational behaviour by Pearson 18e*. Pearson Education India.

**D. REFERENCE BOOKS**

Rao, P. S. (2010). *Organisational behaviour*. Himalaya Publishing House.

Sudhir A. (2009). *Human Resource Management, A Textbook for the Hospitality Industry.* Tata McGraw-Hill Companies

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | Show how the OB works at individual, group and system level |
| CO2 | Comprehension | Help students understand the fact that behaviour is an outcome of the total psychological system of a person including the interaction of emotions, moods, personality, groups, culture etc. |
| CO3 | Application | Train them in using this knowledge to analyse the behaviour of employees and motivate the employees |
| CO4 | Synthesis | Create an understanding so that they can see the behaviour as a whole and not sums as the parts |
| CO5 | Analysis | Show how subtle messages in terms of body language and other behaviour etc. are important to understand behavior |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 1 | 3 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2** | 1 | 2 | 2 | 1 | 2 | 1 | 3 | 1 | 2 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | |
| **CO3** | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 1 | 2 | 3 | 3 | |
| **CO4** | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | |
| **CO5** | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2 | 2 | 2.2 | 2.2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2 | 2 | 2.2 | 2.2 | 2 | 2.2 | 2 | 2.1 |

BBA (HM) SEMESTER – III

**SUBJECT: NUTRITION**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

**A. COURSE OVERVIEW**

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **Cos** |
|---|---|---|---|
| 1 | Introduction to Nutrition<br>A. Relation of Food and Health<br>B. Food and Its Functions<br>C. Factors affecting Food<br>D. Classification of Nutrients | 4 | CO1 |
| 2 | Carbohydrates<br>A. Classification<br>B. Sources<br>C. Functions<br>D. Deficiency<br>E. Excess<br>F. Recommended Dietary Allowances | 5 | CO1 |
| 3 | Proteins<br>A. Classification<br>B. Sources<br>C. Functions<br>D. Deficiency | 5 | CO2 |

| | | | |
|---|---|---|---|
| | E. Excess<br>F. Recommended Dietary Allowances | | |
| 4 | Lipids<br><br>A. Classification<br>B. Sources<br>C. Functions<br>D. Deficiency<br>E. Excess<br>F. Recommended Dietary Allowances | 6 | CO2 |
| 5 | Water<br><br>A. Classification<br>B. Sources<br>C. Functions<br>D. Deficiency<br>E. Excess<br>F. Recommended Dietary Allowances | 4 | CO3 |
| 6 | Vitamins<br><br>A. Classification<br>B. Sources<br>C. Functions<br>D. Deficiency<br>E. Excess<br>F. Recommended Dietary Allowances | 5 | CO4 |
| 7 | Minerals<br><br>A. Classification<br>B. Sources<br>C. Functions<br>D. Deficiency<br>E. Excess<br>F. Recommended Dietary Allowances | 5 | CO5 |
| 8 | Balanced Diet | 2 | CO5 |

**C. TEXT BOOKS**

Food Science and Nutrition - Sunetra Roday - Oxford University Press

**D. REFERENCE BOOKS**

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|

| | | |
|---|---|---|
| CO1 | Evaluate | Importance of food for health and digestion in human body |
| CO2 | Comprehension | Importance of major nutrients like carbohydrate and protein with their sources, functions and deficiency on human body |
| CO3 | Application | Importance and role of major vitamins with their sources, functions and deficiency in human body |
| CO4 | Synthesis | Importance and role of major minerals with their source , functions and deficiency in human body |
| CO5 | Analysis | Importance of balance diet in preparing any meal |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – V**

**SUBJECT: FRONT OFFICE – IV**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

## A. COURSE OVERVIEW

To make students knowledgeable about all advance theories of Front Office

To introduce the Front Office Systems with the latest developments in the field of Hospitality trade which hold significance to the future managers.

## B. COURSE CONTENT

| Sr.No | Major Topics | Lecture + Practical | Cos |
|---|---|---|---|
| 1 | Handling Cash Transaction | 5 | CO1 |
| 2 | The Cashier's Daily Report | 6 | CO1 |
| 3 | Cash and Cash Equivalent | 6 | CO2 |
| 4 | Departure Procedure | 4 | CO2 |
| 5 | Mode of Settlement of Bills | 7 | CO2 |
| 6 | Potential Check-out problems and solutions | 5 | CO3 |
| 7 | Front Office Accounting | 5 | CO3 |
| 8 | Front Office Accounting Cycle | 5 | CO4 |
| 9 | Night Audit | 6 | CO4 |
| 10 | Night Auditor | 4 | CO5 |
| 11 | Night Audit Process | 5 | CO5 |

## C. TEXT BOOKS

Front Office Training Manual – Suxzdhir Andrews – McGraw Hill Publication

Hotel Front Office Operations and Management – Jatashankar Tiwari – Oxford Publication

Front Office Procedures – Kasavana / Brooks

## D. REFERENCE BOOKS

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Functions of property management system |
| CO2 | Comprehension | Know various modules present in a PMS |

| | | |
|---|---|---|
| CO3 | Application | Analyses situation, identify guest problems, formulates solutions and implement corrective measures during the entire guest cycle |
| CO4 | Synthesis | Explain and discuss front office accounting procedures, check-out and settlement procedures, night audit functions and verification |
| CO5 | Analysis | Comprehend the scope of hospitality industry as an International Business |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – V**

**SUBJECT: HOUSE KEEPING - IV**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

**A. COURSE OVERVIEW**

This course will help students to understand managerial aspects of housekeeping works.

**B. COURSE CONTENT**

| Sr.No | Major Topics | Lecture + Practical | Cos |
|---|---|---|---|
| 1 | Principles of Ergonomics | 2 | CO1 |
| 2 | Ergonomics in Hotel Housekeeping | 2 | CO1 |
| 3 | Pest Control | 2 | CO1 |
| 4 | Common Pest and Their Control | 2 | CO1 |
| 5 | Integrated Pest Management | 4 | CO1 |
| 6 | Waste Disposal | 4 | CO2 |
| 7 | Internal Environment | 4 | CO2 |
| 8 | Noise | 2 | CO2 |
| 9 | Air-conditioning | 3 | CO2 |
| 10 | Light | 4 | CO2 |
| 11 | Objectives of Interior Designing | 2 | CO2 |
| 12 | Basic Types of Design | 2 | CO2 |
| 13 | Elements of Design | 2 | CO3 |
| 14 | Principles of Design | 4 | CO3 |
| 15 | Units of Design | 2 | CO3 |
| 16 | Designing for physically challenged | 3 | CO3 |
| | Planning trends in the hotel | 2 | CO3 |
| | Colour | 2 | CO3 |
| | Lighting | 3 | CO4 |
| | Floor, Coverings, and Finishes | 2 | CO4 |
| | Types, Characteristics, and Cleaning of Floor coverings | 2 | CO4 |
| | Carpets | 3 | CO4 |

| | | | |
|---|---|---|---|
| | Importance of Floor Maintenance | 2 | CO4 |
| | Ceilings and Their Maintenance | 3 | CO4 |
| | Wall Coverings | 2 | CO5 |
| | Windows and Windows Treatments | 2 | CO5 |

**C. TEXT BOOKS**

Hotel Housekeeping Operations and Management – G. Raghubalan, Smritee Raghubalan – Oxford Publication.

**D. REFERENCE BOOKS**

Textbook of Housekeeping Management and Operations – Sudhir Andrews – McGraw Hill Publication.

Training Manual of Housekeeping – Sudhir Andrews – McGraw Hill

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Need and importance of Ergonomics in house keeping |
| CO2 | Comprehension | Importance of internal environment like Noise, Air conditioning and light |
| CO3 | Application | Outsourcing cleaning – Types and merits/demerits |
| CO4 | Synthesis | Basics of interior designing like Types, elements, principles and units |
| CO5 | Analysis | Basics of interior decoration like colour, carpets, windows, wall coverings |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – V**

**SUBJECT: FOOD AND BEVERAGE SERVICE - IV**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

**A. COURSE OVERVIEW**

The course designed is to educate the students with regards to the Advance theories of the food and beverage service operations.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **COS** |
|---|---|---|---|
| 1 | Ingredients of Beer | 2 | CO1 |
| 2 | The Brewing Process | 2 | CO1 |
| 3 | Types of Beer & Storage of Beer | 1 | CO1 |
| 4 | Scotch Whisky Manufacturing Process | 3 | CO1 |
| 5 | Irish Whisky Manufacturing Process | 3 | CO2 |
| 6 | Canadian Whisky Manufacturing Process | 2 | CO2 |
| 7 | American Whisky Manufacturing Process | 2 | CO2 |
| 8 | Cognac Manufacturing Process | 2 | CO2 |

| | | | |
|---|---|---|---|
| 9 | Armagnac  Manufacturing Process | 1 | CO3 |
| 10 | Manufacturing Process of Rum | 2 | CO3 |
| 11 | Types of Rum | 2 | CO3 |
| 12 | Manufacturing Process of Gin | 2 | CO3 |
| 13 | Types of Gin | 2 | CO4 |
| 14 | Manufacturing Process of Vodka | 2 | CO4 |
| 15 | Types of Vodka | 2 | CO4 |
| 16 | Manufacturing process of Tequila | 2 | CO4 |
| 17 | Types of Tequila | 2 | CO4 |
| 18 | Manufacturing process  Absinthe, Aquavit & Arrack | 2 | CO4 |
| 19 | Manufacturing process  Calvados , Eau De Vie & Fenny | 2 | CO5 |
| 20 | Manufacturing process  Korn, Pastis & Pomace Brandy | 2 | CO5 |
| 21 | More Local Spirits | 4 | CO5 |
| 22 | Liqueur versus flavored liquor | 4 | CO5 |
| 23 | Ingredients of Liqueur production | 4 | CO5 |
| 24 | Manufacturing Process of Liqueurs | 2 | CO5 |
| 25 | Classification of Liqueurs | 3 | CO5 |
| 26 | Liqueurs – Flavour, base and country of origin | 3 | CO5 |

**C. TEXT BOOKS**

Food and Beverage – Dennis Lillicrap and Cousins (Orient Longman)
Food and Beverage Service – A Training Manual – Sudhir Andrews – Tata McGraw Hill

**D. REFERENCE BOOKS**

Textbook of Food and Beverage Service – SN Bagchi & Anita Sharma – Aman Publications
Food and Beverage: F&B Simplified – Vara Prasad & Gopi Krishna – Pearson

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Develop an understanding of the concepts of beer making |
| CO2 | Comprehension | Develop the knowledge about fermented beverages like sake, cider, and Perry |
| CO3 | Application | To learn the spirit making procedures |
| CO4 | Synthesis | To understand the common indigenous spirit of the world |
| CO5 | Analysis | To learn the manufacturing process and classification of liqueur |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – V**

**SUBJECT: FOOD AND BEVERAGE PRODUCTION - IV**

| Teaching Scheme (Hours/week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 3 | 6 | 5 | 40% | 26.67% | -- | 33.33% | 100% |

## A. COURSE OVERVIEW

This syllabus is intended towards training of students in the advance theory and techniques of the Food and Beverage Production.

## B. COURSE CONTENT

| Sr.No | Major Topics | Lecture + Practical | Cos |
|---|---|---|---|
| 1 | Larder Work | 2 | CO1 |
| 2 | Section And Functions Of Garde Manger | 4 | CO1 |
| 3 | Layout Of The Larder | 3 | CO1 |
| 4 | Ktchen Larder Equipments | 4 | CO1 |
| 5 | Hierarchy Of Larder Staff | 4 | CO2 |
| 6 | Duties And Responsibilities Of Larder Chef | 3 | CO2 |
| 7 | Parts Of Sandwich | 4 | CO2 |
| 8 | Types Of Sandwich | 4 | CO2 |
| 9 | Making Sandwich Storing Sandwich | 3 | CO3 |
| 10 | Modern Approach To Sandwiches In Hotels | 3 | CO3 |
| 11 | Popular Herbs Used In Cooking | 4 | CO3 |
| 12 | Wines Used In Cooking | 1 | CO3 |
| 13 | Italian Cuisine | 3 | CO3 |
| 14 | Lebanese Cuisine | 2 | CO3 |
| 15 | Greek Cuisine | 4 | CO4 |

| | | | |
|---|---|---|---|
| 16 | Spanish Cuisine | 4 | CO4 |
| 17 | Mexican Cuisine | 3 | CO4 |
| 18 | French Cuisine | 3 | CO5 |
| 19 | Cuisine Of UK | 2 | CO5 |

**C. TEXT BOOKS**

International Cuisine & Food Production Management - Parvinder S Bali - Oxford University Press

**D. REFERENCE BOOKS**

Food Production Operations – Parvinder S Bali - Oxford University Press
Quantity Food Production Operation – Parvinder S Bali - Oxford University Press
Modern Cookery (Vol. 1&2) - Thangam E Phillip - Orient Longman

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | Impart knowledge on larder kitchen |
| CO2 | Comprehension | Develop knowledge on various types of sandwiches |
| CO3 | Application | Describe the use of herbs and wine in cooking with their uses |
| CO4 | Synthesis | Develop knowledge on Western cuisine with their history, popular dishes and Cooking methods |
| CO5 | Analysis | Develop knowledge on Continental cuisine with their history, popular dishes and Cooking methods |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – V**

**SUBJECT: FOOD SCIENCE**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

**A. COURSE OVERVIEW**

This Course Focuses On Importance Of Food And Science Related To Maintain And Preserve The Various Food Materials And Products. It is also helpful to identify various methods to evaluate any food with new recipe development.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **COS** |
|---|---|---|---|
| 1 | Introduction and Concepts of Food Science | 2 | CO1 |
| 2 | Need for Convenience Foods | 1 | CO1 |
| 3 | Importance of Microorganisms in Food Microbiology | 2 | CO2 |

| | | | |
|---|---|---|---|
| 4 | Factors Affecting the Growth of Microbes | 2 | CO2 |
| 5 | Food Fermentations | 2 | CO2 |
| 6 | Contamination of food | 2 | CO2 |
| 7 | Food borne Illnesses | 1 | CO2 |
| 8 | Causes of Food Spoilage | 1 | CO2 |
| 9 | Objectives of Food Processing | 1 | CO3 |
| 10 | Methods of Food Preservation | 3 | CO3 |
| 11 | Effect of processing on Food Constituents | 2 | CO3 |
| 12 | Food Additives | 2 | CO4 |
| 13 | Methods of Evaluation | 1 | CO5 |
| 14 | Objective Evaluation | 1 | CO5 |
| 15 | Proximate Composition of Food Constituents | 2 | CO5 |
| 16 | Proximate Analysis of Food Constituents | 2 | CO5 |
| 17 | Soya Foods | 1 | CO5 |
| 18 | Food Fads | 1 | CO5 |
| 19 | Organic Foods | 1 | CO5 |
| 20 | Health Foods | 1 | CO5 |
| 21 | Natural Foods | 1 | CO5 |
| 22 | Live Foods | 1 | CO5 |
| 23 | New Trends in Packaging | 2 | CO5 |
| 24 | Edible Films | 1 | CO5 |

**C. TEXT BOOKS**

Food Science and Nutrition - Sunetra Roday - Oxford University Press

**D. REFERENCE BOOKS**

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Importance and need for convenience food |
| CO2 | Comprehension | Micro-organisms and their growth which affect food to spoil |
| CO3 | Application | Various important food preservation techniques |
| CO4 | Synthesis | Various important food additives |
| CO5 | Analysis | Evaluation of any food and it's importance in developing new recipe |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – V**

**SUBJECT: BASICS OF COMPUTERS - II**

| Teaching Scheme (Hours/week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

**A. COURSE OVERVIEW**

To make students knowledgeable about all fundamentals & basics of Computers.

B. **COURSE CONTENT**

| Sr.No | Major Topics | Lecture + Practical | COS |
|---|---|---|---|
| 1 | Microsoft Word 2003 | 1 | CO1 |
| 2 | F. Major components of MS Word Window | 1 | CO1 |
| 3 | G. Working | 2 | CO1 |
| 4 | Operations performed | 2 | CO1 |
| 5 | Microsoft Excel 2003 | 1 | CO1 |
| 6 | E. Applications | 2 | CO2 |
| 7 | F. Structure | 1 | CO2 |
| 8 | G. Starting MS Excel | 2 | CO2 |
| 9 | H. Components | 2 | CO2 |
| 10 | I. Operations performed | 1 | CO3 |
| 11 | Features of spreadsheets | 2 | CO3 |
| 12 | Microsoft PowerPoint 2003 | 1 | CO3 |
| 13 | M. Starting MS PowerPoint | 1 | CO3 |
| 14 | N. Components | 1 | CO3 |
| 15 | O. Operations performed | 2 | CO3 |
| 16 | Features | 1 | CO4 |
| 17 | Microsoft Access 2003 | 1 | CO4 |
| 18 | Starting MS Access | 1 | CO4 |
| 19 | Components | 2 | CO4 |
| 20 | Operations Performed | 1 | CO4 |
| 21 | Working with Forms | 1 | CO4 |

| | | | |
|---|---|---|---|
| 22 | Management Information System | 1 | CO5 |
| 23 | MIS in Hotels | 1 | CO5 |
| 24 | Usage | 2 | CO5 |
| 25 | Design and Function | 2 | CO5 |
| 26 | Software Development Life Cycle | 2 | CO5 |
| 27 | MIS Evaluation | 1 | CO5 |
| 28 | Managing Management Information Systems | 2 | CO5 |
| 29 | Security Issues of Management | 1 | CO5 |
| 30 | Information System | 1 | CO5 |

**C. TEXT BOOKS**

Computers in Hotels-Concepts and Application – Partho Pratim Seal – Oxford University Press

**D. REFERENCE BOOKS**

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | Understand Microsoft word |
| CO2 | Comprehension | Understand Microsoft Excel |
| CO3 | Application | Understand Microsoft Office |
| CO4 | Synthesis | Understand Microsoft Access |
| CO5 | Analysis | Understand Management Information System |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – V**

**SUBJECT: SALES AND MARKETING - I**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

## A. COURSE OVERVIEW

- To acquaint the students with concepts and techniques in the application for developing and designing in sales and marketing program.
- To sensitize students to the various facets of advertising, public relation and promotion management, Sales promotion, and Publicity, digital Marketing.

## B. COURSE CONTENT

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **COS** |
|---|---|---|---|
| 1 | Introduction to Marketing and Services<br>A. What is marketing?<br>B. What are Products and Services?<br>C. General Marketing Management<br>D. Marketing Mix | 6 | CO1 AND CO5 |

| | | | |
|---|---|---|---|
| | E. Hospitality Marketing vs. Marketing of Manufactured Goods | | |
| 2 | Marketing Environment and Market Research<br>A. Introduction<br>B. Marketing Environment<br>C. Marketing Research | 6 | CO2 |
| 3 | Consumer Behavior in Services and the Future Guest<br>A. Introduction<br>B. Factors which influence Consumer Behavior<br>C. Hospitality Market Segments<br>D. Buying Decision-making Process<br>E. During Marketing Tactics before and after Service<br>F. Buying Decision-making Process of new products<br>G. Customer's Expectations of Service<br>H. Factors Influencing Expectations in Service<br>I. Exceeding Customer Expectations<br>J. Creating Excellent Service Mindsets<br>K. The Future Guest | 6 | CO3 |
| 4 | Hospitality Products and Services<br>A. Introduction<br>B. Hospitality Products<br>C. Dimensions of Hospitality Products<br>D. Marketing strategies for Products<br>E. Product positioning and differentiation<br>F. Branding | 6 | CO4 |

| | | | |
|---|---|---|---|
| | G. Customer Benefit Strategy<br><br>H. Hospitality Services<br><br>I. Hospitality Service Dynamics<br><br>J. Range of Services provided by hotels and restaurants<br><br>K. Product Service Dimensions | | |
| 5 | Hospitality Pricing Strategies<br>A. Introduction<br>B. Pricing strategies of the Hospitality Industry<br>C. Types of Pricing Plans and Room Rates<br>D. Yield Management | 6 | CO4 |
| 6 | Hospitality "Place" Strategies and Distribution Channels<br>A. Introduction<br>B. Distribution Channels<br>C. Guest Contact Options<br>D. Functions of Distribution Channels<br>E. Methods of Distribution Channels<br>F. Methods of Distribution in Hospitality Sector<br>G. Global Distribution Systems<br>H. Online Hotel Reservations<br>I. Central Reservation System<br>J. Tour Operators and Travel Agents | 6 | CO4 |

**C. TEXT BOOKS**

Andrews S. Sales and Marketing. 1st ed., Tata McGraw- Hill. India, 2009.

**D. REFERENCE BOOKS**

Makens J, Bowen J T and Kotler P R. 6th ed., Pearson Education, 2010.

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skills** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | Develop an understanding of marketing as a function and capable to observe the factors effecting marketing of organization's products or services. |
| CO2 | Comprehension | Identify the Marketing Environment and Market Research and to be able to estimate the Market. |

| | | |
|---|---|---|
| CO3 | Application | Understanding the consumer behavior in services and the future guest. |
| CO4 | Synthesis | Make familiar Hospitality Products, Services and Pricing Strategies and Policies. |
| CO5 | Analysis | Summarize the efficiency of marketing function. |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | |
| **CO3** | 3 | 1 | 3 | 2 | 1 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | |
| **CO4** | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | |
| **CO5** | 2 | 2 | 1 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 1 | 2 | 3 | |
| **Avg.** | 2.2 | 2.2 | 2.4 | 2.2 | 2.4 | 2.4 | 2.2 | 2.2 | 2.4 | 2.2 | 2.4 | 2.4 | 2.6 | 2.4 | 2.4 | 2.5 | 2.3438 |

**BBA (HM) SEMESTER – V**

**SUBJECT: FINANCE - I**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

**A. COURSE OVERVIEW**

This course focuses on the basic concept of Finance in Hotel Industry.

**B. COURSE CONTENT**

| Sr.No | Major Topics | Lecture + Practical | COS |
|---|---|---|---|
| 1 | Finance Management in Hospitality Industry | 4 | CO5 |
| 2 | Factors affecting the Hotel Industry | 4 | CO2 |
| 3 | Time Value of Money | 3 | CO2 |
| 4 | Financial Statements of Hospitality Business | 3 | CO1 |
| 5 | Analysis and interpretation of Financial Statement | 4 | CO1 |
| 6 | Funds analysis, Cash Flow Analysis | 3 | CO3 |
| 7 | Working Capital of Hotel Companies | 5 | CO3 |
| 8 | Management of Cash | 5 | CO4 |
| 9 | Inventory and Receivables Management | 5 | CO3 |

**C. TEXT BOOKS**

Hotel Finance – Anand Iyengar – Oxford University Press

**D. REFERENCE BOOKS**

Van horne, *"Fundamentals of Financial Management",* Pearson Education, 11th ed.
Brigham, *"Financial Management"*, Cengage Publication
Kewown, J.Arthur, Martin, John, Petty, William, and Scott David, *"Financial Management: Principles and Applications"*,10th Ed. Pearson.
Chandra Prassanna, *"Financial Management"*, 10th Edition, TMH, New Delhi

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Demonstrate role of financial management in business corporations, Knowledge of the value of money overtime, its utility and trade-off between risk and return. |
| CO2 | Comprehension | Construct and Compare the various capital budgeting techniques and risk in capital budgeting. |
| CO3 | Application | Distinguish between equity, debt and preference capital. |

| | | |
|---|---|---|
| | | Determine capital structure using EBIT –EPS analysis. Calculate specific cost of capital and weighted average cost of capital. |
| CO4 | Synthesis | Demonstrate the concept of working capital and sources of working capital finance. Determine working capital estimation and EOQ levels, Plan cash management, inventory management. |
| CO5 | Analysis | Differentiate between relevance and irrelevance theory of dividends. Calculate value of the firm using Walter's Model,<br>Gordon's Model and MM Hypothesis |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| **CO2** | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| **CO3** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | |
| **CO4** | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 1 | |
| **CO5** | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **Avg.** | 2.4 | 2.4 | 2.6 | 2.2 | 2.6 | 2 | 2.4 | 2.2 | 2.4 | 2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.31 |

**BBA (HM) SEMESTER – VI**

**SUBJECT: FRONT OFFICE – V**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

## A. COURSE OVERVIEW

- To make students knowledgeable about all advance theories of Front Office
- To introduce the Front Office Systems with the latest developments in the field of Hospitality trade which hold significance to the future managers.

## B. COURSE CONTENT

| Sr.No | Major Topics | Lecture + Practical | COS |
|---|---|---|---|
| 1 | Importance of Evaluating Hotel's Performance | 4 | CO1 |
| 2 | A. Various methods to Evaluate Hotel's Performance like Occupancy Ratios, Avaerage Daily rate, Average Room Rate Per Guest and Revenue Per Available Room(Rev-Par) | 7 | CO1 |
| 3 | B. Market Share Index | 4 | CO1 |
| 4 | C. Evaluation of Hotel's By Guests | 3 | CO1 |
| 5 | Yield Management in Hotel industry | 5 | CO2 |
| 6 | Measuring Yield In the hotel Industry | 4 | CO2 |
| 7 | Elements and Benefits of Yield management | 5 | CO2 and CO3 |
| 8 | Challenges in Yield Management | 5 | CO2 and CO3 |
| 9 | Benefits and data required for forecasting | 4 | CO4 |
| 10 | Yield Management Prospects | 4 | CO2 and CO3 |
| 11 | Preparing a Budget for front office department by focusing on various expenses and expected revenue basis | 6 | CO4 |
| 12 | Basic tasks of Front office Heads (Attendance, Briefings, Managing Disciplines, Cost-reducing methods, Staff scheduling, Evaluating staff) | 9 | CO5 |

## C. TEXT BOOKS

Hotel Front Office: Operations and Mangement – Jatashankar Tiwari – Oxford University Press

Textbook of Front Office Management and Operations – Sudhir Andrews – MC Graw Hill Education

**D. REFERENCE BOOKS**

Check-in Check-out: Managing Hotel Operations – Gary K Vallen, Jerome J Vallen – Pearson

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | Learn and Understand Various Methods to Evaluate any Hotel's Performance and evaluation of any Property by Guests |
| CO2 | Comprehension | Understand Yield management concept along with it's Benefits and Elements |
| CO3 | Application | Understand what revenue management is, and why it is important and How effective yielding can improve a hotel's profit |
| CO4 | Synthesis | Uses of various internal and external data of various planning aspects like Forecasting, Establishing room rates and Budgeting |
| CO5 | Analysis | Understand the various tactics to apply and establish Discipline, staff schedule and evaluating an individuals |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – VI**

**SUBJECT: HOUSE KEEPING - V**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

**A. COURSE OVERVIEW**

- To make students knowledgeable about all advance theories of Housekeeping.
- To introduce the Housekeeping systems with the latest developments in the field of Hospitality Industry which hold relevance to the future managers?

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **COS** |
|---|---|---|---|
| 1 | Hotel Renovation | 1 | CO1 |
| 2 | A. Reasons to Renovate | 1 | CO1 |
| 3 | B. Types of Renovation | 3 | CO1 |
| 4 | C. Subsidiary Processes in Renovation | 4 | CO1 |
| 5 | Budgeting for House Keeping Expenses | 1 | CO2 |
| 6 | A. Types of Budget | 2 | CO2 |
| 7 | B. House keeping Expenses | 2 | CO2 |
| 8 | C. Budget-Planning Process | 2 | CO2 |
| 9 | D. Controlling Expenses and Inventory | 3 | CO2 |
| 10 | E. Types, Stages and Process of Purchasing | 5 | CO2 |
| 11 | Flower Arrangement in Hotels | 1 | CO3 |

| | | | |
|---|---|---|---|
| 12 | Flower Arrangement Basics | 4 | CO3 |
| 13 | Designing Flower arrangments | 4 | CO3 |
| 14 | Japanese / Oriental Flower Arrangement | 2 | CO3 |
| 15 | Common Flowers and Foliage | 3 | CO3 |
| 16 | Essential Components of Horticulture | 4 | CO4 |
| 17 | Landscaping | 2 | CO4 |
| 18 | Indoor Plants | 2 | CO4 |
| 19 | Bonsai in Hotel Properties | 1 | CO4 |
| 20 | Ecotel Certification | 1 | CO5 |
| 21 | Choosing an eco-friendly site | 1 | CO5 |
| 22 | Energy Conservation | 2 | CO5 |
| 23 | Water Conservation | 2 | CO5 |
| 24 | Environment Friendly House keeping | 2 | CO5 |

**C. TEXT BOOKS**

Hotel Housekeeping Operations and Management – G. Raghubalan, Smritee Raghubalan – Oxford Publication. 2nd Edition.

**D. REFERENCE BOOKS**

Textbook of Housekeeping Management and Operations – Sudhir Andrews – McGraw Hill Publication.

Training Manual of Housekeeping – Sudhir Andrews – McGraw Hill

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | Need and process of renovation |
| CO2 | Comprehension | Types of Budget and Budgetary control |
| CO3 | Application | Principles and styles of Flower arrangements |
| CO4 | Synthesis | Basics of Horticulture like Indoor plants, Bonsai |
| CO5 | Analysis | Learn different energy and water conservation activities |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – VI**

**SUBJECT: FOOD AND BEVERAGE SERVICE - V**

| Teaching Scheme (Hours/week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 2 | 5 | 4 | 40% | 26.67% | -- | 33.33% | 100% |

A. **COURSE OVERVIEW**
B. **COURSE CONTENT**

| Sr.No | Major Topics | Lecture + Practical | COS |
|---|---|---|---|
| 1 | Steps Followed in Planning an Outlet | 1 | CO1 |
| 2 | Space Calculation for Various F&B Outlets | 3 | CO1 |
| 3 | The Staff Requirement Calculation | 1 | CO1 |
| 4 | Seating Arrangement | 1 | CO1 |
| 5 | Selection and Planning of Equipment | 1 | CO1 |
| 6 | Planning the Interiors of an Outlet | 3 | CO2 |
| 7 | Planning Menu for an Outlet | 1 | CO2 |
| 8 | Constraints in Menu Planning | 2 | CO2 |
| 9 | Categories of Staff & Organization Chart | 1 | CO2 |
| 10 | Hierarchy | 2 | CO2 |
| 11 | Job Descriptions & Job Specifications | 1 | CO3 |
| 12 | Assignment of Duties & Duty Rota & Staff Schedule | 2 | CO3 |
| 13 | Job of Supervisor & Task of Supervisor | 2 | CO3 |
| 14 | Standard Operating Procedure & How to write a SOP | 1 | CO3 |
| 15 | Types of Banquets | 2 | CO3 |
| 16 | Staff Organization of Banquet Department | 1 | CO4 |

| | | | |
|---|---|---|---|
| 17 | Banquet Booking Procedure | 2 | CO4 |
| 18 | Banquet Menus | 2 | CO4 |
| 19 | Banquet Space Requirements & Banquet Seating Plans and Set ups | 1 | CO4 |
| 20 | Banquets Service Procedures & Toasting | 2 | CO4 |
| 21 | Factors to be considered while planning buffet | 1 | CO4 |
| 22 | Guidelines for Calculating the area required for Buffet | 1 | CO5 |
| 23 | Planning Menu for Buffet | 2 | CO5 |
| 24 | Types of Buffet | 1 | CO5 |
| 25 | Equipments Required for a Buffet Set-up | 2 | CO5 |
| 26 | Types of Bar | 2 | CO5 |
| 27 | Bar Layout & Parts of Bar | 1 | CO5 |
| 28 | Bar Stock & Bar Licensing | 1 | CO5 |
| 29 | Bar Control & Bar Staffing | 3 | CO5 |
| 30 | Definition & History of Cocktail | 2 | CO5 |
| 31 | Classification & categories of Cocktail | 2 | CO5 |
| 32 | Basic Bar equipments to make Cocktails | 1 | CO5 |
| 33 | Basic Tips in making cocktails | 2 | CO5 |
| 34 | Organization & Important Tasks of Kitchen Stewarding | 1 | CO5 |
| 35 | Dishwashing Methods & Dish wash Machines | 3 | CO5 |
| 36 | Inventory and Control & Par Levels | 2 | CO4 & CO5 |

**C. TEXT BOOKS**

Food and Beverage: F&B Simplified - Vara Prasad & Gopi Krishna – Pearson Publication

**D. REFERENCE BOOKS**

Food and Beverage - Dennis Lillicrap and Cousins - Orient Longman

Food and Beverage Service – A Training Manual - Sudhir Andrews - Tata McGraw Hill
Textbook of Food and Beverage Service - SN Bagchi & Anita Sharma - Aman Publications

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Understand the planning and managing Food and Beverage outlets considering the planning for staff requirement, space requirement and layout of different area |
| CO2 | Comprehension | Discuss about the banquet and off-premises operations and management |
| CO3 | Application | Understand the concept of buffet in hospitality industry |
| CO4 | Synthesis | To understand Bar management process and procedures |
| CO5 | Analysis | Develop an understanding about cocktail making |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

**BBA (HM) SEMESTER – VI**

**SUBJECT: FOOD AND BEVERAGE PRODUCTION - V**

| Teaching Scheme (Hours/week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | 3 | 6 | 5 | 40% | 26.67% | -- | 33.33% | 100% |

## A. COURSE OVERVIEW

This syllabus is intended towards training of students in the advance theory and techniques of the Food and Beverage Production.

## B. COURSE CONTENT

| Sr.No | Major Topics | Lecture + Practical | COS |
|---|---|---|---|
| 1 | The Concepts Of Plate Presentations | 2 | CO1 |
| 2 | Merging Of Flavours, Shapes, And Textures On The Plate | 2 | CO1 |
| 3 | Emerging Trends In The Food Presentation | 3 | CO1 |
| 4 | Types Of Nutrients | 2 | CO2 |
| 5 | Balanced Diet And Nutritional Analysis | 2 | CO2 |
| 6 | Principles Of Healthy Cooking | 3 | CO2 |
| 7 | Chinese Cuisine | 4 | CO3 |
| 8 | Japanese Cuisine | 4 | CO3 |
| 9 | Thai Cuisine | 3 | CO3 |
| 10 | Kitchen Organization | 3 | CO3 |
| 11 | Allocation Of Work-Job Description, Duty Rosters | 4 | CO4 |
| 12 | Production Planning And Scheduling | 4 | CO4 |
| 13 | Production Quality And Quantity Control | 3 | CO4 |

| | | | |
|---|---|---|---|
| 14 | Forecasting And Budgeting | 2 | CO5 |
| 15 | Yield Management | 4 | CO5 |
| 16 | Testing New Equipments | 4 | CO5 |
| 17 | Developing New Recipes | 3 | CO5 |
| 18 | Food Trials | 2 | CO5 |
| 19 | Evaluating A Recipe | 2 | CO1 & CO5 |
| 20 | Organoleptic Evaluation | 2 | CO4 |
| 21 | Sensory Evaluation | 2 | CO5 |

**C. TEXT BOOKS**

International Cuisine & Food Production Management - Parvinder S. Bali - Oxford University Press

**D. REFERENCE BOOKS**

Food Production Operations – Parvinder S. Bali - Oxford University Press
Quantity Food Production Operation – Parvinder S. Bali - Oxford University Press
Modern Cookery (Vol. 1&2) - Thangam E Phillip - Orient Longman

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | To develop concepts of Food presentations |
| CO2 | Comprehension | Develop knowledge on the concept of Health Food |
| CO3 | Application | Develop knowledge on Oriental cuisine with their history, popular dishes and Cooking methods |
| CO4 | Synthesis | Impart knowledge on the aspect of production planning and management |
| CO5 | Analysis | Describe the use of research in product development |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – VI**

**SUBJECT: HOTEL LAW**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

**A. COURSE OVERVIEW**

This course aims to make students aware of the concepts of Hotel Law, and their importance and relevance in the hospitality industry.

**B. COURSE CONTENT**

| **Sr.No** | **Major Topics** | **Lecture + Practical** | **COS** |
|---|---|---|---|
| 1 | **Introduction to Hotel Law:** Introduction to Hotel Laws | **8** | CO1, CO4 |

| | | | |
|---|---|---|---|
| 2 | **Laws Related to Hotel Operations:** Hotel Licenses and Regulations, Hotel Insurance | **10** | CO2 |
| 3 | **Laws Related to Employees and Guests:** Hospitality Law | **8** | CO3 |
| 4 | **Laws Related to Food and Beverages:** Food Legislation, Liquor Licensing | **10** | CO5 |

**C. TEXT BOOKS**

Devendra A (2010). *Hotel Law. Oxford University Press.*

**D. REFERENCE BOOKS**

**E. COURSE OUTCOMES**

| **CO NUMBER** | **Skill** | **STATEMENT** |
|---|---|---|
| CO1 | Evaluate | Introduce the basic need to study hotel law for the hotel management student |
| CO2 | Comprehension | Develop a comprehension on various types of hotel laws in India |
| CO3 | Application | Develop a basic understanding of implications of major Hotel Laws in India on the businesses of hospitality sector companies |
| CO4 | Synthesis | Instil a mind set to see through combined effects of major hotel laws on the hotel industry in India |
| CO5 | Analysis | Develop an analytical understanding of hotel laws |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 2 | 2 | |
| **CO2** | 2 | 2 | 1 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 1 | 1 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 1 | 2 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | |
| **CO4** | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 2 | 2 | 1 | 2 | 3 | |
| **CO5** | 2 | 2 | 3 | 2 | 3 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | |
| **Avg.** | 2 | 2 | 2.2 | 2.2 | 2.2 | 2.2 | 2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2 | 2 | 2.2 | 2.1375 |

**BBA (HM) SEMESTER – VI**

**SUBJECT: ENGINEERING AND MAINTENANCE**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

**A. COURSE OVERVIEW**

To give an overview of hotel facilities and operations in regards to engineering and maintenance perspective which helpful to understand the importance of supporting department to smooth functioning of the hotel's offerings.

**B. COURSE CONTENT**

| Sr.No | Major Topics | Lecture + Practical | COS |
|---|---|---|---|
| 1 | Hospitality Industry and Engineering Systems | 2 | CO1 |
| | A. Engineering Systems in Hospitality Industry | 1 | CO1 |
| 2 | Water Distribution System | 1 | CO2 |
| | A. Cold Water-Supply, Storage and Distribution | 2 | CO2 |
| | B. Hot water generation and Distribution | 1 | CO2 |
| | C. Piping material for conveying water | 1 | CO2 |
| 3 | Fittings in water distribution line | 2 | CO2 |

| | | | |
|---|---|---|---|
| 4 | Sanitation, Waste Disposal and Pollution | 1 | CO3 |
| | A. Sanitation and Sanitary Systems | 1 | CO3 |
| | B. Treatment and Disposal of Waste | 2 | CO3 |
| | C. Solid Waste and its Disposal | 1 | CO3 |
| | D. Regulations and Norms for Solid Waste Management | 2 | CO3 |
| | E. Pollution and Hotel Industry | 1 | CO3 |
| | F. Pollution Control Boards and Pollution Norms | 1 | CO3 |
| 5 | Maintenance Management | 1 | CO4 |
| | A. Role and importance of maintenance department | 1 | CO4 |
| | B. Types of maintenance procedures in department | 1 | CO4 |
| | C. Maintenance management policy | 1 | CO4 |
| | D. Elements of maintenance programmes | 1 | CO4 |
| | E. Contract maintenance | 1 | CO4 |
| 6 | Tendering practice | 2 | CO4 |
| 7 | Equipment Replacement Policy | 1 | CO4 |
| | A. Causes for Equipment replacement | 1 | CO4 |
| | B. Equipment Replacement policy | 2 | CO4 |
| 8 | Safety and security | 1 | CO5 |
| | A. Safety in hotels and its management | 1 | CO5 |
| | B. Fire Safety | 1 | CO5 |
| | C. A few Safety issues in hotel | 1 | CO5 |
| | D. Security in Hotels and its management | 1 | CO5 |

**C. TEXT BOOKS**

Hotel Engineering - Sujit Ghosal - Oxford University Press

## D. REFERENCE BOOKS

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Identify the need, importance and organization of engineering department |
| CO2 | Comprehension | Gain depth knowledge about water distribution system along with various materials used for transportation of water |
| CO3 | Application | Gain depth knowledge about waste disposal and sanitation systems and procedures |
| CO4 | Synthesis | Well versed about maintenance management program and replacement policy |
| CO5 | Analysis | Learn about fire safety measures used in hospitality industry |

F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – VI**

**SUBJECT: SALES AND MARKETING - II**

| Teaching Scheme (Hours/week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

## A. COURSE OVERVIEW

- To acquaint the students regarding Hospitality promotion.
- To familiarize the students Marketing strategy.
- To make students know about supports or pillars of marketing.

## B. COURSE CONTENT

| Sr.No | Major Topics | Lecture + Practical | COS |
|---|---|---|---|
| 1 | Hospitality Sales<br>A. Sales Objectives<br>B. Sales Force Strategy<br>C. Sales-Force Structure<br>D. Selling Principles<br>E. Steps to Effective Selling<br>F. Managing the Sales Force<br>G. In-House Selling | 6 | CO1 |
| 2 | Hospitality Promotion, Advertising and Public Relations<br>A. Introduction<br>B. Hospitality Communication Channels<br>C. Hospitality Marketing Communication System<br>D. Promotional Objectives<br>E. Buying Influences in Hospitality Services | 6 | CO1 |

| | | | |
|---|---|---|---|
| | F. Promotion Products and Services<br><br>G. Web Marketing | | |
| 3 | People as a Marketing Proposition<br><br>A. Introduction<br><br>B. Features of Service Personnel<br><br>C. Maintaining Consistent Performance<br><br>D. Delivering Service as Promised | 6 | CO2 |
| 4 | Physical Evidence as a Marketing Strategy<br><br>E. Types of Physical Evidence<br><br>F. Managing Physical Evidence<br><br>G. Making Tangible the Intangible in Hospitality | 6 | CO3 |
| 5 | Processes as a Marketing Support<br>A. Operations Management in Services<br>B. Process Management<br>C. Processes within a Delivery System<br>D. Process and People<br>E. Process and Organizations | 6 | CO4 |
| 6 | Strategic Marketing Planning and Control<br>A. Benefits of Planning<br>B. What is planning?<br>C. Planning Process<br>D. Phases of Planning<br>E. What is Strategy?<br>F. The Marketing Plan<br>G. Essential Hospitality Marketing Strategies | 6 | CO5 |

**C. TEXT BOOKS**

Andrews S. Sales and Marketing. 1st ed., Tata McGraw- Hill. India, 2009.

**D. REFERENCE BOOKS**

Makens J, Bowen J T and Kotler P R. 6th ed., Pearson Education, 2010.

**E. COURSE OUTCOMES**

| CO NUMBER | Skill | STATEMENT |
|---|---|---|

| | | |
|---|---|---|
| CO1 | Evaluate | Describe the marketing communication mix, IMC, Communication models, describe the methods for setting the advertising budget, and describe the functions of advertising Agencies. |
| CO2 | Comprehension | Participation and importance of people as a Marketing proposition. |
| CO3 | Application | Develop to making tangible the intangible in hospitality services. |
| CO4 | Synthesis | Correlate and locate marketing support as a process. |
| CO5 | Analysis | Analyze the behavior of target market and relate them to Organizational marketing strategies. |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 3 | |
| **CO2** | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 1 | |
| **CO4** | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | |
| **Avg.** | 2.2 | 2.6 | 2.4 | 2.2 | 2.4 | 2.6 | 2.4 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.4 | 2 | 2.2 | 2.3625 |

**BBA (HM) SEMESTER – VI**

**SUBJECT: FINANCE - II**

| **Teaching Scheme (Hours/week)** | | | | **Credits** | **Examination Scheme** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lecture | Tutorial | Practical | Total | | External | Sessional | Term work | Practical | Total |
| 3 | | | 3 | 4 | 60% | 40% | | | 100% |

## A. COURSE OVERVIEW

This course focuses on the basic concept of Finance in Hotel Industry.

## B. COURSE CONTENT

| Sr.No | Major Topics | Lecture + Practical | COS |
|---|---|---|---|
| 1 | Short Term Finance | 4 | CO5 |
| 2 | Basics of Capital Budgeting and Estimating Cash Flows | 5 | CO2 |
| 3 | Capital Budgeting Techniques | 3 | CO2 |
| 4 | Valuation of Hotel Real Estate | 3 | CO1 |
| 5 | Risk in Hospitality Industry | 4 | CO1 |
| 6 | The Financial System | 3 | CO3 |
| 7 | Source of Long Term Finance | 5 | CO3 |
| 8 | Franchising | 5 | CO4 |
| 9 | Leasing | 4 | CO3 |

## C. TEXT BOOKS

Hotel Finance – Anand Iyengar – Oxford University Press

## D. REFERENCE BOOKS

Van horne, *"Fundamentals of Financial Management",* Pearson Education, 11th ed.
Brigham, *"Financial Management"*, Cengage Publication
Kewown, J.Arthur, Martin, John, Petty, William, and Scott David, *"Financial Management: Principles and Applications"*,10th Ed. Pearson.
Chandra Prassanna, *"Financial Management"*, 10th Edition, TMH, New Delhi

## E. COURSE OUTCOMES

| CO NUMBER | Skill | STATEMENT |
|---|---|---|
| CO1 | Evaluate | Demonstrate role of financial management in business corporations, Knowledge of the value of money |

| | | |
|---|---|---|
| | | overtime, its utility and trade-off between risk and return. |
| CO2 | Comprehension | Construct and Compare the various capital budgeting techniques and risk in capital budgeting. |
| CO3 | Application | Distinguish between equity, debt and preference capital. Determine capital structure using EBIT –EPS analysis. Calculate specific cost of capital and weighted average cost of capital. |
| CO4 | Synthesis | Demonstrate the concept of working capital and sources of working capital finance. Determine working capital estimation and EOQ levels, Plan cash management, inventory management. |
| CO5 | Analysis | Differentiate between relevance and irrelevance theory of dividends. Calculate value of the firm using Walter's Model, Gordon's Model and MM Hypothesis |

**F. COURSE MATRIX**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| **CO2** | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | |
| **CO3** | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | |
| **CO4** | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 3 | 2 | 2 | |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **Avg.** | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2.4 | 2.2 | 2.2 | 2.175 |

## BCA SEMESTER–I

## SUBJECT: (BC-106) COMPUTER PROGRAMMING IN C

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | 1 | 3 | 8 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understanding | Know the basic structure of C program. Develop simple and complex C program using C-tokens, Constants, Operators and Expressions. |
| CO2 | Analyzing | Discover the knowledge of Decision-making and branching statements, Decision-making and looping. |
| CO3 | Applying | Explore manipulation of Array and String. |
| CO4 | Applying | Learn and develop Programming using User Define Function, Structure and Pointer. |
| CO5 | Understanding | Gain the knowledge of File management and Pre-processor. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Introduction to C | ✓ | | | | |
| 2 | I/O operators, Control statements, Array and String handling | | ✓ | ✓ | | |
| 3 | User-defined functions and storage class | | ✓ | ✓ | ✓ | |
| 4 | Structures and Unions | | | | ✓ | |
| 5 | Pointers | | | | ✓ | |
| 6 | File management in C | | ✓ | | | ✓ |
| 7 | The pre-processor | | | | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | -- | 1 | 1 | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 1 | 1 | -- | 1 | 2 | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 1 | 2 | 1 | 1 | 3 | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 2 | 3 | 1 | 1 | 3 | -- | -- | 1 | -- | -- | -- | -- |
| CO5 | 2 | 3 | 2 | 1 | 3 | -- | -- | 1 | -- | -- | -- | 1 |
| Avg | 1.4 | 2 | 0.8 | 1 | 2.4 | -- | -- | 0.4 | -- | -- | -- | 0.2 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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## BC-106 Programming in 'C'

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Pr | Tw | Total |
| 4 | 1 | 3 | 60 | 40 | 25 | 25 | 150 |

**Unit-1IntroductiontoC**

- Introduction to C : (Middle level language, Multipurpose) [1]
- History of C ,
- Features of C (Robust, Fast & Efficient ,Portable ,Extendable, Structured Programming)
- Program characteristics(Lowercase, Free form ,Function based)
- Basic structure of C program [1]
  ( Documentation, Link Section, Definition section ,Global declaration ,Main function, Subprogram section)
- Character set (letters, digits, special characters, white spaces) [1]
- C tokens( Keywords, identifiers, constants, strings, special symbols, operators)
- Constants(Primary and User defined data types), Symbolic constants
- Operators (Arithmetic,Relational,Logical,Assignment,Increment/Decrement , Conditional ,Bitwise ,Special operators) [2]
- Expressions
- Implicit and Explicit Type Casting
- Operators precedence and Associativity

**Unit-2I/Ooperators.Controlstatements.arrayandstringhandling**

- I/O operation ( getchar ,putchar , printf & scanf functions) [1]
- Formatted input and output [1]
- Control statements
  - Decision-making and branching statements [2]
    - if statement and various types of if statements,
    - switch-case statements
    - conditional operator statement
  - Decision making and looping [3]
    - while statement,
    - do – while statement
    - for statement
- Jump in loops – break and continue statement
- Arrays [2]
  - Introduction to array
  - One-dimensional arrays, two-dimensional arrays
- String handling [2]
  - Reading ,Writing ,Combining ,Copying ,Comparing ,Extracting strings
  - In-built string functions (strcat ,strcmp ,strcpy ,strlen)

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**Unit-3User-definedfunctionsandstorageclass**

-User-defined functions [1]

- Introduction
- Need for user-defined functions
- The form of C functions [1]
- Return values and their types
- Calling a function
- Category of functions [1]
    - Functions with no arguments and no return types
    - Functions with arguments and no return types
    - Functions with arguments and return types
- Nesting of functions
- Recursion [1]
- Call by value and call by reference
- Function with array

- Storage classes (Storage, default value, scope, life) [1]
    - Static storage class
    - Automatic storage class
    - Extern storage class
    - Register storage class

**Unit-4StructuresandUnions**

- Introduction [2]
- Structure definition, structure initialization, giving values to members
- Comparison of structure variables
- Arrays of structures [1]
- Arrays within structures
- Nested structures
- Structures and functions [1]
- Unions
- Bit fields

**Unit-5Pointers**

- Introduction [2]
- Understanding pointers
- Declaring & Initializing pointers , Accessing a variable and address of a variable
- Pointer expressions [2]
- Pointer increments and scale factor
- Pointers and arrays [1]
- Pointers and character strings
- Pointer and functions [2]
- Pointers and structures
- Void pointers

**Unit–6FilemanagementinC**

- Introduction
- Why we need file [1]
- Defining and opening a file (fopen) [1]
- Closing a file (fclose)
- Input/Output operations on files (getc, putc, getw, putw, fprintf, fscanf ) [1]
- Error handling during I/O operations
- Random access to files ( ftell, fseek and rewind) [1]
- Command line arguments

**Unit7-Thepreprocessor**

- Introduction [1]
- Categories of preprocessor
- Macro substitution
- File inclusion [1]
- Compiler control directives [2]
- #pragma and #error directives
- stringizing and token-pasting operator

**Text Book:**

1. Programming in ANSI C, Balagurusamy, Tata McGraw-Hill

**Reference Books:**

1. Let us C, Kanitkar, BPB.
2. Programming with C, Gottfried, McGraw-Hill International
3. Programming with C , Venugopal & Prasad , Tata McGraw-Hill

## BCA SEMESTER–I

## SUBJECT: (BC-107) DIGITAL COMPUTER ORGANIZATION

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | - | 4 | 60 | 40 | 25 | - | 125 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Analyse | Understand the basics of number system and their conversions. |
| CO2 | Apply | Demonstrate computer architecture concepts related to design of circuits using gates and registers. |
| CO3 | Understand | Compare and contrast different types of memories |
| CO4 | Analyse | To notice how to perform computer arithmetic operations |
| CO5 | Apply | Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Representation of Information | ✓ | | | | |
| 2 | Basic Logic Design | | ✓ | ✓ | | |
| 3 | Memory Devices | | | ✓ | | |
| 4 | CPU Architecture | | | ✓ | ✓ | |
| 5 | I/O Architecture | | | | | ✓ |
| 6 | Case Study of a Micro-Processor | | | | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 1 | 1 | 1 | 1 | -- | -- | 1 | -- | 2 |
| CO2 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | -- | -- | 1 | -- | 3 |
| CO3 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | -- | -- | 1 | -- | 2 |
| CO4 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | -- | -- | 1 | -- | 2 |
| CO5 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | -- | -- | 1 | -- | 2 |
| Avg | 1.4 | 2.4 | 2.2 | 1.2 | 1.2 | 1 | 1 | - | - | 1 | - | 2.2 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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## BC-107 Digital Computer Organization

| Teaching scheme (H/W) | | Exam. Scheme (Marks) | | |
|---|---|---|---|---|
| L | Tu | Ss | Tw | Total |
| 4 | - | 40 | 25 | 125 |

**1.RepresentationofInformation**

Number systems: binary, octal, hexadecimal [1]
Positive and negative number, integers and real ` [1]
Characters and codes ASCII, EBCDIC [1]
Redundant coding for error detection and correction. [1]

**2.BasicLogicDesign**

Truth tables, Boolean algebra [2]
Combination circuit design with AND, OR [2]
NOT, NAND NOR gates [2]
Multiplexers [2]
Decoder and encoder [2]
Full adder and full sub tractor [2]
Look ahead carry generator with binary adder [2]
Flip-flops : R-S F/F, J-K F/F, [2]
Toggle F/F, D F/F, Master-Slave F/F [2]
Shift registars [2]
counters [3]
Simple arithmetic and logic circuits. [1]

**3.MemoryDevices** **[3]**

Computer Memory Introduction, Memory Representation, Memory Hierarchy, CPU Registers, Cache Memory, Primary Memory, Secondary Memory, Access Types of Storage Devices Magnetic Tape, Magnetic Disk, Optical Disk, Magneto-Optical Disk, Using the Computer Memory, Random access, Serial accesses, Directs access memories and their specifications.

**4.CPUArchitecture**

Instruction format [1]
Addressing modes-direct, indirect, immediate, relative, indexed
Addressing formats: Zero, single, double, register etc.
Instruction set selection [1]
Instruction execution
Fetch and execution cycles
Microprogramming concept [1]
Speed mismatch between CPU and memory and methods of alleviating it.

**5.I/OArchitecture** **[3]**

Introduction, Input-Output Unit, Input Devices, Human Data Entry Devices, Pointing Devices, Pick Devices, Source Data Entry Devices, Output Devices, Hard Copy Devices, Soft Copy Devices, I/O Port, Working of I/O System, Properties of simple I/O devices and their Controllers, Transfer of information between I/O devices, CPU and memory
Program controlled and interrupt controlled information transfer,
Alleviating speed mismatch between I/O units and memory
DMA control I/O
channels Peripheral
processors.

**6.CaseStudyofaMicro-Processor**

- Study of 8086 Micro-Processor:

o Register Structure [1]
o Buses [1]
o Instruction Set: [1]

**MOV, PUSH, POP, IN, OUT, ADD, ADC, INC, SUB, SBB, DEC,CMP, MUL, DIV, NOT, AND, OR, XOR, JMP, LOOP, INT, STC, CLC, CMC, HLT, WAIT, ESC**

**Text Book :**

1. Digital Logic and Computer Design
   M. Morris Mano(PHI)

**Reference Book :**

1. Computer System Architecture
   M. Morris Mano (PHI)
2. Microprocessor and Interfacing Programming and Hardware
   Douglas V. Hall (TMH) Second Edition
3. Computer Fundamentals by Anita Goel

## BCA SEMESTER–I

## SUBJECT: (BC-108) COMMUNICATIVE ENGLISH – I

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | - | 4 | 60 | 40 | - | - | 100 |

### COURSE OUTCOMES :

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | To understanding the methodology of communication. |
| CO2 | Understanding | To understand the barriers and flows of communication, interconnection of the flow, the basics of writing technical, purposes of writing letters. To develop efficiency in writing. |
| CO3 | Understanding | Understand the vocabulary and their root forms to enhance vocabulary level. Grammatical tests, to rectify their mistakes/errors while writing and speak-ing. |
| CO4 | Applying | Rectify common errors in their speaking and writing, Acquire proficiency in all four skills of language. |
| CO5 | Understanding | Be competent at a public speaking and Interviews. |
| CO6 | Applying | To deconstruct the challenges of delivering effective presentation, to develop strategies to make effective presentations. |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | 1 | - | 2 | 3 | - | 3 | 2 | - | 1 | 2 | - |
| CO2 | - | 1 | - | 2 | 3 | - | 3 | 2 | - | 1 | 2 | - |
| CO3 | - | 1 | - | 2 | 3 | - | 3 | 2 | - | 1 | 2 | - |
| CO4 | - | 1 | - | 2 | 3 | - | 3 | 2 | - | 1 | 2 | - |
| CO5 | - | 1 | - | 2 | 3 | - | 3 | 2 | - | 1 | 2 | - |
| CO6 | - | 1 | - | 2 | 3 | - | 3 | 2 | - | 1 | 2 | - |
| Avg | | | | | | | | | | | | |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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**Communicative English - I**

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | |
|---|---|---|---|---|---|---|
| **L** | **Tu** | **Pr** | **Th** | **Ss** | **Tw** | **Total** |
| **4** | **-** | **-** | **60** | **40** | **-** | **100** |

Looking at the diverse backgrounds & abilities of the thresh hold students, this syllabus aims at

(1) Importing the basic communication competency of the learners.
(2) Familiarize them with the basic contents necessary for English communication during their studies.
(3) Facilitate them in LSRW skills. &
(4) Enable them to use English language for communicational needs.

So the syllabus is need base & it has a tentativeness, to facilitate the various learners of various competencies:

(I) Introduction to Basics of Communication. [1]
(II) Introduction to Basics of Communication. [1]
(III) What is Communication? It's various definitions. [2]
(IV) The salient features / Characteristics of the communication. [2]
Barriers to effective communication. [1]
[1]
[2]
[2]
(V) Improving LSRW**:** [18]
Introduction. [18]
Verbal and Nonverbal Communication
Listening Process
GD
Forms of Oral Presentation
(VI) The Basic Vocabulary [8]
The Basic Vocabulary [8]

(a) How to improve vocabulary?
(b) Prefixes / Suffixes (MFU).
(c) Synonyms/ Antonyms.
(d) One word substitution.
(e) Spellings.

(VII) Developing Fluency & Pronunciation. [8]
IPA
Grammar [conjunction, auxiliaries, prepositions, articles, tenses….]
Language games

**Text:/Source :**

The major source of studies for the students is the classroom, which will be very interactive & full of activities related to their syllabus. They must participate actively in their classes. The faculty will be a guide, helper, motivator & facilitator for the learners, but not the traditional teacher. So the learner's evaluation will be based on the class work only. The tests & exams will be based entirely on the class work & the participation of the learners in the classroom activities.

--- Prof. Rajanikant Jain.
Co - ordinator English Communication.

## BCA SEMESTER–I

## SUBJECT: (BC-109) COMPUTER FUNDAMENTALS & APPLICATION

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 2 | 6 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Remember | Obtain the knowledge of Computer history, hardware and software, |
| CO2 | Understand | Experience with the OS, MS-DOS Commands and Windows OS. |
| CO3 | Understand | Able to understand about Multimedia, Computer Security and Hacking. |
| CO4 | Create | Learn about Basic formatting of Text and style in Writer. Get the Knowledge of how to present the information with the help of different presentation style in Impress. |
| CO5 | Apply | Get the knowledge how to enter data in a spreadsheet and then manipulate this data to produce certain results with the use of available function and can perform some formatting. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Basic of computer | ✓ | | | | |
| 2 | User-computer interface | | ✓ | | | |
| 3 | Applications and security | | | ✓ | ✓ | |
| 4 | Computer practical | | | | ✓ | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | -- | -- | -- | -- | 1 |
| CO2 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | -- | -- | -- | -- | 2 |
| CO3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | -- | -- | -- | -- | 2 |
| CO4 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | -- | -- | -- | -- | 1 |
| CO5 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | -- | -- | -- | -- | 3 |
| Avg | 2.6 | 2.8 | 2.2 | 1.2 | 1 | 1.2 | 1 | - | - | - | - | 1.8 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

## BC-109 Computer Fundamental and Applications

| Teachingscheme(Hr./W) | | | Exam.Scheme(Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Pr | Tw | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 |

**UNIT I BASIC OF COMPUTER (PARTI)**

**Introduction to computer** [2]

- Introduction,
- Digital and Analog computer,
- Characteristics of computer,
- History of Computer, Generation of Computer,
- Classification of Computer,
- The Computer System
- Application of Computers

**The Computer System Hardware** [1]

- Introduction,
- Central ProcessingUnit,
- Memory Unit,
- Microprocessor,
- Interconnecting the Units of a Computer,
- Performance of a Computer,
- Inside a Computer Cabinet,
- Introduction to Emerging Technologies

**UNIT II USER-COMPUTER INTERFACE**

**Interaction of User and Computer** [1]

- Introduction,
- Types of Software,
- System Software,
- Application Software,
- Software Acquisition

**Operating System**

[5]

- Introduction
- Objectives of Operating System, Types of OS,
- Functions of OS,
- User Interface,
- Examples of Operating Systems

**MS-DOS**

- File naming rules,
- Wildcard characters,
- Internal & External commands
- dir, mkdir, chdir, type, copy, xcopy, delete, rename, format, sys, label, scandisk, attrib, path, prompt, date, time, tree, deltree, defrag, edit,etc.
- File Allocation Table(FAT), autoexec.bat & Config.sys

**Window OS** [2]

- Introduction
- Features of Windows,
- The Desktop,
- Structure of Windows,Windows Explorer,
- The Search,
- The Recycle Bin,
- Configuring the Screen,

- Configuring the Mouse,
- Adding or Removing Programs,
- Adding New Hardware,
- System Tools, The Scandisk,
- Windows Media Player,
- Windows Help,
- Versions of Windows

**UNIT III APPLICATIONS AND SECURITY**

**Introduction to Multimedia** [1]

- Introduction, Multimedia:Definition, Characteristics of Multimedia System Elements of Multimedia, Multimedia System,Multimedia Applications,

**Introduction to Computer Security** [1]

- Introduction,Security Threat and Security Attack, Malicious Software, Hacking Users Identifications and Authentication

**UNIT IV COMPUTER PRACTICAL**

**Word Processing** [10]

- Features of Word processing
- Wordprocessing window, Create, edit, store documents, print high quality documents, Navigating documents, Cursor movement commands, Spell checking, cut & paste, Find & replace, word-wrap Alignment, formatting the document using font dialogbox, Inserting tables, pictures, hyperlinks, Macros, Mailmerge, Template, Overview of Index and Tables dialog box etc .

**Presentation Software** [6]

- Features of Presentation software, Presentation window, Creating/editing slides
- Using text, drawings, tables, pictures, charts and other objects in slide, Creating and running slideshow, animator & slide transition, Effects:,Macros, templates; packing a presentation

**Spreadsheet** [11]

- Features of Spreadsheet, Concept of worksheet, Spreadsheet window, Navigating worksheet, entering & editing data in to cells, Insert/delete/hide/showrows/columns, Change column width/row right. Formatting data, Formulas & operators Range of cells, moving–copying data, Spell checking, Various types of addressing, Protecting & hiding data, sorting data, Searching & replacing data., Multiple worksheets & operations on them, Built-in functions, Lookup tables, Pivot table, Data organization-what-if analysis, Charts, pictures, file operations, Macros, Circular reference, Goal seek etc.

**Text Book :**

1.“PCSOFTWARE For Windows 98 Made Simple”by-R.K.TAXALI (Tata Mc-Graw Hill Publication)

2. Libre Office 5.1 Writer, Calc Math Formula Book Vol-1
Publisher : Notion Press
ISBN : 978194702756, 1947027565

**Reference Books:**

1.ComputerFundamentalsbyAnitaGoel

2.DOS6.2:ByRobertM.Thomas(BPBPublication)

## BCA SEMESTER–II

## SUBJECT: (BC-203) INTRO. TO INTERNET & HTML SCRIPTING

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 2 | 6 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | Become familiar with Internet concepts |
| CO2 | Apply | Creating Web Pages using Hypertext Markup Language |
| CO3 | Apply | Develop skills to design HTML web page embedded with multimedia elements, forms and frames. |
| CO4 | Analyse | Design Web Pages Elements using Cascading Style Sheets and validating input values. |
| CO5 | Evaluate | Designing dynamic web page learning of HTML5 elements. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Internet Concepts: | ✓ | | | | |
| 2 | Static Web Page Development- | | ✓ | ✓ | | |
| 3 | Cascading Style Sheets | | | | ✓ | ✓ |
| 4 | DHTML | | | | ✓ | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | -- | -- | -- | -- | - |
| CO2 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | -- | -- | 2 | 1 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | -- | -- | 2 | 1 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | -- | -- | 2 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | -- | -- | 2 | 1 | 3 |
| Avg | 2.8 | 3 | 3 | 2.6 | 2.6 | 1.6 | 1.6 | - | - | 1.6 | 0.8 | 1.4 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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**BCA-203-Introduction to Internet & HTML Scripting**

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Pr | Tw | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 |

**Detailed Syllabus: -**

**Internet Concepts:** **[17 hr.]**

Internet:

- Basic concept of network [1]
- Different types of Network [1]
  LAN-MAN-WAN
- Brief history of Internet, Terminologies related to Internet [1]
- Interconnection of various networks [2]
- Devices used to form Internet, Methods of connecting to Internet. [1]
- Protocols [1]
- Packet switching [1]
- Domain names [2]
- IP address
- URL.

Various Services available on Internet-

- World Wide Web [1]
- E-mail [2]
- FTP [2]
- Chat [1]
- Instant Messaging, Telnet [1]

**Static Web Page Development-** **[23hr.]**

Tools available for Static Web Page Development [1]
Use of tools for Web Page Development

HTML Scripting

- Hypertext [1]
- HTML Document Structure and elements [1]
- HTML tags and attributes for-
  - Formatting the web page [1]
  - Various types of lists. [1]
  - Tables [2]
  - Forms [1]
  - Frames [1]

Logical Styles and Physical Styles [1]
Inserting Special Characters
Adding Images [2]
Sound and animation.
Linking -Various web pages, within the same page. [1]

HTML editors.

**Cascading Style Sheets**

- Understanding CSS [1]
  - Terminologies
  - Advantages and Limitation
- Making HTML and CSS work together [1]
  - Ways of attaching a stylesheet to an HTML Documents
  - Applying styles to a Class with the Class Attribute
- CSS Units, Properties and Categories of Properties [2]

**DHTML**

- Introduction to DHTML and Java Script. [1]
- Operators, control statements [1]
- Strings, Array and date Objects [1]
- User-defined & built-in, functions,Window object, Document Object [2]
- Event Handling [1]

**Text Book:**

1) HTML 4.0 (No Experience Required),By-E.Stephen Mack, Janan Platt.
(BPB Publication)

**Reference Books:**

1) Internet an introduction', Compiled by Tata McGraw-Hill.
(Cistems, Tata McGraw-Hill publication)
2) The Internet,By –Douglas E.Comer
(Prentice Hall of India publication)
3) Web enabled commercial application development using … HTML,DHTML, Java Script, Perl, CGI - Ivan Bayross
(BPB Publication)
4) Data Communications and Networking – Behrouz A. Forouzan
(Tata McGraw Hill publication)

## BCA SEMESTER–II

## SUBJECT: (BC-204) BUSINESS DATA PROCESSING

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 2 | 6 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | Able to differentiate data and information and how data will be processed after analysis, Understand different online and offline processing system. |
| CO2 | Understand | How to manage the file and different types of Information system for data processing. |
| CO3 | Create | Earn the knowledge how to create the database with the use of MS-Access, How to connect the tables with each other, Learn about designing input and outputs. |
| CO4 | Understand | Learn about how the build Queries through expression builder, Function, able to understand action queries, designing forms, reports, form to database connectivity. |
| CO5 | Remember | Understand how to recover the corrupted database, how to create Macros using controls. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Introduction | ✓ | ✓ | | | |
| 2 | Electronic Data Processing System | | ✓ | | | |
| 3 | File organization | | ✓ | | | ✓ |
| 4 | Application of computer in business organization, Designing Outputs and Data input methods | | | ✓ | | ✓ |
| 5 | Introduction to Access | ✓ | | ✓ | | |
| 6 | Query | | | | ✓ | |
| 7 | Froms | | | | ✓ | |
| 8 | Reports | | | | ✓ | |
| 9 | Relationship | | | ✓ | | |
| 10 | Advanced Query | | | | ✓ | |
| 11 | Other features of access | | | | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 2 | 3 | - | - | - | - | - | 1 |
| CO2 | - | 1 | 2 | 1 | 1 | 1 | - | - | - | - | - | - |
| CO3 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | 2 |
| CO4 | 2 | 3 | 3 | 2 | 2 | 3 | - | - | - | - | - | - |
| CO5 | 1 | 3 | - | 2 | 1 | 3 | - | - | - | - | - | 1 |
| Avg | 1.8 | 2.4 | 1.6 | 1.4 | 1.6 | 2 | - | - | - | - | - | 0.8 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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## BCA-204 Business Data Processing

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Pr | Tw | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 |

**1.Introduction:** [2]
-Data and information
-Difference between data and information with proper examples
-Data processing, Need of data processing, data structure,
-Database, Data processing cycle
-Methods of data processing [2]
- Manual data processing system
- Semi Manual data processing method
- Electro mechanical data processing method
- Electronic data processing method.

-Application of data processing, System development, MIS
-advantages and disadvantages of EDP. [2]

**2.ElectronicDataProcessingSystem:-**
-Online processing, Time sharing system [1]
-Real time system, Batch system
-Multiprogramming, Multiprocessing [1]
-SPOOLING, Distributed data processing.

**3.Fileorganization:-**
-Elements of computer file, Types of files (master, transaction, audit, backup, work) [2]
-File processing activities (File updation, File referencing, File maintenance, File enquiry),
File design factors [1]
-Sequential access method, random access method, Index sequential access method, [1]
-merits and demerits of file organisation, database management system, components of DBMS, ADBMS. [2]

**Applicationofcomputerinbusinessorganization**
Computer application in financial accounting, Computer application in payroll, Computer application in inventory control [1]

**ManagementInformationSystem** [2]
-Concept and Importance of MIS
-Definition
-Information Technology and MIS
-Nature and scope of MIS
-MIS Characteristics and Function

**DesigningOutputs.** [2]

- Output devices,
- objectives of output design,
- Design of o/p reports,
- Design of screen,
- Use of Business graphics.

**Datainputmethods.** [2]

- Data input,
- coding techniques,
- modulus-11 code for detection of errors,
- validations of input data,
- Interactive data input techniques (menus, templates, commands)

**5.IntroductiontoAccess:-**

- Various data-types available in access, Introduction to various objects available in access. [1]
-Designing of tables (Design and data sheet view of the table), primary key [1]
-Various field properties (Field size, Format, Default value, Allow zero length,
-Required, indexes, Validation rule & text, input mask, Caption properties and look up wizard) [2]
-Working with database entering, editing, updating data, datasheet view of table,
working with columns, find tool, freeze and unfreeze, hide and unhide column. [1]
Operators and expressions, expression builder, various functions of access [2]

**6.Query:-**

- Types of queries, Dynaset, Design grid, uses of expression in query [1]

**7.Forms:-**

-Introduction to Forms, form wizard, designing, controls used in form, components of form. [2]

**8.Reports:-**

-Introduction to Reports, Components of report, ideal report, types of report,
-Designing of report (tabular and columnar), mailing label. [2]

**9.Relationship:-**

- Concept of Normalization, Entity, Entity set, Entity schema,
-binary and ternary relationship
  - one to one relationship
  - one to many relationship
  - many to one relationship
  - many to many relationship with suitable examples [2]

-Master table and transaction table. Join property, various join options
(Cascade, Delete and Referential Integrity) available in access [1]

**10.AdvancedQuery:-**

- select query.
- Action query.
- parameter query.
- crosstab query.
- summary query. [2]

**11.Otherfeaturesofaccess:-**

Macro, page, and utilities for managing access database, indexing and its advantages. [2]

**Text Book:**

1) Teach yourself Access. : Sieglel, BPB
2) Introduction to Computer Data Processing and System Analysis: V K Kapoor (Sultan Chand and Sons)

**Reference Books:**

1) Management Information system by D.P. Goyal (Macmillan India Ltd.)
   System Analysis & design by V. Rajaraman

## CA SEMESTER–II

## SUBJECT: (BC-206) DATA STRUCTURES

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | 1 | 3 | 8 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | Learning the basics of data structure and its fundamental types. Exploring the concept of array and using it to solve basic data structure like stack. |
| CO2 | Apply | Understanding about the applications of stack and using array to design some new data structures like Queue and its types. |
| CO3 | Analyse | Explore the concept of dynamic memory allocation by implementing link list and its algorithms. Also implementing link list to solve other data structures like stack and queue. |
| CO4 | Understand | Understanding non linear data structures like tree and graph and its real life applications. |
| CO5 | Evaluate | Applying algorithms to solve the problems of sorting and searching. Gaining the knowledge of BigO notation to understand different level of time complexity |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Linear Data Structures and Their Sequential Storage Representation | √ | √ | | | |
| 2 | Linear Data Structures and their Linked Storage Representation | | | √ | | |
| 3 | Non-linear Data Structures | | | | √ | |
| 4 | Sorting and Searching Methods | | | | | √ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | - | 1 | 3 | - | - | 1 | - | - | - | - |
| CO2 | 1 | 2 | - | 1 | 3 | - | - | 1 | - | - | - | - |
| CO3 | 2 | 3 | 1 | 1 | 3 | - | - | 2 | - | - | - | - |
| CO4 | 2 | 3 | 1 | 1 | 3 | - | - | 2 | - | - | - | - |
| CO5 | 2 | 3 | 1 | 1 | 3 | - | - | 2 | - | - | - | 1 |
| Avg | 1.6 | 2.6 | 0.6 | 1 | 3 | 0 | 0 | 1.6 | 0 | 0 | 0 | 0.2 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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**BCA-206 Data Structure**

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Pr | Tw | Total |
| 4 | 1 | 3 | 60 | 40 | 25 | 25 | 150 |

**Unit-1LinearDataStructuresandTheirSequentialStorageRepresentation**

Why we study data structure? [2]

- Primitive Data Structures

Operations on Data Structure

Integers, Real Number, Character Information, logical Information, pointer Information.

- Nonprimitive data Structure

1. Array [2]

(a) Definition of array

(b) Calculate address of elements of the array

(c) Row major order and column major order

(d) Application of array

2. Stacks [5]

(a) Definition of Stack

(b) Operations on Stack

Ex. Push, PoP, Emptystack, Underflow, Overflow.

(c) Implementation of stack

i. Using static allocation ( array & record representation )

ii. Using linked list ( by using pointer data type )

(d) Application of Stack

i. Conversion from infix expression to postfix expression

ii. Evaluation of the given postfix expression by using stack

(Assuming single operand) (e.g 421*+# --- Equivalent infix is 4+2*1)

e) Advantages and Disadvantages of using stack.

Queue [6]

a) Definition of Queue

b) Operations like insert, remove, empty, underflow , overflow of Queue.

c) Implementation of linear queue by:

i. Using array representation (static allocation)

ii. Using linked- list representation ( by using pointer data type)

d) Circular Queue & Priority Queue

i. Definition, operations

ii. Implementation by array representation.

e) Advantages and Disadvantages of using different types of queue.

**Unit–2LinearDataStructuresandtheirLinkedStorageRepresentation.**

1) Linked List [8]

(a) Definitions. Advantages over sequential – allocation list

(b) Operations on linked list

i. Insert new element in front.

ii. Insert new element in last

iii. Insert new element in sorted list
iv. Insert new element after the given location
v. Delete from front
vi. Delete from a particular node form list.

(c) Implementation of singly list by using pointer Data type (dynamic allocation)
(d) Implementation of Circular Singly – Linked List with header node by using pointer Data type.
(e) Implementation of Doubly Linked – list by using pointer Data type.
(f) Advantages and Disadvantages of using different types of lists.

**Unit–3Non-linearDataStructures**

**1)** Binary Tree : [6]
(a) Definition (Tree, Binary Tree , Binary Search Tree, Complete Binary Tree, Edge , Path )
(b) Operations
i) Insert new item into Binary Search Tree.
ii) Delete given item from binary search tree.
iii)Inorder, Preorder, Postorder Traversals

**2)** Graphs : [4]
(a) Definitions (Graph, loop, cycle, acyclic graph, directed graph, forest, path, mixed graph )
(b) Operations on graph
i) Insert new node into graph
ii) Insert new edge into graph.
iii) Graph Traversals - BFS, DFS Traversals

**Unit–4SortingandSearchingMethods**

**1)** Sorting Methods [5]
(a) Exchange Sort
i) Bubble Sort
ii) Quick Sort (partition Exchange sort)
(b) Selection Sort
i) Straight selection sort
ii) Heap Sort
(c) Insertion Sort
i) Simple insertion Sort ii) Binary insertion sort
iii)Address calculation sort
(d) Merge Sort
(e) Radix Sort.
(f) Comparison of all the sorting techniques.

**2)** Searching Methods [2]
Sequential Search, Binary Search

Text Book: 1) Data Structure using C
By Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein.

Reference Book: 2) An Introduction to Data structures with applications
By Jean-Paul Tremblay and Paul Sorenson.

## BCA SEMESTER–II

## SUBJECT: (BC207) COMMUNICATIVE ENGLISH - II

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | - | 4 | 60 | 40 | - | - | 100 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Apply/Creating | To develop the Writing Skills and techniques |
| CO2 | Analyze | To enhance the Writing patterns and their structures |
| CO3 | Apply/Analyze | To develop the competence of speaking and writing skills |
| CO4 | Apply/Creating | To be efficient in Group Discussion and Speaking about self |
| CO5 | Apply/Understanding | To adapt the new techniques of Professional environment and their patterns of writing and speaking |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | - | 1 | 3 | - | - | 1 | - | - | - | - |
| CO2 | 1 | 2 | - | 1 | 3 | - | - | 1 | - | - | - | - |
| CO3 | 2 | 3 | 1 | 1 | 3 | - | - | 2 | - | - | - | - |
| CO4 | 2 | 3 | 1 | 1 | 3 | - | - | 2 | - | - | - | - |
| CO5 | 2 | 3 | 1 | 1 | 3 | - | - | 2 | - | - | - | 1 |
| Avg | 1.6 | 2.6 | 0.6 | 1 | 3 | 0 | 0 | 1.6 | 0 | 0 | 0 | 0.2 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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## BCA-207 Communicative English - II

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | |
|---|---|---|---|---|---|---|
| **L** | **Tu** | **Pr** | **Th** | **Ss** | **Tw** | **Total** |
| **4** | **-** | **-** | **60** | **40** | **-** | **100** |

Looking at the diverse backgrounds & abilities of the thresh hold students, this syllabus aims at

1. Importing the basic communication competency of the learners.
2. Familiarize them with the basic contents necessary for English communication during their studies.
3. Facilitate them in LSRW skills. &
4. Enable them to use English language for communicational needs.

So the syllabus is need base & it has a tentativeness, to facilitate the various learners of various competencies:

I) Oral Communication [6]
Hard Skills and Soft Skills
Dyadic Communication
Presentation
5Cs of Communication

II) Comprehension and Précis [6]

III) Essays & Paragraph writing. [8]
IV) Letter writing
(i) Personal & Social letters [3]
(ii) Business letters. [5]
(iii) Applications. [3] V)
Developing dialogues [3]
VI) Group Discussion. [3]
VII) Self – Presentation. [3]

**Text:/Source :**

The major source of studies for the students is the classroom, Which will be very interactive & full of activities related to their syllabus. They must participate actively in their classes. The faculty will be a guide, helper, motivator & facilitator for the learners, but not the traditional teacher. So the learner's evaluation will be based on the class work only. The tests & exams will be based entirely on the class work & the participation of the learners in the classroom activities.

--- Prof. Rajanikant Jain.
Co - ordinator English Communication.

## BCA SEMESTER–III

## SUBJECT: (BC-304) OBJECT ORIENTED METHOD & PROGRAMMING

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | 1 | 3 | 8 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | Understand the basic concepts of OOP |
| CO2 | Understand | Understand the budling blocks of C++ |
| CO3 | Apply | Implement Object and Class using C++ by learning datatypes, constructors, data members and member functions |
| CO4 | Apply | Implement concepts of OOP like polymorphism and inheritance using C++ |
| CO5 | Create | Implement virtual functions using C++ |
| CO6 | Apply | Handle files, IO and common library functions using C++ |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | | |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
| 1 | Object Oriented Programming Concepts | ✓ | | | | | |
| 2 | C++ Programming Basics | | ✓ | | | | |
| 3 | Pointers | | ✓ | | | | |
| 4 | Object and Classes | | | ✓ | | | |
| 5 | Overloading | | | ✓ | | | |
| 6 | Inheritance and Polymorphism | | | | ✓ | | |
| 7 | Virtual function and other subtitles | | | | | ✓ | |
| 8 | File Stream and I/O Operator | | | | | | ✓ |
| 9 | Common Library Functions | | | | | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | - | 2 | - | - | - | - | - | - | - |
| CO2 | 1 | 1 | 1 | - | 2 | - | - | - | - | - | - | - |
| CO3 | 1 | 2 | 2 | 2 | 1 | - | 1 | - | - | - | - | 3 |
| CO4 | 1 | 3 | 3 | 2 | 1 | - | 1 | - | - | - | - | 3 |
| CO5 | 1 | 3 | 3 | 2 | 1 | - | 1 | - | - | - | - | 3 |
| CO6 | 1 | 3 | 3 | 2 | 1 | - | 1 | - | - | - | - | 2 |
| Avg | 1 | 2.16 | 2.16 | 1.33 | 1.33 | - | 0.67 | - | - | - | - | 1.83 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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## BCA-304 Object Oriented Methods & Programming

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **Tu** | **Pr** | **Th** | **Ss** | **Pr** | **Tw** | **Total** |
| **4** | **1** | **3** | **60** | **40** | **25** | **25** | **150** |

- Object Oriented Programming Concepts [3]
  - Procedural Language and Object Oriented approach
  - Characteristics of OOP

- C++ Programming Basics
  - Loops and Decision [1]
  - Structure
  - Function [3]
  - Inline function
  - Default argument
  - Variables [2]
  - Array

- Pointers [2]

- Object and Classes
  - Simple Class and Object [2]
  - C++ object as physical object and as Data type [1]
  - Constructor and Destructor [2]
  - Copy constructor, Overloaded constructor [1]
  - Object as function argument and returning object from function [1]
  - Static class data [1]

- Overloading
  - Unary and Binary operator overloading [1]
  - Function Overloading [3]
  - Data Conversion

- Inheritance and Polymorphism
  - Derived Class and Base Class [2]
  - Different types of Inheritance
  - Constructor
  - Overriding member function [2]
  - Abstract Class
  - Public and Private Inheritance [2]
  - Ambiguity in Multiple inheritance [2]
  - Containership

- Virtual function and other subtitles
  - Virtual function [2]
  - Friend function
  - Static function
  - Assignment and copy initialization [1]
  - 'this' Pointer

- File Stream and I/O Operator
  - Stream [1]
  - String I/O and Object I/O
  - File Pointers [2]
    - Specifying the position
    - Specifying the offset
  - Closing file
  - Error handling [1]

- Common Library Functions [2]

**Text Book** : Turbo C++
-Robert Lafore

**Reference Book** : Object Oriented Programming in C++
-E. Balaguruswami

## BCA SEMESTER–III

## SUBJECT: (BC313) SYSTEM ANALYSIS AND DESIGN

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 2 | 6 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | To learn about the basics of system, data, information and many more basic concepts involved in designing the system |
| CO2 | Analyze | Develop an in-depth knowledge about Requirement gathering and how it can be used to design various models to design a system accordingly |
| CO3 | Apply | In depth learning about data flow diagrams, structured English, decision tables and decision trees. |
| CO4 | Understand | Acquire the skill to draw multiple diagrams depicting system design such as Class, Sequence, collaboration, use-case, activity and state chart |
| CO5 | Evaluate | To acquire knowledge about implementation of the system. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Information and management | ✓ | | | | |
| 2 | Information system analysis. | ✓ | ✓ | | | |
| 3 | Information gathering (Fact finding) | | ✓ | | | |
| 4 | Requirements specifications | | ✓ | | | |
| 5 | Feasibility Analysis. | | | | | |
| 6 | Data flow diagrams. | | | ✓ | | |
| 7 | Process Specifications. | | | ✓ | | |
| 8 | Control, Audit and Security of Info system | | | | | |
| 9 | System implementation | | | | | ✓ |
| 10 | Object Oriented Design | | | | ✓ | |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | 1 | - | - | - | - | - | - | - |
| CO2 | 2 | 1 | 1 | - | 2 | 1 | - | - | - | - | - | - |
| CO3 | 2 | 2 | 2 | 2 | 3 | 2 | - | 1 | - | 1 | - | - |
| CO4 | 2 | 3 | 2 | 3 | 3 | 2 | - | 1 | - | 1 | - | 1 |
| CO5 | 2 | 3 | 3 | - | 3 | 2 | - | 1 | - | 1 | - | 1 |
| Avg | 2 | 2.0 | 1.60 | 1 | 2.40 | 1.40 | - | 0.60 | - | 0.60 | - | 0.40 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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**BCA-313 System Analysis And Design**

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Prac | Th | Ss | Tw | Viva | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 |

1. **Informationandmanagement** [4]
   - Data, Information, system - definition and examples,
   - types of information
   - Why CBIS ? (computer based information system),
   - management structure
   - Qualities of information,
   - Classifications or varieties of CBIS - TPS, MIS, DSS, OAS
2. **Informationsystemanalysis.** [6]
   - What is system analysis ?
   - what is system design ?
   - What is system analysis and design?
   - Characteristics of system - organization, interaction, interdependence, integration, central objective.
   - Elements of system analysis - output, input, files, processes
   - System approaches :

   i. System development Life cycle (SDLC) When and Why ?
   ii. Structured Analysis (The Paris model)
   iii. Prototyping, When and why prototyping ?

   -The role of system analysts,
   - Attributes of system analyst,
   - tools used by system analyst.(data dictionary, decision trees, decision tables, structured English)
   - The waterfall model (Classic life cycle or linear sequential model)
   - Boehm's Spiral model
3. **Informationgathering(Factfinding)** [3]
   - Communication with people
   - Strategy to gather information, information sources (inside and outside of org. )
   - Methods of searching information - Interviewing, Questionnaires, System observations, Determinations of DFDs, New system
4. **Requirementsspecifications.** [2]
   - Data dictionary,
   - major symbols,
   - four rules,
   - Why data dictionary ?
5. **FeasibilityAnalysis.** [4]
   - Different types of Feasibility,
   - Cost-benefit Analysis (Present value of benefits),
   - Payback method, Examples.

**6. Dataflowdiagrams.** [3]

- What is DFDs ? ,
- Context diagram,
- Symbols used to construct DFDs,
- Rules to construct DFDs,
- Leveling of DFDs,
- Logical DFDs,
- Physical DFDs, Examples

**7. ProcessSpecifications.** [5]

- Tools used in structured analysis
  - i. Structured English (types of structured used, examples)
  - ii. Decision tables ( types of decision tables, examples)
  - iii. Decision Trees (Examples)

**8. Control,auditandsecurityofinformationsystems** [2]

- Controls in information system,
- Audit of information systems,
- Security of information (computer virus)

**9. Systemimplementation.** [2]

- Coding and unit test
- Employing programmers to write code,
- Using code Generator
- Testing : ensuring the quality,
- data takeon and conversion,
- User training,
- Going live
- The maintenance cycle.

**10. ObjectOrientedDesign.** [9]

- Introduction
- Introduction to UML
- Relationship, Aggregation, Composites, Interfaces, Realization
- Components of UML
  - Use Cases, Use Case Diagrams, State Diagrams, Sequence Diagrams, Activity Diagrams

**Practicals:**

System Requirement Specification, Feasibility Study, DFD, Data Dictionary, System Analysis & Designing Case Study, UML Diagrams

**Text-Books:**

1. Analysis And Design of Information Systems.
   By V Rajaraman.
2. Sams Teach Yourself UML in 24 Hours
   By Joseph Schmuller

**Reference Books:**

1. Analysis and Design of Information Systems
   By James A. Senn
2. Systems Analysis And Design
   By Don Yeates, Maura Shields and David Helmy

## BCA SEMESTER–III

## SUBJECT: (BC-319) MULTIMEDIA AND GRAPHICS DESIGN

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 2 | 6 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understanding | Recognize the elements of graphic and editor. |
| CO2 | Applying | Acquire knowledge of shapes, colors and text. |
| CO3 | Creating | Design complex graphics using multiple layers. |
| CO4 | Applying | Develop simple and complex Button and Animation. |
| CO5 | Applying | Develop Interactive movie and Publishing it various file formats. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Basic flash | ✓ | | | | |
| 2 | Getting Graphic | ✓ | ✓ | | | |
| 3 | You Are the Object Editor | ✓ | ✓ | | | |
| 4 | What's Your Type? | | ✓ | | | |
| 5 | Layer It On | | ✓ | ✓ | | |
| 6 | Pushing Buttons | | | | ✓ | |
| 7 | Getting Animated | | | ✓ | ✓ | |
| 8 | Getting Interactive | | | ✓ | ✓ | ✓ |
| 9 | Publishing Your Flash Files | | | | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | -- | 3 | 2 | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 3 | 2 | 3 | 2 | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 2 | 3 | 3 | 3 | 3 | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 3 | 3 | 3 | 3 | -- | -- | -- | -- | -- | -- | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | -- | -- | -- | -- | -- | -- | 3 |
| Avg | 2.6 | 2.8 | 2.2 | 3 | 2.6 | -- | -- | -- | -- | -- | -- | 1 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

## Multimedia and Graphics Design

| Teaching scheme | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Pr | Tw | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 |

**1 Basic flash** [3]

Taking a Look Around, Tooling around the toolbars, Using panels, Discovering the Flash menus, Staging your movies ,Following a timeline ,Setting the Stage, Grabbing a Graphic ,Using a Template

**2 Getting Graphic** [5]

Sharpen Your Pencil, Creating Shapely Shapes, Mixing and Matching Shapes, Creating Curves with the Pen ,Getting Artistic with the Brush ,Pouring on the Paint ,Strokes, Ink, A Rainbow of Colors ,Drawing Precisely, The Import Business — Using Outside Graphics

**3 You Are the Object Editor** [5]

Selecting Objects Moving, Copying, and Deleting,
Making Shapes More Shapely, Transforming Fills, Transferring Properties Finding and Replacing Objects, Transforming Objects, Getting Grouped, Breaking Apart Objects, Establishing Order on the Stage

**4 What's Your Type?** [3]

Presenting Your Text ,Creating text ,Editing text ,Setting character attributes, Hyper linking text ,Getting the best text appearance ,Setting up paragraph formats ,Creating input and dynamic text ,Creating Cool Text Effects

**5 Layer It On** [4]

Creating Layers, Using layers, Changing layer states ,Getting Those Layers Right ,Deleting layers ,Copying layers ,Renaming layers ,Reordering layers ,Organizing layers ,Modifying layer properties ,Creating Guide Layers ,Opening Windows with Mask Layers ,Creating a mask layer ,Editing mask layers, Animating mask layers

**6 Pushing Buttons** [4]

Creating Simple Buttons, Understanding button states, Making a basic button, Putting Buttons to the Test, Creating Complex Buttons, Adding a sound to a

button, adding a movie clip to a button, adding an action to a button, creating a button that acts on text input

**7 Getting Animated**

Preparing to Animate, Animating with Keyframes, Creating Animations Instantly with Timeline Effects, The Animation Tween, Editing Animation Making the Scene [6]

**8 Getting Interactive**

Understanding Actions, Using Behaviors, Adding Actions to Frames, Adding Actions to Buttons, Adding an Action to a Movie Clip, Using Actions, Timeline Control actions, Method acting, creating animated masks with movie clips [5]

**9 Publishing Your Flash Files**

Testing Movies, Saving Your Work in Flash MX Format, Publishing Flash Movies, Publishing to HTML, Publishing to Other Formats ,Creating GIF graphic files ,Creating JPEG graphic files ,Creating PNG graphic files ,Creating QuickTime movies ,Creating self-playing movies [5]

**Text Book**

1) Macromedia Flash for Dummies, by Ellen Finkelstein and Gurdy Leete, Wiley Publishing Inc

**Reference books**

1) Flash 8 Bible, IDG Book India Reinhardt, Robert
2) Flash 4 Magic, TechMedia Darnell Rick

**Tools for practical:**

Macromedia Flash

## BCA SEMESTER–IV

## SUBJECT: (BC404) DATABASE MANAGEMENT SYSTEM

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 2 | 6 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | Understand data, database, DBMS, and its architectural components |
| CO2 | Remember | Understand RDBMS, ERD and Normalization of DB with constraints and dependencies |
| CO3 | Analyse | Understand Relational Algebra and Calculus to perform on any normalized RDBMS |
| CO4 | Apply | Install Oracle and will be able to query, manipulate and manage it using concepts of SQL |
| CO5 | Understand | Gain insights of creating Views and manipulating them. |
| CO6 | Understand | Understand concepts of Transactions, ACID properties, issues related to concurrency, deadlock transaction failure and recovery with their related protocols/solutions |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | | |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
| 1 | Overview of Database System | ✓ | | | | | |
| 2 | Database system Architecture | ✓ | | | | | |
| 3 | Introduction to Relational Database | ✓ | ✓ | | | | |
| 4 | Structured Query Language | | | | ✓ | | |
| 5 | Domains, Relations and Base Relvars | | ✓ | | | | |
| 6 | Relational Algebra | | | ✓ | | | |
| 7 | Relational Calculus | | | ✓ | | | |
| 8 | Integrity | | ✓ | | | | |
| 9 | Views | | | | | ✓ | |
| 10 | Functional Dependencies | | ✓ | | | | |
| 11 | Normalization | | ✓ | | | | |
| 12 | Semantic Modelling | | ✓ | | | | |
| 13 | Recovery | | | | | | ✓ |
| 14 | Concurrency | | | | | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | 2 | - | 1 | - | - | - | - | - |
| CO2 | - | 3 | 3 | - | 2 | - | 1 | - | - | - | - | 3 |
| CO3 | 3 | 3 | 3 | - | 2 | - | 1 | - | - | - | - | 3 |
| CO4 | - | 3 | 3 | 3 | 2 | - | 1 | - | - | - | - | - |
| CO5 | - | 1 | 1 | - | 2 | - | 1 | - | - | - | - | - |
| CO6 | - | 2 | 2 | - | 2 | - | 1 | - | - | - | - | - |
| Avg | 0.5 | 2 | 2 | 0.5 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 1.5 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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**BCA-404 Database Management System**

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Pr | Tw | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 |

1. **OverviewofDatabaseSystem** [3]
   - Introduction Data, Database
   - Entities and relationships, properties,
   - Data and Data model, DBA,
   - Data independence.
2. **DatabasesystemArchitecture** [2]
   - Three level of Architecture:
     - Internal level
     - External level
     - Conceptual level
   - DBMS and its functions
   - Data Communication Manager,
   - Client –Server Architecture
   - Utilities to help DBA
3. **IntroductiontoRelationalDatabase** [2]
   - Informal look at relational model,
   - Relations and Relvars and what relations mean.
   - Optimization
   - Catalog
4. **StructuredQueryLanguage:** [9]
   - Data Definition Language
   - Data Manipulation Language
   - Transaction Control Language
5. **Domains,RelationsandBaseRelvars** [3]
   - Introduction
   - Domains
   - Relation values:
     - Attributes
     - Cardinality, Degree,
     - Properties of relations.
   - Relation Variables
6. **RelationalAlgebra** [3]

- Overview of the Original Algebra
  - Relational expressions
  - Operators:
    - Restrict, Project, Product, Union, Intersect, Divide, Difference, Join.
  - Additional Operators:
    - Semijoin, Semidifference, Extend, Summarize
  - Grouping and ungrouping.
  - Relational Comparisons

7. **RelationalCalculus** [2]
   - Tuple calculus
   - Domain calculus.
8. **Integrity** [2]
   - Keys: Candidate key, Foreign key, Primary key, Alternate key
   - Domain constraints, Base table Constraints, General Constraints,
   - Referential Action: Cascade, Restrict.
9. **Views** [2]
   - Introduction
   - What are views for?
     - Logical data independence
   - View Retrievals
   - View Updates.
10. **FunctionalDependencies** [2]
    - Basic Definitions
    - Trivial and nontrivial dependencies
    - Closure of a set of Dependencies
    - Closure of a set of attributes
    - Irreducible set of dependencies.
11. **Normalization** [3]
    - Introduction
    - Nonloss decomposition and functional dependencies
    - First, Second and Third Normal Forms, BCNF
    - Dependency preservation
    - Denormalization.
12. **SemanticModeling** [3]
    - Introduction and overall approach
    - E/R Model &E/R Diagrams
      - Entities, properties, relationships,
      - Entity subtypes and supertypes
13. **Recovery** [2]
    - Introduction
    - Transactions
    - Transaction Recovery
      - The ACID Properties
    - System Recovery
    - Media Recovery
    - Two Phase Commit.
14. **Concurrency** [2]
    - Introduction
    - Three concurrency problems
      - The lost update problem
      - The Uncommitted dependency problem
      - The Inconsistent Analysis Problem
    - Locking
    - Three concurrency problems revisited
    - Deadlock, Serializability, Intent locking.

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**PracticalBasedTopics:**

1. Data types: CHAR, VARCHAR2, DATE, NUMBER, LONG, RAW/ LONG ROW
2. CREATE TABLE, Creating a table from another table
3. INSERT, Inserting data into a table from another table
4. SELECT with WHERE, DISTINCT and ORDER BY clause
5. DELETE with WHERE clause, Deleting specific rows based on the data held by the other table
6. UPDATE with WHERE clause
7. ALTER TABLE with ADD, DROP COLUMN and MODIFY keyword
8. RENAME, TRUNCATE TABLE, DROP TABLE
9. CRATE SYNONYM
10. DROP SYNONYM
11. DESCRIBE
12. SELECT * FROM TAB;
13. **CONSTRAINTS:**
    - PRIMARY KEY
    - FOREIGN KEY WITH ON DELETE CASCADE and ON DELETE SET NULL
    - Assigning User Defined names to Constraints
    - UNIQUE
    - CHECK
    - NULL
    - NOT NULL
    - The USER_CONSTRAINTS Table
    - Applying and Dropping Constraints with ALTER TABLE Command
14. DEFAULTE value
15. Arithmetic Operators
    - Addition
    - Subtraction
    - Multiplication
    - Division
    - Exponentiation
    - Enclosed Operation
16. **Logical Operators:** AND, OR, NOT
17. BETWEEN… AND….
18. LIKE Predicate with Wildcard Characters
19. IN and NOT IN Predicates
20. DUAL Table
21. SYSDATE
22. **Aggregate Functions:** MIN, COUNT, MAX, SUM
23. **Numeric Functions:** ABS, POWER, ROUND, SQRT, EXP, EXTRACT, GREATEST, LEAST, MOD, TRUNC, FLOOR, CEIL.

24. **String Functions:** LOWER, INITCAP, UPPER, SUBSTR, ASCII, COMPOSE, DECOMPOSE, INSTR, TRANSLATE, LENGTH, LTRIM, RTRIM, TRIM, LPAD, RPAD, VSIZE.
25. **Conversion Functions:** TO_NUMBER, TO_CHAR, TO_DATE
26. **Date Functions:** ADD_MONTHS, LAST_DAY, MONTHS_BETWEEN, NEXT_DAY, ROUND, NEW_TIME
27. Manipulations on Date
28. Group By
29. Having with DISTINCT keyword
30. Subqueries, subquery in FROM clause, Correlated subqueries, multi column subqueries, with ORDER BY keyword, with EXIST and NOT EXIST keyword
31. JOIN, equi join, inner join, outer join, cross join, self join, left join, right join
32. Concatenating data from table columns
33. UNION, INTERSECT AND MINUS clause

**Text Book:**

Database Management System
By: C. J. Date (Seventh Edition)

**Reference Books:**

Fundamentals of Database System
By: Navathe

**Text Book for Practicals:**

SQL, PL / SQL The Programing language of Oracle
Ivan Bayross

## BCA SEMESTER–IV

## SUBJECT: (BC409) JAVA PROGRAMMING

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 4 | 8 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | Learn the basic designing of java programming language by emphasizing on object oriented programming concepts. |
| CO2 | Apply | Develop a fundamental approach to write and execute java program to solve real life problems. |
| CO3 | Create | Explore the graphic interface facilities available in java libraries to create user friendly applications. |
| CO4 | Analyze | Enhance the skills of multithreading and exception handling and template to solve problems. |
| CO5 | Apply | Obtain the knowledge of streams, files and object serialization for data storage and retrieval. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Introduction to Java | √ | | | | |
| 2 | Java Program Building elements | √ | | | | |
| 3 | Arrays, String and Vector | | √ | | | |
| 4 | GUI | | | √ | | |
| 5 | Event -Driven programming | | | √ | | |
| 6 | Exception Handling | | | | √ | |
| 7 | Multithreading | | | | √ | |
| 8 | Streams and IO | | | | | √ |
| 9 | Graphics | | | √ | | |
| 10 | Template | | | | √ | |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 3 | 1 | 3 | 3 | - | - | 3 | - | - | - | - |
| CO2 | 1 | 3 | 2 | 3 | 3 | - | - | 3 | - | - | - | - |
| CO3 | 1 | 3 | 2 | 3 | 3 | - | - | 3 | - | - | - | 1 |
| CO4 | 1 | 3 | 3 | 3 | 3 | 1 | - | 3 | - | - | - | 2 |
| CO5 | 1 | 3 | 3 | 3 | 3 | 2 | - | 3 | - | 1 | - | 1 |
| Avg | 1 | 3 | 2.2 | 3 | 3 | 0.6 | 0 | 3 | 0 | 0.2 | 0 | 0.8 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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## BCA-405 Java Programming

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **Tu** | **Pr** | **Th** | **Ss** | **Pr** | **Tw** | **Total** |
| **4** | **1** | **3** | **60** | **40** | **25** | **25** | **150** |

1. Introduction to Java [6]
   - History of Java
   - Features of Java
   - Difference between with C and C++
   - JDK tools
   - Anatomy of Application and Applet
   - Anatomy and structure of Java Program

2. Java Program Building elements [7]
   - Character set, keywords, identifiers
   - Structure of java program
   - Variables
   - Scope of variables
   - Blocks
   - Statements
   - Data Types
   - Operators and expressions
   - Programming style
   - Control Structure
   - Oops, Object, class and instance variables, methods, scope modifiers
   - Abstract class
   - Interfaces: How to create, implementation rules, partial implementation rules, extending interface
   - Packages

3. Arrays, String and Vector [3]
   - Arrays
   - String manipulation
   - String class and methods
   - Wrapper classes
   - Utility classes : Hashtable, StringTokenizer, Vector, Date, Calendar, Enumeration, ArrayList, Random, Timer

4. GUI (awt package, Font, Color, Image, Button, Label, TextField, TextArea, Choice, List, Scrollbar, Checkbox, CheckboxGroup, Dialog, Menus, Windows) Layouts, awt package GUI Components [9]

5. Event -Driven programming [4]
   - Applet Programming and GUI
   - Event-Delegation Model, Difference with event model
   - All Listeners and Event Objects

6. Exception Handling [2]
   - Exception types
   - How to use try, catch, throw, throws and finally clauses
   - Nested try, Multiple catch, Java's built-in Exceptions

7. Multithreading [2]
   - Java thread model
   - Creating threads
   - Thread priorities
   - Interthread communication
   - Synchronization
   - Blocking thread

8. Streams and IO [3]
   - The Stream classes
   - Byte Streams
     InputStream, OutputStream, FileInputStream, FileOutputStream, ByteArrayInputStream, ByteArrayOutputStream, BufferedByteStreams, RandomAccessFile
   - Character Streams
     Reader, Writer, FileReader, FileWriter, CharArrayReader, CharArrayWriter, BufferedReader, BufferedWriter

9. Graphics [2]
   - Drawing oval, arc, polygon, ractangle….
   - Font (Excluding FontMetrix)

10. Template [2]
   - Templates and its usefulness
   - How to create your own template
   - Advantages of using template
   - Examples

**Text Book** : 1. The Complete Reference JAVA 2.0
- By Patrick Naughton , Herbert Schildt ( TMH)

**Reference Books**: 1. Programming in JAVA
- By Sachin Malhotra, Saurabh Choudhary (OXFORD)

2. Java Primer
- By E. Balagurusamy (TMH).

## BCA SEMESTER–IV

## SUBJECT: (BC-407) OPERATING SYSTEM

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 2 | 6 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understanding | To understand the fundamental concepts of an operating System. Know fundamentals of Process scheduling Algorithms and Deadlocks. |
| CO2 | Understanding | Learn Early and Recent memory allocation schemes. |
| CO3 | Apply | Acquire the knowledge of Storage Media and Management of I/O Requests. |
| CO4 | Understanding | To study File organization, Physical storage allocation and file access technologies. |
| CO5 | Analyze | Learn basic Unix commands and Shell scripts. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Introduction to Operating System | ✓ | | | | |
| 2 | Process Management | ✓ | | | | |
| 3 | Memory management | | ✓ | | | |
| 4 | Device Management | | | ✓ | | |
| 5 | File Management | | | | ✓ | |
| 6 | Deadlocks | ✓ | | | | |
| 7 | Case study: LINUX Operating System | ✓ | ✓ | ✓ | ✓ | |
| 8 | Practical Based topics: Unix commands and Shell script | | | | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | -- | -- | -- | -- | -- | -- | -- |
| CO2 | 3 | 3 | 2 | 3 | 3 | -- | -- | -- | -- | -- | -- | -- |
| CO3 | 2 | 3 | 3 | 2 | 2 | -- | -- | -- | -- | -- | -- | -- |
| CO4 | 3 | 2 | 2 | 2 | 2 | -- | -- | -- | -- | -- | -- | -- |
| CO5 | 3 | 3 | 3 | 3 | 3 | -- | -- | -- | -- | -- | -- | 3 |
| Avg | 2.8 | 2.8 | 2.6 | 2.6 | 2.6 | -- | -- | -- | -- | -- | -- | 0.6 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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# BCA – 407 Operating System

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Tw | Pr | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 |

**1. Introduction to Operating System** [4]

- Introduction
- OS as an extended machine & as a resource manager
- Single user OS
- Types of OS
- History of OS
- OS concepts (processes, files, system calls, shell)
- OS structure (monolithic systems, layered systems, virtual machines, client server model)
- Assembly language

**2. Process Management:** [7]

- Introduction to processor manager
- Process Model, process hierarchies, Interprocess communication,
- Process Scheduler (High level, Low level & Middle level)
- Process scheduling policies
- Process scheduling Algorithms
  - FIFO
  - SJN
  - Priority
  - SRT
  - RR
  - Multiple level queues
- Cache memory
- Parallel processing
- Typical Multiprocessing configurations
  - Master/slave
  - Loosely coupled
  - Symmetric
- Process Synchronisation software
  - Test –and-Set
  - Wait and Signal
  - Semaphores
- Process Cooperation
  - Producers and consumers
  - Readers and writers
- Explicit and Implicit parallelism

**3. Memory management:** [8]

- Introduction to memory manager
- Early memory allocation schemes
  - Single user contiguous scheme
  - Fixed partitions scheme
  - Dynamic partitions scheme, Best Fit vs. First Fit allocation, Deallocation
  - Relocatable dynamic partitions scheme
- Recent memory allocation schemes
  - Paged memory allocation
  - Demand paging allocation
  - Segmented memory allocation
  - Segmented / Demand paged allocation
  - Page replacement policies (FIFO, LRU, working set)
  - Virtual memory

**4. Device Management:** [6]

- Introduction to device manager
- System devices(dedicated ,shared and virtual)
- Sequential Access Storage Media (Magnetic tape, IRG ,IBG and blocking)
- Direct Access Storage Devices
  - Fixed head devices (magnetic recordable drum) and its Access time
  - Movable head devices (disk & disk packs) and its Access time
  - Optical disk storage
- Components of the I/O subsystem
- Communication among devices
  - Polling
  - Interrupts
  - DMA
  - Buffering & double Buffering
- Management of I/O Requests
  - I/O traffic controller, I/O scheduler & I/O device handler
  - Device handler seek strategies ( FCFS ,SSTF ,SCAN ,C-SCAN ,LOOK , C-LOOK )
  - Search strategies( Rotational Ordering)
- RAID.

**5. File Management** **[6]**

- Introduction to file manager
- Definitions: field ,file ,database ,program files ,directories
- Device independence, Typical volume configuration, File dir tree structure ,File naming convention
- File organization
  - Record format( fixed length & variable length records)
  - Physical file organization (sequential record organization, direct record organization , Indexed sequential record organization)
- Physical storage allocation
  - Contiguous storage
  - Non contiguous storage
  - Indexed storage
- Data compression
- Access methods ( Sequential and Direct access)
- Levels in file management

- Access control verification module (access control matrix, access control lists, capability lists and lockwords)

**6. Deadlocks** [5]

- Introduction to deadlock
- Seven cases of deadlock
  - Deadlock in file requests
  - Deadlock in databases
  - Deadlock in dedicated device allocation
  - Deadlock in multiple device allocation
  - Deadlock in spooling
  - Deadlock in disk sharing
  - Deadlock in network
- Conditions for Deadlock
  - Mutual exclusion
  - Hold and wait
  - No preemption
  - Circular wait
- Deadlock handling strategies
  - Deadlock Prevention
  - Deadlock Avoidance
  - Deadlock Detection and recovery
- Starvation

**7. <u>Casestudy:LINUXOperatingSystem.</u>** [4]

- Process Management
- Device Management
- File Management
- Memory Management

**<u>PracticalBasedTopics:</u>**

- **List of Commands**: date ,clear ,pwd ,who ,who am I , cal ,mkdir, ls ,cd / cd .., touch , cat ,mv , rm, rmdir, wc , ps, | and > operator ,cp ,ln ,dir ,echo ,uname ,logname ,id ,tty , bc ,grep ,fgrep ,vi, cmp ,comm.,diff ,sort, unique ,ed ,cut ,paste ,split ,nl ,pr ,od ,chmod , head ,tail ,zip ,gunzip ,zcat ,zcomm ,sh ,bsh ,csh ,ksh ,alias, unalias
- Basic Shell scripts.

**Text Book :** 1.Understanding Operating Systems (3rd Edition)
By Ida M. Flynn and Ann McIver McHoes
(Thomson Learning Publication)

**Reference Books :**

1.Dhamdhere "Structured Programming and Operating Systems", TMH

2. Andrew S. Tanenbaum "Modern Operating Systems" Prentice-Hall

**For Practical**:

3. Unix Operating System, Sumitabha Das.

## BCA SEMESTER–IV

## SUBJECT: (BC408) INTRODUCTION TO WEB DEVELOPMENT

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | 1 | 3 | 8 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | Gain knowledge of .net framework. |
| CO2 | Apply | Understand Web forms, web controls, events in details. |
| CO3 | Analyze | Learn use of different controls as well as user control and custom control. |
| CO4 | Evaluate | To understand how to validate user inputs through use of different validators. |
| CO5 | Evaluate | Develop Application using database programming.<br>Understand the concept of data binding. |

### COURSE OUTCOME MAPPING:

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Understanding .Net Framework | ✓ | | | | |
| 2 | Building forms with Web controls | | ✓ | | | |
| 3 | Using rich web controls | | | ✓ | | |
| 4 | Creating and using custom controls | | | ✓ | | |
| 5 | Validating user inputs | | | ✓ | ✓ | |
| 6 | Debugging ASP.net pages | | | | ✓ | |
| 7 | ASP.net database programming | | ✓ | | | ✓ |
| 8 | Understanding data binding | | ✓ | | | ✓ |
| 9 | Working with Data Grids | | ✓ | | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 3 | 3 | 1 | - | - | 1 | 1 | 1 | 1 | 1 |
| CO2 | 1 | 1 | 1 | 3 | 1 | - | - | 1 | 1 | 1 | 1 | 2 |
| CO3 | 1 | 1 | 3 | 3 | 1 | - | - | 1 | 1 | 1 | 1 | 1 |
| CO4 | 1 | 1 | 3 | 3 | 1 | - | - | - | - | - | - | 1 |
| CO5 | 1 | 1 | 3 | 3 | 1 | - | - | 1 | 1 | 1 | 1 | 2 |
| Avg | 1.20 | 1 | 2.60 | 3 | 1 | - | - | 0.80 | 0.80 | 0.80 | 0.80 | 0.40 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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# Introduction to Web Development

| Teaching scheme | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Pr | Tw | Total |
| 4 | 1 | 3 | 60 | 40 | 25 | 25 | 150 |

1) Understanding DOT NET (.NET) Framework [3]
   1. Introducing the .NET Framework
   2. Benefit of .NET Framework
   3. Components of .NET framework
2) Building Forms with Web Controls [4]
   1. Introducing ASP.NET web forms
   2. Creating Web forms Application
   3. Basic Web controls
   4. Working with Events
3) Using Rich web controls [5]
   1. AdRotator Control
   2. Calender Control
   3. Treeview Control
   4. TabStrips and Multipage Controls
   5. Tool bar controls
4) Creating and Using Custom Controls [6]
   1. Introduction to Custom Controls
   2. Basic Structure of Web forms Controls
   3. Classes Used for Web form Controls
   4. Interface used for Web froms Controls
   5. Creating, Using and Developing User Controls
   6. Adding Properties and methods
   7. Handling and exposing Events
5) Validating User Inputs [8]
   1. Understanding Validation controls
   2. Using the RequiredFieldValidator Control
   3. Using CompareValidator Control
   4. Using RangeValidator Control
   5. Using the RagularExpressionValidator Control
   6. Using the CustomValidator control
   7. Using the ValidationSummary Control
   8. Validation event
   9. Multiple validation control
6) Debugging ASP.NET Paes [3]
   1. Error Handling
   2. Using Debugging Tools
7) ASP.NET Database Programming [5]
   1. Introducing ADO.NET
   2. ADO.NET Basics
   3. ADO.NET Object Model

4. Communicating with OLEDB data sources using ADO.NET

8) Understanding Data Binding [2]
   1. Introduction to Data Binding
   2. Data Source Binding

9) Working with Data Grids [4]
   1. Using Data Grids examples
   2. Additional Capabilities when designing ASPX Pages
   3. Using the Columns properties
   4. Paging Grid Data
   5. Sorting Grid Data

Text Book: ASP.NET Bible by Mridula Parihar et al,
WILEY –dreamtech India Private Limited

Reference Book: ASP.NET 3.5 Black Book by Kognet Solutions Inc.,
Dreamtech Press

## BCA SEMESTER–V

## SUBJECT: (BC501) INTERNET TECHNOLOGIES AND PROGRAMMING

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 4 | 8 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Apply | Explore the concepts of socket programming and RMI to develop real life networking applications. |
| CO2 | Analyze | Learn the database connectivity skills to perform crud operations in java using JDBC |
| CO3 | Create | Design and develop web applications in java using the core concepts of servlet and JSP |
| CO4 | Understand | Explore the working of XML to independently allow data Interchange that is valid to all programming languages. |
| CO5 | Create | Design projects that focus on application-level business logic for modern Java-based enterprise applications |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Networking with Java | √ | | | | |
| 2 | RMI | √ | | | | |
| 3 | JDBC | | √ | | | |
| 4 | Servlets | | | √ | | |
| 5 | JSP | | | √ | | |
| 6 | Introduction to XML | | | | √ | |
| 7 | Spring Framework | | | | | √ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 3 | 3 | 3 | 3 | - | - | 3 | - | - | - | 1 |
| CO2 | 1 | 3 | 3 | 3 | 3 | - | - | 3 | - | - | - | 1 |
| CO3 | 2 | 3 | 3 | 3 | 3 | - | - | 3 | - | - | - | 3 |
| CO4 | 2 | 3 | 3 | 3 | 3 | - | - | 3 | - | - | - | 1 |
| CO5 | 2 | 3 | 3 | 3 | 3 | - | - | 3 | - | 1 | - | 3 |
| Avg | 1.6 | 3 | 3 | 3 | 3 | 0 | 0 | 3 | 0 | 0.2 | 0 | 1.8 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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**BCA-501 Internet Technologies & Programming**

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| **L** | **Tu** | **Pr** | **Th** | **Ss** | **Tw** | **Pr** | **Total** |
| **4** | **1** | **3** | **60** | **40** | **25** | **25** | **150** |

**[Advanced JAVA]**

1. Networking with Java [TB1] **[6]**
   - Sockets in Java
   - Java Net API
     - InetAddress Factory Methods & Instance Methods
     - Socket class & ServerSocket class
     - URL, URLConnection,
   - Working with Datagram
     - DatagramPacket, DatagramSocket class
   - Handling Multiple Clients Communication
   - Implementation using Java API

2. JFC & Adv. JFC [TB1] **[8]**
   - Java Foundation Classes
   - Swing Classes & Features
   - Graphics Programming using Panes
   - MVC Architecture
   - JApplet, Painting in Swing vs. AWT, Displaying Controls in Swing vs. AWT
   - JPanel, JFrame
   - Jcomponent, Jlabel, Jbutton, Tooltips and icons, JTextField, JPasswordField, JCheckBox, ButtonGroup, JRadioButton, JScrollPane, JSlider, JList, JComboBox JProgressBar, JTabbedPane, Overview of JTree & JTable
   - BoxLayout
   - Pluggable look and feel
   - Menus and toolbars, Popup Menus
   - Locales
   - Number Formats
   - Date & Time
   - Implementation using Java API

3. Object Serialization [TB1] **[2]**
   - Overview
   - How it works?
   - Creating Object Serialization based applications
   - Implementation using Java API

4. RMI [TB1] **[3]**
   - Introduction to RMI
   - RMI Architecture
   - Stub-skeleton Layer, Remote Reference Layer, Transport Layer
   - Sample RMI application, Deploying the RMI application

- Implementation using Java API

5. JDBC [TB1] **[5]**
   - Overview
   - Different types of driver
   - JDBC classes overview
   - Metadata functions: Database Metadata and Resultset Metadata
   - Statement, Prepared Statement, CallableStatements (Excluding practical implementation of Callable Statement)
   - Enterprise Architecture Types
   - Implementation using Java API

6. Servlets [TB2] **[4]**
   - Introduction to dynamic pages
   - Features of Servlet
   - Servlet Engines
   - Lifecycle of servlet, Servlet API
   - Working with HttpServletRequest, HttpServletResponse
   - Deploying Servlet Application
   - Session Handling
   - Implementation using Java API

7. JSP [TB2] **[6]**
   - Introduction to JSP
   - JSP syntax and structure
   - JSP life cycle
   - JSP elements
     Standard actions, Directives, Scripting elements, comments
   - JSP implicit objects & its methods
   - Implementation using Java API

8. Introduction to XML [TB1 & TB2] [6]
   - Introduction of XML
   - Use of XML
   - XML Parsers
   - Creating XML Documents
   - Creating Document Type Definition (DTD)
   - Creating XML Schema
   - Creating an XSLT
   - XHTML
   - Parsing XML using DOM & SAX Parser

**Note:**

TB1 = Text Book 1
TB2 = Text Book 2

**Text Books:**

1. Java 6 Programming Black Book, DreamTech Press

2. Java Server Programming Java EE 5 Black Book, DreamTech Press

**Ref. Books:**

1. Core Java 2 Volume II, Sun Microsystems
2. Java 2 Enterprise Edition Bible
3. J2EE Complete Reference, Tata McGraw Hill

**Tools for practical:**

1. Eclipse Editor OR Textpad
2. Tomcat Server
3. JSDK

## BCA SEMESTER–V

## SUBJECT: (BC506) INRTODUCTION TO SOFTWARE VALIDATIONA AND VERIFICATION

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 2 | 6 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | To Be aware of design principles and gain knowledge of software testing principles. |
| CO2 | Analyze | Learn to select project methodology based on project characteristics. And learn different life cycle models. |
| CO3 | Evaluate | By looking inside application be aware with the technical working of application. To understand how to test from end user perspective by applying different methodology of black box testing. |
| CO4 | Apply | To know the compliance of the system or component with specified functional requirements and be able to gain knowledge of performance testing. |
| CO5 | Evaluate | Learn different testing methodology and technique. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Principles of Testing | ✓ | | | | |
| 2 | Software Development Life Cycle models. | | ✓ | | | |
| 3 | White box testing | | | ✓ | | |
| 4 | Black box testing | | | ✓ | | |
| 5 | Integration testing | | | | ✓ | |
| 6 | System and Acceptance testing | | ✓ | | ✓ | |
| 7 | Performance testing | | ✓ | | ✓ | |
| 8 | Regression testing | | | | | ✓ |
| 9 | Test planning Management Execution and Reporting | | | | | ✓ |
| 10 | Static Verification | | | ✓ | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | - | 1 | 1 | - | 1 | - | - | - | 1 |
| CO2 | 1 | 2 | 3 | - | 1 | 1 | - | 1 | - | - | - | - |
| CO3 | 1 | 3 | 3 | - | 1 | 1 | - | 1 | - | - | - | - |
| CO4 | 2 | 3 | 3 | - | 1 | 1 | - | -- | -- | -- | -- | 1 |
| CO5 | 1 | 2 | 3 | - | 1 | 1 | - | 1 | - | - | - | 1 |
| Avg | 1.60 | 2.60 | 3.0 | - | 1 | 1 | - | 0.80 | - | 0 | - | 0.60 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

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**BCA-506 Software Verification & Validation**

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Tw | Pr | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 |

1. **PrinciplesofTesting:-**
   -Context of testing in producing software [1]
   -Dijkstra's Doctrine
   -Test in Time [1]
   -Test the Tests first

2. **SoftwareDevelopmentLifeCycleModels(Introduction):-**
   -Phases of Software Project [1]
   -Quality Assurance and Quality Control
   -Testing, Verification and validation concepts
   -Life Cycle Models [2]
   - Waterfall
   - Prototype
   - Spiral
   - V Model and Modified V Model

3. **WhiteBoxTesting:-**
   -What is White Box Testing? [2]
   -Static testing by Humans
   -Static Analysis Tools [1]
   -Structural Testing
   - Unit/ Code Functional Testing
   - Code Coverage Testing [1]
   - Code Complexity Testing [1]
   -Challenges in White Box Testing

4. **BlackBoxTesting:-**
   -What is Black Bok Testing and what is its importance? [2]
   -When to do Black Box Testing?
   -How to do Black Box Testing?
   - Requirement based testing [1]
   - Positive and Negative testing
   - Boundary Value Analysis [1]
   - Decision Tables [1]
   - Equivalence Partitioning
   - Graph based Testing [1]
   - Compatibility Testing

5. **IntegrationTesting:-**
   -Introduction [1]
   -Top-Down Integration
   -Bottom-Up Integration [1]
   -Bi-Directional Integration [1]
   -System Integration

6. **SystemandAcceptanceTesting:-**
   -System Testing Overview [2]
   -Functional System Testing
   - Beta Testing
   -Non-Functional System Testing [1]
   - Stress Testing
   - Interpretability Testing
   -Acceptance Testing [1]
   - Acceptance Criteria, Selecting Test Cases
   - Executing Acceptance Tests
   -

7. **PerformanceTesting:-**
   -Introduction [1]
   -Factors governing performance testing
   -Methodology for performance testing
   - Collecting Requirement [1]
   - Writing Test Cases
   - Executing and Analyzing Performance test case [1]
   - Performance Tuning
   -

8. **RegressionTesting:-**
   -Introduction [1]
   -Types of Regression Testing
   -Understanding the Criteria for selecting Test Case [1]
   -Classifying Test Cases
   -Methodology for selecting Test Case



9. **TestPlanning,Management,ExecutionandReporting:-**
   -Test Planning
   - Preparing a Test Plan [1]
   - Deciding Features to be tested/ Not Tested [1]
   - Deciding Test Approach/ Strategy [1]
   - Setting up Criteria for Testing [1]
   - Identify Resource Requirement [1]
   - Activity Breakdown and Scheduling Process
   - Test Case Specification [1]
   - Update of Traceability Matrix
   - Developing and Executing Test Cases [1]
   - Collecting and Analyzing Metrics [1]
   - Test Summary Report

**10. StaticVerification:-**

-Introduction [1]
-Design and Code Reviews [1]
-Program Inspection and checklist [1]
-Mathematically based verification [1]

**Text Book:** **Software Testing Principles and Practices**
By: Srinivasan Desikan and Gopalaswamy Ramesh
Publisher: Pearson Education

## BCA SEMESTER–V

## SUBJECT: (BC507) E-COMMERCE & WEB TECHNOLOGIES

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | 2 | 6 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | Understand the fundamentals of e-commerce, its applications and difference of physical commerce and e-commerce |
| CO2 | Create | Create client side of the e-commerce by creating logical, perceptual, and content |
| CO3 | Create | Create server side of the e-commerce using concepts of PHP like fundamental blocks, database connectivity, sessions, forms etc. |
| CO4 | Remember | Gain insights of cryptography and firewalls for internet security |
| CO5 | Understand | Understand WAP, Mobile Commerce and electronic payments |
| CO6 | Understand | Understand concepts of e-retailing, B2B commerce and e-services |

### COURSE OUTCOME MAPPING

| Chapter No. | Unit Name | Course Outcome | | | | | |
|---|---|---|---|---|---|---|---|
| | | CO1 | CO 2 | CO3 | CO4 | CO5 | CO6 |
| 1 | Introduction to E-Commerce | ✓ | | | | | |
| 2 | Client side Programming | | ✓ | | | | |
| 3 | Server side Programming | | | ✓ | | | |
| 4 | Basic cryptography for enabling e-commerce | | | | ✓ | | |
| 5 | Internet Security | | | | ✓ | | |
| 6 | Advanced Technologies for E-Commerce | | | | | ✓ | |
| 7 | Internet Payment Systems | | | | | ✓ | |
| 8 | Consumer Oriented E-Commerce | | | | | | ✓ |
| 9 | Business Oriented E-Commerce | | | | | | ✓ |
| 10 | E-Services | | | | | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | - | - | 3 | - | 1 | - | - | - | - | - |
| CO2 | - | 3 | 3 | - | - | - | 1 | - | - | - | - | - |
| CO3 | - | 3 | 3 | 3 | - | - | 1 | - | - | - | - | 3 |
| CO4 | 3 | 3 | 3 | - | 3 | - | 1 | - | - | - | - | 3 |
| CO5 | - | - | - | - | 3 | - | 1 | - | - | - | - | - |
| CO6 | - | - | - | - | 3 | 3 | 1 | 2 | - | 3 | 3 | - |
| Avg | 0.5 | 1.5 | 1.5 | 0.5 | 2 | 0.5 | 1 | 0.33 | 0 | 0.5 | 0.5 | 1 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

**DHARMSINH DESAI UNIVERSITY, NADIAD**
**FACULTY OF INFORMATION SCIENCE**

## BCA-507 E-Commerce & Web Technologies

| Teaching scheme (H/W) | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Pr | Tw | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 |

1. **IntroductiontoE-Commerce** [4]
   - E-Commerce & Physical Commerce
   - Types of E-Commerce & Examples
   - Advantages & Myths

2. **ClientsideProgramming** [2]
   - Important factors in client-side or web programming
   - Web page design and production
     - Define the audiences and the information requirements
     - Develop the logical design of the web site
     - Develop the perceptual design
     - Content creation
     - Programming
   - Posting and hosting the site

3. **ServersideProgramming** [10]
   - Introduction of Server Side Programming
   - Building Blocks of PHP
   - Flow Controls functions in PHP
   - Functions
   - Arrays
   - Including Files
   - Object Oriented PHP
   - Overview of MySQL
   - Features of MySQL
   - Database Connectivity with MySQL
   - Working with Forms
   - Session Handling
     - Traditional session tracking techniques
     - Hidden form field
     - URL rewriting
     - H'ITP user authentication
     - Cookies
     - Comparison of the above session tracking methods
   - Session Handling with PHP

4. **Basiccryptographyforenablinge-commerce** [3]
   - Security concerns
   - Security requirements
   - Encryption
   - Two basic principles for private key encryption
     - Data encryption standard
     - Other symmetric key encryption algorithm
   - Public key encryption
   - RSA encryption
   - Hybrid encryption
   - Stream cipher and block cipher
   - Message digest
   - Digital signature
   - Authentication
     - Digital certificate
   - Note: Exclude all algorithms

5. **InternetSecurity** [3]
   - Firewalls
   - Different types of firewalls
     - Packet filtering router
     - Application gatewaylproxy server
     - Circuit level gateway
   - Examples of firewall systems
   - Overview of Secure socket layer (SSL)

6. **AdvancedTechnologiesforE-Commerce** [5]
   - WAP: the enabling technology for mobile commerce
     - The WAP model
     - WAP architecture
     - Benefits of WAP to e-commerce
     - WML
     - M-Commerce Payment Systems
     - M-Commerce Applications

7. **InternetPaymentSystems** [3]
   - Characteristics of Payment Systems
   - 4C Payment Methods
   - SET Protocol for Credit Card Payment
   - Ecash
   - Echeck
   - Micropayment System

8. **ConsumerOrientedE-Commerce** [3]
   - Introduction
   - Traditional retailing & E-retailing
   - Benefits of E-Ratailing
   - Key Success Factors
   - Models of E-Retailing
   - Features of E-Retailing

9. **BusinessOrientedE-Commerce** [3]
   - Features of B2B E-Commerce
   - Business Model

10. **E-Services** [4]
   - Categories of E-Services
   - WebEnabled Services
   - Matchmaking Services
   - Information-Selling on the Web
   - E-Entertainment
   - Auctions and Other Specialized Services

**PracticalBasedTopics:**

Practical based on PHP and MySQL & minor project
Minor Project should be documented in term-work along with lab practical.

**Text Book:**

1. E Commerce Fundamentals & Applications
   By: Wiley India Edition

**Reference Books:**

1. E Commerece Framework Technologies & Application
   Tata McGraw Hill, By Bharat Bhasker

**Text Book for Practicals:**

1. Sams Teach Yourself PHP, MySQL & Apache All in one

## BCA SEMESTER–V

## SUBJECT: (BC510) DATA COMMUNICATION & NETWORK

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | - | - | 4 | 60 | 40 | 25 | | 125 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | Making students aware of basic terminology in networking and fundamental concepts. |
| CO2 | Understand | Learning modulation, multiplexing, developing an understanding of components of computer networks, protocols, modern technologies and their applications. |
| CO3 | Apply | Imparting an in depth knowledge of OSI layer and its utilization in modern day networking. Learning the functionality of physical layer and data link layer. |
| CO4 | Apply | Explore the functions of Network Layer. Imparting knowledge about different Transport Layer functions. |
| CO5 | Analyze | Understand functions offered by application layer and their Implementation. |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Communication | √ | | | | |
| 2 | Communication channels | √ | | | | |
| 3 | Modulation | | √ | | | |
| 4 | Multiplexing | | √ | | | |
| 5 | Use of computer network | | √ | | | |
| 6 | OSI model | | | √ | | |
| 7 | Physical layer | | | √ | | |
| 8 | Design issues of Data Link Layer | | | √ | | |
| 9 | The Medium Access Sub Layer | | | √ | | |
| 10 | The Network Layer | | | | √ | |
| 11 | The Transport Layer | | | | √ | |
| 12 | The Application Layer | | | | | √ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | - | 3 | - | - | - | - | - | - | - |
| CO2 | 2 | 1 | 1 | - | 3 | - | - | - | - | - | - | - |
| CO3 | 3 | 1 | 1 | - | 3 | - | - | - | - | - | - | 1 |
| CO4 | 3 | 1 | 1 | - | 3 | - | - | - | - | - | - | 2 |
| CO5 | 3 | 1 | 1 | - | 3 | - | - | - | - | - | - | 2 |
| Avg | 2.6 | 1 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

**DHARMSINH DESAI UNIVERSITY, NADIAD**
**FACULTY OF INFORMATION SCIENCE**
**BC508 Data Communication & Network**

| Teaching scheme (H/W) | | Exam. Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **L** | **Tu** | **Th** | **Ss** | **Tw** | **Total** |
| **4** | **-** | **60** | **40** | **25** | **125** |

INTRODUCTION :

1). **Communication**, Block diagram of communication system, Types of communication, Telecommunication, Use of communication (TB1) [2]

2). **Communication channels**, Wavepropogation modes, TE, TM, TEM mode Frequency, Wavelength, Electromagnetic waves, serial and parallel data transmission, Wireless communication, types of noise, Wireless communication, Fiber optics, coaxial cable, channel capacity, Frequency spectrum, Facsimile. (TB1) [4]

3). Design issues of **Modulation**, Amplitude modulation, Frequency modulation, Phase modulation, Base band system, Total power, carrier power, Digital communication, ASK, FSK, PSK, Line codes, Synchronous and Asynchronous modulation, Demodulation, Phase Locked Loop. (TB1) [3]

4). **Multiplexing** FDM, TDM, CDMA (Code Division Multiple Access - TB2), WDM(Wavelength Division Multiplexing - TB2) Combined Multiplexing, TDM designing with counter, decoder and switches. (TB1) [3]

5). **Use of computer network**, open loop and closed loop network, Network topology, Mesh, Star, Ring, Tree, Bus, Tree topology, LAN, MAN, WAN. (TB1) [3]

6). **OSI model**, Introduction to each layers of OSI model. (TB1) [3]

7). **Physical layer,** Transmission media, Geostationary satellites, circuit switching and packet switching, PSTN (Public Switched Telephone Network - Structure of Telephone System, Modem, ADSL and Fibre), The Mobile Telephone System - overview of 1G, 2G and 3G. (TB2). [4]

8). **Design issues of Data Link Layer**, Services provided to network layer, Framing, Error Control, Flow control, Elementary data link protocols, UTOPIA protocol, Simplex Stop and Wait protocol, Simplex Stop and Wait protocol for noisy channel, One bit sliding window protocol (TB2). [5]

9). **The Medium Access Sub Layer**, The channel allocation problem, ALOHA and CSMA protocols, IEEE Standard 802.3(Ethernet), 802.4(Token Bus), 802.5 (Token Ring), Comparison of 802.3, 802.4 and 802.5, ARP, arp command, RARP Setting hostname, using ifconfig, netsate command, ping tracing a connection, Gateway and routing protocols (TB2) [5]

10). **The Network Layer**, Network layer design issues, The Optimality principle, Shortest path routing, How Network Differ, The IP protocol, IP address, Internet Protocol (IP), Primary function of IP, Data delivery by IP, IP header (TB2). [5]

11). **The Transport Layer**, Ports, TCP architecture, UDP architecture, The Transport Service, Elements of Transport Protocol. (TB2) [4]

12). **The Application Layer**, Network Security, DNS Domain Name System. (TB2). [2]

**TEXTBOOKS :-**

(1) Data Communication By W.L, Schweber.

(2) Computer Networks By A.S.Tanenbaum.

**REF. BOOK :-**

(1) Data Communication and Networking By Behrouz Forouzan.

## BCA SEMESTER–V

## SUBJECT: (BC511) ANDROID PROGRAMMING

| Teaching Scheme(Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | Ext | Sess. | TW | Pract. | Total |
| 4 | 1 | 3 | 8 | 60 | 40 | 25 | 25 | 150 |

### COURSE OUTCOMES:

On the completion of the course students will:

| CO | Skills | Statement |
|---|---|---|
| CO1 | Understand | Install and configure Android application development tools. |
| CO2 | Analyze | In-depth learning of designing and developing user interface to build android application. |
| CO3 | Apply | Apply java programming concepts to develop mobile application on android platform. |
| CO4 | Apply | Develop server-less database application using SQLITE and run on physical phone device. |
| CO5 | Evaluate | Describe the deployment process of the application on Google Play |

### COURSE OUTCOME MAPPING

| Chapter No. | Chapter Name | Course Outcome | | | | |
|---|---|---|---|---|---|---|
| | | CO1 | CO2 | CO3 | CO4 | CO5 |
| 1 | Introduction to Android | ✓ | | | | |
| 2 | Android Application Design Essentials | | ✓ | ✓ | | |
| 3 | User Interface | | ✓ | ✓ | ✓ | |
| 4 | Android APIs | | | | | ✓ |

### COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | P10 | P11 | P12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | - | -- | -- | -- | - |
| CO2 | 2 | 3 | 2 | 1 | 2 | 1 | 1 | - | -- | 3 | 2 | 2 |
| CO3 | 2 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | -- | 3 | 2 | 2 |
| CO4 | 2 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | -- | 3 | 2 | 2 |
| CO5 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | -- | 3 | 3 | - |
| Avg | 1.6 | 2.4 | 1.8 | 1.2 | 1.8 | 1 | 1 | 0.6 | - | 2.4 | 1.8 | 1.2 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation "-"

# Android Programming

| Teaching scheme | | | Exam. Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| L | Tu | Pr | Th | Ss | Pr | Tw | Total |
| 4 | 1 | 3 | 60 | 40 | 25 | 25 | 150 |

## Introduction [08]

**1) An Overview of ANDROID :**

- History of Mobile Software Development
- The Android Platform

**2) Android Development Environment:**

- Configuring Development Environment
- Android SDK

**3) Android Application Development**

- Creating Android Virtual Device(AVD)
- Building First Android Application

## Android Application Design Essentials [10]

**1) Understanding Android Application**

- Android terminology
- Application Context
- Application Task and Activity
- The lifecycle of Android Activity
- Working with Services

**2) The Android Manifest File**

- Configuring Manifest File
- Managing Application's Identity

**3) Managing Application Resources**

- Android Resources and Types
- Working with resources

## User Interface [14]

**1) Exploring User Interface with Screen Layout**

- Android View and Layout
- Android Controls – TextView, EditText, Spinner, Button, Check Boxes and Radio Groups, DatePicker, ProgressBar, RatingBar etc.
- Option and Context Menues

**2) Designing User Interface Layout**

- Creating user interface in Android
- Using Built-In Layout Classes – FrameLayout, LinearLayout, RelativeLayout, TableLayout
- Using Data Driven Containers

**3) Drawing and Working With Animations**

- Working with Canvases and Paints
- Working With Text
- Working With Shapes
- Working With Animation

## Android APIs **[08]**

**1) Using Android Data and Storage APIs**

- Working with Application Preferences
- Working with Files and Directories
- Storing Structured Data using SQLite Database
- Creating, Updating and Deleting Database Records
- Building Data to the Application User Interface

**Text Book:**

Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd edition. (2011)

**Reference Books:**

1. Reto Meier Professional ANDROID 4 Application Development, WROX Latest Edition

2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd

3. Sayed Y Hashimi and Satya Komatineni, "Pro Android", Wiley India Pvt Ltd

# REGULATIONS AND CURRICULUM

# FOR

# BACHELOR OF DENTAL SURGERY COURSE

## Our Vision:

Faculty of Dental Science, Dharmsinh Desai University is a centre of excellence for learning and innovation driven by social sensitivity and state-of-the-art technology. The University is amongst the top-rated Educational Institute offering contemporary education, high quality research, and training and consultancy services in Health sciences to suit the ever-changing needs of society.

## Our Philosophy:

- To train the students in a way that help them to understand its rationale.
- To Identify, discuss and defend medico-legal, socio-cultural economic and ethical issues as it pertains to rights, equity and justice in access to health care.
- Demonstrate ability to communicate to patients in a patient, respectful, non-threatening, non-judgemental and empathetic manner.
- To encourage Research in all the disciplines of health sciences.
- To set the Benchmark in Educational Standards, Policies and Practice.
- To function with spirit of humanity, liberty, integrity, responsibility and togetherness.
- To Demonstrate ability to maintain confidentiality in patient care
- To create and maintain National as well as Global identity.
- To create a rewarding sense of belonging for mutual growth.
- To develop a sense of partnership amongst all.
- To strive hard towards creating human cantered development and building knowledge-cantered society and nation.

## Our Strength:

- First Largest and Recognized Deemed Health University of Gujarat State.
- First University in Gujarat to introduce Oral Cancer Centre
- Largest Dental Hospital of Gujarat state having highest patient OPD.

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| | V. Preclinical Prosthodontics, Crown & Bridgework | 134 |

| | | |
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## SECTION-I

## GOALS OF EDUCATION AND TRAINING IN DENTAL SCIENCE

- The Dental curriculum is oriented towards educating students of B.D.S. course to:

1. Take up the responsibilities as dental surgeon and be capable of functioning independently in both urban and rural environment with special attention to diagnosis, prevention and treatment planning of the society by being abreast to scientifically proven empirical evidence.
2. Provide educational experience that allows hands-on-experience both in hospital as well as in community setting with systematic evidence-based approach.
3. Make maximum efforts to encourage substantial evidence based integrated teaching and de-emphasize compartmentalization of disciplines so as to achieve horizontal and vertical integration in different phases.
4. Offer educational experience that emphasizes health rather than only disease.
5. Use learner-oriented methods, which would encourage clarity of expression, independence of judgment, scientific habits, problem solving abilities, self-initiated and self-directed learning thus making a paradigm shift from passive traditional learning to an active, learner-cantered and result-oriented approach to learning.

6. The changes in Teaching Methodology shall be as following:

- Addition of active learning methods such as flipped classroom, group discussions, seminars etc,
- Use of role play, field visits, student exchange and field projects, demonstrations, peer interactions etc.

These will enable students to develop personality, communication skills and other qualities.

7. Inculcate in the student the technique to reason out the basic need to understand the evidence, the nature and hierarchy of the evidence, choose the best evidence and how to apply it.

- Towards achieving these goals, the Dental College shall:
  1. Evolve institutional objectives, which would be in consonance with the national goals and health policy. The institutional objectives should describe the attributes of their product.
  2. Shift the role of Dental teachers from merely imparting knowledge to that of a facilitator and motivator of student learning.
  3. Establish a Dental Education Unit for faculty development, preparation of learning resource materials and for improving evaluation methods.
  4. Continuous upgradation of the faculty to appraise self and the students in implementation of evidence-based education system.

- Regular periodic assessment shall be done throughout the course. The examinations are designed with a view to assess the knowledge along with practical and clinical skills, habits and values which are necessary for a Graduate to carry out professional day to day work competently.

## SECTION-II

### AIM AND OBJECTIVES OF BDS COURSE

### AIM:

The dental graduates during training in the institutions shall acquire adequate knowledge, necessary skills and such attitudes which are required for carrying out all the activities appropriate to general dental practice involving the prevention, diagnosis and treatment of anomalies and diseases of the teeth, mouth, jaws and associated tissues in line with Evidence based basic and Advanced dental sciences. The graduate shall also understand the concept of community oral health education and be able to participate in the rural health care delivery programs existing in the country. The course aims to cater to an overall multi-dimensional academic upbringing of the student with quality improvement initiatives, evidence-based practice, professional accountability and public expectations.

### OBJECTIVES:

The objectives shall deal with (a) Knowledge and Understanding (b) Skills and (c) Attitudes.

**A.** Knowledge and understanding-

- Adequate knowledge of the scientific foundations on which dentistry is based and good understanding of various relevant scientific methods, principles of biological functions and shall be able to evaluate and analyse scientifically various established facts and data.
- Adequate knowledge of the development, structure and function of the teeth, mouth and jaws and associated tissues both in health and disease and their relationship and effect on general-state of health and also the bearing on physical and social well-being of the patient.
- Adequate knowledge of clinical disciplines and methods, which provide a coherent picture of anomalies, lesions and diseases of the teeth, mouth and jaws and preventive, diagnostic and therapeutic aspects of dentistry.

- Adequate clinical experience and decision making based on an approach that is beyond the arena of learning to reasoning what is present worldwide.
- Adequate knowledge of biological function and behavior of persons in health and sickness as well as the influence of the natural and social environment on the state of health so far as it affects dentistry.
- Acquire knowledge of basic research methodology and perform research as a part of their dental curriculum.

## B. Skills-

A graduate shall be able to demonstrate the following skills necessary to practice dentistry.

a. Able to diagnose and manage various common dental problems encountered in general dental practice, keeping in mind the expectations and the right of the society to receive the best possible treatment available wherever possible.

b. Skills needed for Evidence Based Practice for e.g., Formulating a question, conducting a literature search, computer skills etc. This will enable the learner to analyse the information at a fairly deep level. Thus, the learner shall be fine-tuned in the skill to delete some information (trivial and redundant), substitute some information and keep some information.

c. Acquire skills to prevent and manage complications if encountered while carrying out various dental surgical and other procedures with scientifically driven inductive techniques to compare published literature as studies, ideas or problems that share a similar concept. This shall foster the synthesis and analysis of information to identify the concept being learned.

d. Possess evidence-based decision skill to carry out required investigative procedures and ability to interpret laboratory findings

e. Inculcate in the student a deliberate practice to concentrate on critical aspects and gradually refining performance through instructor explanatory feedback and repetition.

f. Supporting deliberate practice with feedback information will enlighten learners not only of the correctness of their response but the reason behind a correct or

incorrect response. This shall be done through a continuous assessment of both didactic and psychomotor skills and EBES integrated assignments.

g. Promote oral health and help to prevent oral diseases wherever possible with critical appraisal of observational cross sectional, case control or cohort studies especially pertaining to the Indian sub-continent.

h. Competent in controlling pain and anxiety during dental treatment.

**C.** Attitudes-

A graduate shall develop during the training period the following attitudes-

i. Willing to apply current knowledge of dentistry in the best interest of the patients and the community.

j. Maintain a high standard of professional ethics and conduct and apply these in all aspects of professional life.

k. Seek to improve awareness and provide possible solutions for oral health problems and needs throughout the community.

l. Willingness to participate in the continuing education programs to update knowledge and professional skills from time to time.

m. To help &participate in implementation of National Health programs.

n. To become a creative, flexible and critical in thinking to make treatment effective

**<u>Program Outcome</u>**

- Adequate knowledge of the scientific foundations on which dentistry is based and good understanding of various relevant scientific methods, principles of biological functions and shall be able to evaluate and analyse scientifically various established facts and data.

- Adequate knowledge of the development, structure and function of the teeth, mouth and jaws and associated tissues both in health and disease and their relationship and effect on general-state of health and also the bearing on physical and social well-being of the patient.

- Adequate knowledge of clinical disciplines and methods, which provide a coherent picture of anomalies, lesions and diseases of the teeth, mouth and jaws and preventive, diagnostic and therapeutic aspects of dentistry.

- Adequate clinical experience and decision making based on an approach that is beyond the arena of learning to reasoning what is present worldwide.

- Adequate knowledge of biological function and behaviour of persons in health and sickness as well as the influence of the natural and social environment on the state of health so far as it affects dentistry.

- Adequate training in identifying research questions analyse and interpret existing evidences and use this background for designing pertinent researches

- Acquire a quality of lifelong learning to update with basic and recent advances within the program

- Adopt ethical principles in all aspects of practice.

- Possess Professional honesty and integrity and deliver patient care irrespective of social status, caste, creed or religion of the patient.

❖ The educational literature recognizes four approaches to learning: Receptive, Directive, Guided discovery and Exploratory. Each has its merits, depending on the intended instructional outcome. The oldest and most traditional approach to learning is receptive. In this means of delivering content, the learner is passive. An analogy is that the instructor

opens up the head of the learner, pours in the content, and hopes the brain absorbs it like a sponge. Examples include traditional lecture, a video, or a textbook.

- Although receptive learning environments do not provide active engagement with the content, they can still promote learning.
- In the directive approach, learners gradually build skills and knowledge by progressing from basic to advanced skills. The leaner responds to questions, and the instructors provide corrective feedback. This approach can be use to teach procedural skills for e.g. routine traditional methods of diagnosis and treatment planning.
- Guided discovery learning allows for the development of knowledge and skills through real work-related experiences. Instructors provide relevant problems, resources, and guidance. For e.g., problem or case-based studies and researches conducted by the student in person.
- Exploratory approaches incorporate a collaborative structure whereby learners can exchange ideas and resources with other clinicians with respect to a common outcome goal. Examples of this include use of the Internet to explore current research and evidence-based practice. Many educational activities are a combination of one or more of these approaches. The best approach needs to match the instructional goals and the learner's level of knowledge and skill.

❖ Our university, as an instructional planner, has selected the best mix of modes, methods, and learning approaches to achieve the intended educational outcome of course with the greatest credence given to an Evidence Based Education System.

❖ Thus, in nutshell the Dental curriculum is designed and custom made to:

1. Transfer, translate and integrate basic and research findings into curriculum.
2. Involve and integrate health research in teaching and learning.
3. Provide students with focused tasks for research and integration of the same.
4. Develop seminars and workshops for faculty and students to provide updates.
5. Practice based on Evidence Based Education System.

## SECTION-III
## REGULATIONS

### 1. Eligibility Criteria for admission:

#### 1.1. QUALIFYING EXAMINATION-

A candidate seeking admission to First BDS course:

1.1.1. Shall have passed the Two years Pre-University Examination with English, Physics, Chemistry and Biology,

OR

1.1.2. Shall have passed Intermediate examination in Science of an Indian University/Board/Council or other recognized examining bodies with Physics, Chemistry and Biology, which shall include a practical test in these subjects and also English as compulsory subject. The candidate shall have passed subjects of English, Physics, Chemistry and Biology individually.

OR

1.1.3. Shall have passed pre- professional/ pre- medical examination with Physics, Chemistry and Biology, after passing either the higher secondary school examination. The pre-professional/ pre- medical examination shall include a practical test in Physics, Chemistry and Biology and also English as compulsory subject.

OR

1.1.4. Shall have passed first year of the three-year degree course of a recognized University with Physics, Chemistry and Biology including a practical test in these subjects provided the examination is an 'University Examination' provided that the candidate shall have passed subjects of English, Physics, Chemistry and Biology individually in the pre university or other examinations mentioned in the clauses above.

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OR

1.1.5. Shall have passed B.Sc. Examination of an Indian University, provided that he/she has passed the B.Sc. examination with not less than two of the following subjects:

Physics, Chemistry, Biology (Botany, Zoology) provided the candidate has passed subjects of English, Physics, Chemistry and Biology individually in the qualifying examinations mentioned in clause 1.1.1,1.1.2, 1.1.3.

AND

1.2. National Eligibility-cum- Entrance Test for admission to BDS course

- There shall be a single eligibility-cum-entrance examination namely "National Eligibility-cum-Entrance Test for admission to BDS course" in each academic year."
- In order to be eligible for admission to BDS Course for a particular academic year, it shall be necessary for a candidate to obtain minimum of marks of 50$^{th}$percentile in 'National Eligibility cum-Entrance Test to BDS course' held for the said academic year. However, in respect of candidates belonging to Scheduled Castes, Scheduled Tribes, Other Backward Classes, the minimum marks shall be at 40$^{th}$percentile.
  In respect of candidates with locomotory disability of lower amendments, the minimum marks shall be at 45$^{th}$percentile. The percentile shall be determined on the basis of highest marks secured in the All-India common merit list in "National Eligibility-cum-Entrance Test for admission to BDS course."

- Provided when sufficient number of candidates in the respective categories fail to secure minimum marks as prescribed in National Eligibility-cum-Entrance Test held for any academic year for admission to BDS Course, the Central Government in consultation with Dental Council of India may at its discretion lower the minimum marks required for

admission to BDS Course for candidates belonging to respective categories and marks so lowered by the Central Government shall be applicable for the said academic year only.

- The reservation of seats in dental colleges for respective categories shall be as per applicable laws prevailing in States/Union Territories. An all-India merit list as well as State-wise merit list of the eligible candidates shall be prepared on the basis of the marks obtained in National Eligibility-cum-
- Entrance Test and candidates shall be admitted to BDS course from the said lists only.
- No Candidate who has failed to obtain the minimum eligibility marks as prescribed in Clause (ii.) above shall be admitted to BDS course in the said academic year.
- All admissions to BDS course within the respective categories shall be based solely on marks obtained in the National Eligibility-cum-Entrance Test.
- To be eligible for admission to BDS Course, a candidate must have passed in the subjects of Physics, Chemistry, Biology/Biotechnology and English individually and must have obtained a minimum of 50% marks taken together in Physics, Chemistry and Biology/Biotechnology at the qualifying examination as mentioned in Sub-regulation 2 of Regulation I and in addition must have come in the merit list of "National Eligibility-cum-Entrance Test" for admission to BDS course. In respect of candidates belonging to Scheduled Castes, Scheduled Tribes or other Backward Classes the minimum marks obtained in Physics, Chemistry and Biology/Bio-technology taken together in qualifying examination shall be 40% instead of 50%. In respect of candidates with locomotory disability of lower limbs in terms of sub-regulation 4, after the commencement of these amendments, of Regulation 1 above, the minimum marks in qualifying examination in Physics, Chemistry and Biology/Bio-technology taken together in qualifying examination shall be 45%instead of 50%.

- Provided that a candidate who has appeared in the qualifying examination the result of which has not been declared, he/she may be provisionally permitted to take up the National Eligibility-cum-Entrance Test and in case of selection for admission to the BDS course, he/she shall not be admitted to that course until he fulfils the eligibility criteria under Regulation 1.

## 1.3. Common Counselling:

1.3.1. There shall be a common counselling for admission to BDS course in all dental educational institutions on the basis of merit list of the National Eligibility-cum-Entrance Test.

1.3.2. The designated authority for counselling for the 15% All India Quota seats of the contributing States and all BDS seats of Dental Education Institutions of the Central Government universities established by an Act of Parliament and the Deemed Universities shall be the Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India.

1.3.3. The counselling for admission to BDS course in a State/Union Territory, including Dental Education Institutions established by the State Government, University established by an Act of State/Union Territory Legislature, Trust, Society, and Minority Institutions shall be conducted by the State/Union Territory Government.

1.3.4. In case any dispute arises on such common counselling, the respective State Government shall refer the matter to the Central Government and its decision shall be final, in this regard.

## 2. Age Limit:

The candidate shall have completed the age of 17 years at the time of admission or shall complete this age on 31st December of the year in which he/she seeks admission.

## 3. Duration of the course:

Is a total of FOUR Academic years and ONE year of rotating Internship program. There shall be at least 240 teaching days in each Academic year.

Any student who does not clear the BDS course in all subjects within a period of 9 years, including one-year compulsory rotary paid internship from the date of admission shall be discharged from the course.

4. Titles and Year Wise Distribution of the Subjects for Study:

## FIRST YEAR BDS-

1. General Human Anatomy including Embryology and Histology
2. General Human Physiology and Biochemistry, Nutrition and Dietetics
3. Dental Anatomy, Embryology and Oral Histology
4. Dental Materials
5. Preclinical Prosthodontics and Crown & Bridge
6. Management science
7. Behavioural science

## SECOND YEAR BDS-

1. General Pathology and Microbiology
2. General and Dental Pharmacology and Therapeutics
3. Dental Materials
4. Oral Pathology & Oral Microbiology
5. Preclinical Prosthodontics and Crown & Bridge
6. Preclinical Conservative Dentistry & Endodontics

## THIRD YEAR BDS-

1. General Medicine
2. General Surgery
3. Oral Pathology and Microbiology
4. Oral Medicine and Radiology
5. Public Health Dentistry
6. Prosthodontics and Crown & Bridge
7. Periodontology
8. Oral & Maxillofacial Surgery
9. Conservative Dentistry & Endodontics
10. Orthodontics & Dentofacial Orthopaedics
11. Paediatric& Preventive Dentistry

**FOURTH YEAR BDS-**

1. Oral Medicine and Radiology
2. Public Health Dentistry
3. Prosthodontics and Crown & Bridge
4. Periodontology
5. Oral & Maxillofacial Surgery
6. Conservative Dentistry & Endodontics
7. Orthodontics & Dentofacial Orthopaedics
8. Paediatric& Preventive Dentistry

## 5. Teaching Hours:

The Teaching hours for each subject from First to Fourth year – Theory and Practical/Clinical are shown in the Tables I to VI-

TABLEI: TOTAL TEACHING/LEARNING HOURS FOR BDS PROGRAM-

| Sr. No. | Subject | Lecture Hours | Practical Hours | Clinical Hours | Total Hours |
|---|---|---|---|---|---|
| 1 | General Human Anatomy including Embryology, Osteology & Histology | 100 | 175 | - | 275 |
| 2 | General Human Physiology | 120 | 60 | - | 180 |
| | Biochemistry, Nutrition& Dietetics | 70 | 60 | - | 130 |
| 3 | Dental Materials | 80 | 240 | - | 320 |
| 4 | Dental Anatomy, Embryology and Oral Histology | 105 | 250 | - | 355 |
| 5 | Dental Pharmacology and Therapeutics | 70 | 20 | - | 90 |
| 6 | General Pathology | 55 | 55 | - | 110 |
| | Microbiology | 65 | 50 | - | 115 |
| 7 | General Medicine | 60 | - | 90 | 150 |
| 8 | General Surgery | 60 | - | 90 | 150 |

| | | | | | |
|---|---|---|---|---|---|
| 9 | Oral Pathology and Microbiology | 145 | 130 | - | 275 |
| 10 | Oral Medicine and Radiology | 65 | - | 170 | 235 |
| 11 | Paediatric& Preventive Dentistry | 65 | - | 170 | 235 |
| 12 | Orthodontics & Dental Orthopaedics | 50 | 80 | 140 | 220 |
| 13 | Periodontology | 80 | - | 170 | 250 |
| 14 | Oral & Maxillofacial Surgery | 70 | - | 270 | 340 |
| 15 | Conservative Dentistry & Endodontics | 135 | 200 | 370 | 705 |
| 16 | Prosthodontics and Crown & Bridge | 135 | 300 | 370 | 805 |
| 17 | Public Health Dentistry including Lectures on Tobacco Control & Habit Cessation | 60 | - | 200 | 260 |
| | Total | 1596 | 1540 | 2070 | 5200 |

TABLE –II: TEACHING HOURS FOR FIRST YEAR BDS

| Sr. No. | Subject | Lecture Hours | Practical Hours | Total Hours |
|---|---|---|---|---|
| 01 | General Human Anatomy including Embryology, Osteology and Histology | 100 | 175 | 275 |
| 02 | General Human Physiology, | 120 | 60 | 180 |
| 03 | Biochemistry, Nutrition and Dietetics | 70 | 60 | 130 |
| 04 | Dental Anatomy, Embryology, and Oral Histology | 105 | 250 | 355 |
| 05 | Dental Materials | 20 | 40 | 60 |
| 06 | Preclinical Prosthodontics and Crown & Bridge | - | 100 | 100 |
| 07 | Management Science | 40 | - | 40 |
| 08 | Behavioral Science | 20 | - | 20 |
| | Total | 475 | 685 | 1160 |

TABLE –III: TEACHING HOURS FOR SECOND YEAR BDS

| Sr. No. | Subject | Lecture Hours | Practical Hours | Total Hours |
|---|---|---|---|---|
| 01 | General and Dental Pharmacology and Therapeutics | 70 | 20 | 90 |
| 02 | General Pathology | 55 | 55 | 110 |
| 03 | Microbiology | 65 | 50 | 115 |
| 04 | Dental Materials | 60 | 200 | 260 |
| 05 | Oral Pathology and Microbiology | 25 | 50 | 75 |
| 06 | Pre-clinical Prosthodontics and Crown & Bridge | 25 | 200 | 225 |
| 07 | Pre-clinical Conservative Dentistry | 25 | 200 | 225 |
| | Total | 325 | 725 | 1050 |

TABLE-IV: TEACHING HOURS FOR THIRD YEAR BDS

| Sr. No. | Subject | Lecture Hours | Practical Hours | Clinical Hours | Total Hours |
|---|---|---|---|---|---|
| 01 | General Medicine. | 60 | - | 90 | 150 |
| 02 | General Surgery. | 60 | - | 90 | 150 |
| 03 | Oral Pathology and Microbiology. | 120 | 80 | - | 200 |
| 04 | Oral Medicine and Radiology | 20 | - | 70 | 90 |
| 05 | Conservative Dentistry & Endodontics. | 30 | - | 70 | 100 |
| 06 | Oral & Maxillofacial Surgery. | 20 | - | 70 | 90 |
| 07 | Orthodontics & Dentofacial Orthopaedics. | 20 | - | 80 | 100 |
| 08 | Paediatric& Preventive Dentistry. | 20 | - | 70 | 90 |
| 09 | Periodontology. | 30 | - | 70 | 100 |
| 10 | Prosthodontics and Crown & Bridge. | 30 | - | 70 | 100 |
| 11 | Public Health Dentistry | 40 | - | 56 | 96 |
| | Total | 450 | 80 | 736 | 1270 |

TABLE –V: TEACHING HOURS FOR FOURTH YEAR BDS

| Sr. No. | Subject | Lecture Hours | Practical Hours | Clinical Hours | Total Hours |
|---|---|---|---|---|---|
| 01 | Oral Medicine and Radiology. | 45 | - | 100 | 145 |
| 02 | Orthodontics & Dentofacial Orthopedics. | 30 | 30 | 70 | 130 |
| 03 | Paediatric& Preventive Dentistry. | 45 | - | 100 | 145 |
| 04 | Periodontology. | 50 | - | 100 | 150 |
| 05 | Oral & Maxillofacial Surgery. | 50 | - | 200 | 250 |
| 06 | Prosthodontics and Crown and Bridge. | 80 | - | 300 | 380 |
| 07 | Conservative Dentistry & Endodontics. | 80 | - | 300 | 380 |
| 08 | Public Health Dentistry. | 60 | - | 200 | 260 |
| | Total | 440 | - | 1420 | 1860 |

# 6. EXAMINATION

## **6.1** INTERNAL ASSESSMENT EXAMINATIONS:

6.1.1 The Internal assessment examination for each year of BDS course shall be conducted by the authorities of the dental college.

6.1.2 There shall be THREE Internal examinations (including Preliminary examination) during each year of BDS course. All these three internal examinations are compulsory and shall include Theory as well as Practical/Clinical examination. The average marks of these examinations shall be considered for calculation of internal assessment marks.

6.1.3 The First Internal examination (TERMINAL): shall be conducted at the end of First term of the academic year in the following manner-

- Theory examination- It shall consist of 100 marks with two sections-I & II. Section I and II shall have Two long questions of 15 marks each two short notes to attempted out of three for 5 marks each and five multiple choice questions of 2 marks each.
- Practical/ Clinical examination- It shall consist of 100 marks according to the scheme of respective departments.

6.1.4 The Second Internal examination: shall be conducted in the mid of the second term of the academic year in the following manner-

- Theory examination- It shall consist of 100 marks having 50 MCQ for 2 Marks each.
- Practical/ Clinical examination- It shall consist of 100 marks. For subjects of I, II and III BDS the marks obtained by the candidate in the practical examination conducted in the II term at the level of the respective Department shall be considered for the second internal examination. For IV BDS the marks obtained by the candidate in the practical examination at the end of four clinical postings by the respective department shall be considered for the second internal examination

6.1.5 The Third Internal examination: called as the Preliminary examination shall be completed at least 21 days prior to the University examination and shall be conducted in the following manner-

- Theory examination- It shall consist of 100 marks with two sections-I & II. Section I and II shall have Two long questions of 15 marks each two short notes to attempted out of three for 5 marks each and five multiple choice questions of 2 marks each.
- Practical/ Clinical examination- It shall consist of 100 marks according to the scheme of respective departments.

*6.1.6 The changes in Internal Assessment marks pattern shall be as following:*

- The Internal examination marks and Continuous cumulative evaluation system (CCES) should be considered out of ten marks each then added and averaged in both theory and practical.
- The internal assessment marks in the subject of Pre-clinical Prosthodontics and Pre-clinical Conservative Dentistry shall be calculated out of 20 marks.

*The changes in Internal Assessment marks pattern shall be as following:*

6.1.7 The marks obtained by the candidate in all the three internal examinations shall be considered for calculating 60% of the total internal assessment marks.

6.1.8 The remaining 40 % of the internal assessment marks shall be calculated from the Continuous cumulative evaluation system (CCES) earned by the student in Theory and Practical's/clinical individually.

6.1.9 The internal assessment marks for the subject of Evidence Based Dentistry shall comprise of twenty (20) marks which will be the total of the two assignments of ten (10) marks each.

6.1.10 The Internal Marks shall be known to students before they appear for university theory examination.

6.1.11 The Internal Assessment marks shall be submitted to the Dean, by the HOD of each department in the time period prescribed by the office. The Dean, shall submit these marks to the Controller of Examinations.

## **6.2** UNIVERSITY EXAMINATION:

### 6.2.1 Eligibility Criteria

#### 6.2.1.1 Attendance:

- Every candidate shall fulfil at least 75 %of the attendance during each academic year of the BDS course; separately for both- Theory and Practical/ Clinical in the exam going subjects.
- In case of a subject in which there is no examination at the end of the academic year/semester, the percentage of attendance shall not be less than 70%.
- The candidate shall be detained only in that subject/s in which the attendance is below 75% and/or work quota is not complete.
- On extreme compassionate grounds, the Dean refers the matter to the Student Reform's Committee for authorization to grace Five percent of the attendance, for both- Theory and Practical/ Clinical.
- Student should obtain NOC for successfully attending EBD module. Student fails to do so shall not be allowed to appear for the university examination for all subjects of that year.

### 6.2.1.2 Progress and Conduct:

- Every candidate shall maintain a Work done record book/journal containing the details of work done during the training program.
- Every candidate shall complete the Work quota as designed by the department. The satisfactory work completion certificate shall be certified by the subject in-charge and the Head of the department.
- Every candidate shall satisfactorily complete the assignments allotted by the respective departments.
- The candidate appearing for the university examination shall fulfil the prescribed requirements of all subject appearing departments and submit the following certificates/ copies of certificates along with the Examination Form to the Controller of Examination:
    - A copy of mark sheet of Last university examination.
    - An NOC from the Student section, Account Section, Hostel, Mess, Learning Resource Centre, which then will be countersigned by Dean.

## 6.2.2. SCHEME OF UNIVERSITY EXAMINATION:

6.2.2.1. The Undergraduate Course shall have TWO University Examinations in each Academic year:

- The Regular Annual examination shall be conducted at the end of One full academic year as follow:

  I B.D.S. Examination at the end of first academic year.

  II B.D.S. Examination at the end of second academic year.

  III B.D.S. Examination at the end of third academic year.

  IV B.D.S. Examination at the end of fourth academic year.
- Supplementary Examination:

  The supplementary examination for Unsuccessful candidate of First, Second, Third, and Fourth BDS shall be conducted not before FOUR months and not after SIX months from the date of declaration of results.

6.2.2.2. The University Examination shall consist of:

- Written/Theory examination
- Clinical and /or Practical examination
- Viva-Voce examination

6.2.2.2.1. Written/Theory Examination:

A. Following shall be the Subjects &Titles of papers for University examinations:
   - First B.D.S. Examination:
     - ➢ General Anatomy including Embryology and Histology
     - ➢ General Human Physiology and Biochemistry, Nutrition and Dietetics
     - ➢ Dental Anatomy, Embryology and Oral Histology.

- Second B.D.S. Examination:
    - ➢ General and Dental Pharmacology and Therapeutics
    - ➢ General Pathology and Microbiology
    - ➢ Dental Materials
    - ➢ Evidence Based Dentistry
- Third B.D.S. Examination:
    - ➢ General Medicine
    - ➢ General Surgery
    - ➢ Oral Pathology and Microbiology
    - ➢ Evidence Based Dentistry
- Fourth B.D.S. Examination:
    - ➢ Oral Medicine and Radiology
    - ➢ Paediatric and Preventive Dentistry
    - ➢ Orthodontics and Dentofacial Orthopaedics
    - ➢ Periodontology
    - ➢ Oral & Maxillofacial Surgery
    - ➢ Prosthodontics including Crown & Bridge
    - ➢ Conservative Dentistry and Endodontics
    - ➢ Public Health Dentistry
    - ➢ Evidence Based Dentistry

B. Format of University Theory Question Paper:

- The Theory paper for all the subjects shall be of total 70 Marks and of Three hours duration.

- The Theory paper shall consist of Two sections viz. Section I& Section II. Each Section shall consist of total 35 marks.
- Each Section shall comprise of Compulsory Two Long questions of 10 marks each (with one option in the second long question), 02 out of 03 Short Notes of 05 marks each and 05 MCQs of 01 mark each.
- The FIRST long answer question shall be from the “MUST to KNOW” syllabus, the SECOND long answer questions shall be from “GOOD to KNOW” and/or “DESIRABLE to KNOW “syllabus. The short notes and the MCQs shall be a mix of “MUST to KNOW”, “GOOD to KNOW” and/or “DESIRABLE to KNOW”
- There shall be NO theory examination for Pre-clinical Prosthodontics and Pre-clinical Conservative & Endodontics.

6.2.2.2.2. Clinical and /or Practical Examination:

- There shall be practical/clinical examinations in all the subjects except for evidence Based Dentistry (EBD). The Clinical or Practical examination shall aim at examining clinical skills and competence of candidates.
- The Practical examinations for all the subjects shall consist of total 90 marks.
- The Practical examinations for Preclinical Prosthodontic and Preclinical Conservative & Endodontics shall be of 80 marks (including 20 marks for Viva Voce).

6.2.2.2.3 Viva-voce examination:

- The Viva-voce examination shall aim at assessing depth of knowledge, logical reasoning, confidence and verbal communication skills.
- There shall be Viva-voce examination of 20 marks for all the subjects except for Evidence Based Dentistry. Marks obtained in the viva-voce examination shall be added to the marks obtained in the theory examination.

## 7. ELIGIBILITY CRITERIA FOR DECLARING PASS:

7.1. A candidate shall secure an aggregate of 50% of total marks allotted in both- theory and in practical / clinical examination independently, so as to be declared as Pass in the university examination.

- For passing in Theory examination, a candidate shall secure 50% marks in aggregate i.e. marks obtained in university Written examination, Vivavoce examination and Internal assessment (theory) combined together i.e. fifty out of One hundred marks.
- For passing in the university Practical/clinical examination, a candidate shall secure 50% marks in aggregate i.e. Practical / Clinical and Internal Assessment combined together i.e. fifty out of One hundred marks.
- In case of Pre-clinical Prosthodontics and Pre-clinical Conservative Dentistry in II BDS, where there is no written examination, for passing, the candidate shall secure 50% of marks in University Practical examination, Viva voce and Internal Assessment combined together i.e. fifty out of One hundred marks.
- For Evidence Based Dentistry only grades shall be awarded.

7.2. A candidate, securing less than 50% marks shall be declared as Failed in the said examination.

7.3. A candidate, who has passed all the subjects, shall be allowed to appear for the next higher BDS Class University Examination.

## 8. ELIGIBILITY CRITERIA TO APPEAR IN SUPPLEMENTARY EXAMINATION:

8.1. The candidate failing in any subject/subjects of the university examination shall appear for the supplementary examinations.

8.2. The failed candidate shall compulsorily appear in both- Theory as well as Practical / Clinical examination irrespective of failing in either of them.

8.3. The unsuccessful candidate can appear for multiple number of times / attempts to clear the BDS University examination provided he/she should be able to complete the course including 1 year of internship within 9 years from the date of joining the course.

8.4. The failed candidate shall pay the required fees for the failed period.

The Internal assessment marks for the unsuccessful candidate shall be counted from the examinations conducted between the last University examination and forthcoming examination. The internal assessment marks shall be considered as best out of the two (between previous and present internal assessment marks).

## 9. ALLOWED TO KEEP THE TERM (ATKT):

9.1. ATKT will be granted in 1st, 2nd and 3rd year of BDS only if the candidate fails in one subject.

9.2. The ATKT candidate shall undergo all the examinations as scheduled for them from time to time during the period between the last examination and forthcoming examination.

9.3. The ATKT candidate shall pay the required fees for the ATKT period as prescribed by the university.

9.4. The Internal assessment marks for the subject in which ATKT is granted shall be counted from the examinations conducted between the last University examination and forthcoming examination. The internal assessment marks shall be considered as best out of the two (between previous and present internal assessment marks).

9.5. The candidate shall have to pass the ATKT subject before he/she is permitted to appear for the next higher examination.

## 10. AWARD /DISTINCTION/ UNIVERSITY RANKS:

10.1. A candidate, who has successfully passed in all the academic years of BDS course and successfully completed the compulsory rotating one year Internship program, shall be granted a degree of Bachelor of Dental Surgery.

10.2. The successful candidate will be awarded Class/ Distinctions as prescribed by the University guidelines.

10.3. The successful candidate/s who have secured highest marks either subject wise or on aggregate in first attempt shall be declared as Topper in aggregate or in the concerned subject/s.

## SECTION-IV

## BDS COURSE CURRICULUM

## FIRST YEAR BDS

## GENERAL HUMAN ANATOMY

(Including Embryology, Osteology and Histology)

### INTRODUCTION

What is Human Anatomy?
It is a branch of science which deals with the structure of Human Body.

Aim:
The students should know structural, functional, histological and developmental anatomy of head and neck as relevant to first year BDS course

Objectives:

At the end of the First year BDS course in Anatomical Sciences the Undergraduate student is expected to:

1. Know and demonstrate the normal disposition of structures in head and neck region.
2. Know and demonstrate the inter-relationship of various structures.
3. Know and demonstrate the clinical correlation of various structures
4. Know and demonstrate the microscopic structures of various tissues related to head and neck
5. Know and demonstrate the basic components of nervous system with clinical correlates
6. Know and demonstrate the basis of abnormal development
7. Know and demonstrate the sectional anatomy of head and neck and its correlation to modern imaging techniques.
8. Know and identify the microscopic anatomy

**COURSE OUTCOMES ASSESSED:**

Were the students able to**:** Describe the normal disposition of the structures in the body while clinically examining a patient and while conducting clinical procedures. Describe the anatomical basis of disease and injury. Know the microscopic structure of the various tissues, a pre-requisite for understanding of the disease processes. Know the nervous system to locate the site of lesions according to the sensory and or motor deficits encountered. Explain the basis of abnormal development, critical stages of development, effects of teratogens, genetic mutations and environmental hazards. Know the sectional anatomy of head neck and brain to read the features in radiographs and pictures taken by modern imaging techniques. Know the anatomy of cardio-pulmonary resuscitation. To locate various structures of the body and to mark the topography of the living anatomy. To identify various tissues under microscope. To identify the features in radiographs and modern imaging techniques. To detect various congenital abnormalities.

## A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. General Anatomy | |
| 1.1 Introduction, subdivisions of Anatomy | Must to Know |
| 1.2 Anatomical terms and planes | Must to Know |
| 1.3 Connective tissue- Superficial and deep fascia, modifications of deep fascia | Must to Know |
| 1.4 Bone- Classification, Ossification and growing ends of bone, Structure and Blood supply | Must to Know |
| 1.5 Muscles- Classification and mode of action | Must to Know |
| 1.6 Joints- Classification with examples, Typical synovial joint Axis of movement | Must to Know |
| 1.7 Circulatory system including Anastomosis and collateral circulation , Portal system of veins | Must to Know |
| 1.8 Nervous system- Central and peripheral nervous system, Autonomic Nervous System, Reflex arc, Spinal nerve | Must to Know |
| 2. Neuroanatomy | |
| 2.1 Meninges, Dural Venous sinuses | Must to Know |
| 2.2 Subdivisions of nervous system and Ventricles of brain | Must to Know |
| 2.3 Attachment of Cranial Nerves on the base of brain | Good to Know |
| 2.4 Medulla, Pons and Mid brain – localization of cranial nerve nuclei | Must to Know |
| 2.5 $3^{rd}$, $4^{th}$,$5^{th}$, $6^{th}$,$7^{th}$, $9^{th}$ and $12^{th}$ Cranial nerves | Desirable to Know |
| 2.6 $1^{st}$,$2^{nd}$,$10^{th}$ and $11^{th}$ Cranial nerves | Must to Know |

| | |
|---|---|
| 2.7 Pituitary gland | Good to Know |
| 2.8 Blood supply of brain | Desirable to Know |
| 2.9 Functional areas of brain | Desirable to Know |
| 3. Gross Anatomy of Head & Neck | |
| 3.1 Scalp | Must to Know |
| 3.2 Face including facial nerve and lacrimal apparatus | Must to Know |
| 3.3 Cervical fascia- General investing layer, Pre tracheal and Pre vertebral fascia, Carotid sheath and contents | Must to Know |
| 3.4 Anterior and posterior Triangles of neck including and spinal accessory nerve | Must to Know |
| 3.5 Carotid system of arteries, Internal Jugular Vein, Subclavian artery | Must to Know |
| 3.6 Cranial cavity including muscles of eye ball, vessels and nerves of orbit | Must to Know |
| 3.7 Parotid gland and facial nerve | Must to Know |
| 3.8 Temporal and infra temporal fossa including maxillary artery, mandibular nerve and muscles of mastication, Pterygopalatine fossa and maxillary nerve | Must to Know |
| 3.9 Temporo-mandibular joint | Must to Know |
| 3.10 Sub mandibular region including sub mandibular and gland sub lingual salivary glands | Must to Know |
| 3.11 Thyroid and parathyroid gland | Must to Know |
| 3.12 Oral cavity, tongue, Hypoglossal nerve, Hard and soft palate | Must to Know |
| 3.13 Pharynx, Palatine tonsil, pharyngotympanic tube and glossopharyngeal nerve | Must to Know |
| 3.14 Larynx, Nasal cavity and paranasal air sinuses | Must to Know |
| 3.15 Cervical plexus and sympathetic ganglia | Good to Know |
| 3.16 Joints of neck | Must to Know |
| 3.17 Cervical part trachea, esophagus | Must to Know |
| 4. Embryology | |
| 4.1 General embryology complete- Oogenesis, Spermatogenesis, Fertilisation, Placenta, Primitive streak, Neural crest, Bilaminar and Trilaminar Disc, Intra-embryonic mesoderm | Must to Know |
| 4.2 Formation and fate of Notochord | Must to Know |
| 4.3 Branchial apparatus- formation and fate | Must to Know |
| 4.4 Congenital abnormalities of branchial apparatus | Good to Know |
| 4.5 Development of face, hard palate, nasal cavity and paranasal sinuses, | Must to Know |
| 4.6 Congenital Abnormalities, face, palate | Must to Know |
| 4.7 Development of Tongue, thyroid gland and pituitary | Must to Know |
| 4.8Temporo-mandibular joint. | Must to Know |
| 5. Histology | |
| 5.1 General histology Epithelium, Glands, Cartilage, Bone, | Must to Know |

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|---|---|
| Lymphoid tissue, Skeletal, Cardiac and Smooth muscle, Blood Vessels, Nervous Tissue | |
| 5.2Intra membranous and endochondral ossification | Must to Know |
| 5.3Skin, tongue and lip | Must to Know |
| 5.4Salivary glands | Must to Know |
| 5.5Endocrine glands (Thyroid, Para thyroid, Pituitary) | Must to Know |
| 5.6Trachea and esophagus | Must to Know |
| 5.7Fundus of stomach | Desirable to Know |
| 5.8Spinal cord | Desirable to Know |
| 6. Structures important to clinical procedures | Must to Know |
| 6.1 Muscles- Deltoid and Axillary nerve, Gluteus maximus and Sciatic nerve, Vastus lateralis,Triceps and Radial nerve | Must to Know |
| 6.2Veins- Cephalic, Basilar, Median cubital and Long Saphenous | Must to Know |
| 6.3 Arterial pulsations- Axillary, Brachial, Radial, Carotid, Facial, Superficial temporal, Femoral, Popliteal and Dorsalis Pedis | Must to Know |
| 6.4Anatomy of Lumbar puncture | Must to Know |

## B. PRACTICAL:

1. The student will dissect and demonstrate the following:

- Scalp
- Face including facial nerve and lacrimal apparatus
- Cervical fascia- General investing layer, Pre tracheal and Prevertebral fascia, Carotid sheath and contents
- Anterior and posterior Triangles of neck including and spinal accessory nerve
- Carotid system of arteries, Internal Jugular Vein, Subclavian artery
- Cranial cavity including muscles of eye ball, vessels and nerves of orbit
- Parotid gland and facial nerve
- Temporal and infra temporal fossa including maxillary artery, mandibular nerve and muscles of mastication, Pterygopalatine fossa and maxillary nerve.
- Temporo-mandibular joint
- Sub mandibular region including sub mandibular and gland sub lingual salivary glands
- Thyroid and parathyroid gland
- Oral cavity, tongue, Hypoglossal nerve, Hard and soft palate and Pharynx, Palatine tonsil, pharyngotympanic tube and glossopharyngeal nerve
- Larynx
- Nasal cavity and paranasal air sinuses
- Cervical part of trachea and esophagus
- Cervical plexus and sympathetic ganglia
- Joints of neck

- Thoracic and abdominal viscera

**2.** Osteology Demonstration**:**

- Skull
  - Norma verticalis
  - Norma frontalis
  - Norma lateralis
  - Norma Basalis
  - Interior of skull
  - Frontal, Parietal, Occipital and Temporal bones.
  - Maxillary and Sphenoid bones

- Mandible

3. Histology Practical:
   - Epithelium
   - Glands
   - Cartilage
   - Bone
   - Lymphoid tissue
   - Skeletal, Cardiac and smooth muscle.
   - Blood vessels
- Nervous tissue
- Skin, Tongue and Lip
- Salivary glands
- Endocrine glands
- Trachea and Oesophagus.

## C. RECOMMENDED BOOKS

| S.No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Anatomy of Head, Neck and Brain | Vishram Singh | Elsevier |
| 2 | T.B. General Anatomy | Shobha RawlaniShivlalRawlani | Jaypee |
| 3 | T.B. Clinical Embryology | Vishram Singh | Elsevier |
| 4 | Practical Manual of Histology | Neelkanth B Kote | Jaypee |

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|---|---|---|---|
| 5 | Grant's Dissector | Patrick W Tank | Wolters Kluwer |
| 6 | Exam Oriented Anatomy for Dental Students | Dr. S.N.Qazi | CBS |
| 7 | T.B. Human Osteology | I.B.Singh | Jaypee |

REFERENCE BOOKS

| S.No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Clinical Anatomy for Medical Students | Richard S. Snell | Wolters Kluwer |
| 2 | Gray's Anatomy | Williams | Churchill Livingstone |

## A. EXAMINATION SCHEME

a. INTERNAL EXAM

- First internal (Theory/Practical): 20 Marks
- Second internal (Theory/Practical): 20 Marks
- Third Internal (Theory/Practical): 60 Marks

b. University Exam:

As per University rules.

## PHYSIOLOGY

### DEFINITION:

Human physiology is the study of living organs of the body.

### INTRODUCTION:

1. Aim:
   The broad goal of teaching of undergraduate student in Human physiology aims at providing the student comprehensive knowledge of the normal function of the organ systems of the body to facilitate an understanding of the physiological basis of the health and disease.

2. Objectives:
   At the end of the course the student shall be able to
   - Explain the normal functioning of all the organ systems and their interactions for well-coordinated total body function:
   - Assess the relative contribution of each organ system to the maintenance of milieu interieur.
   - Elucidate the physiological aspects of normal growth and development.
   - Describe the physiological response and adaptations to environmental stresses.
   - List the physiological principles underlying pathogenesis and treatment of disease.

3. Scope:
   At the end of the course the student shall be able to
   - Conduct experiments designed for study of physiological phenomena.
   - Interpret experimental / investigative data
   - Distinguish between normal and abnormal data derived as a result of tests which he / she has performed and observed in the laboratory.

### COURSE OUTCOMES ASSESSED:

Were the students able to**:** Explain the normal functioning of all the organ systems and their interactions for well-co-ordinated total body function. Assess the relative contribution of each organ system towards the maintenance of the milieu interior. List the physiological principles underlying the pathogenesis and treatment of disease. Conduct experiments designed for the study of physiological phenomena. Interpret experimental and investigative data. Distinguish between normal and abnormal data derived as a result of tests which he/she has performed and observed in the laboratory.

## A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction | |
| 1.1 Cell | Must to Know |
| 1.2 Tissue | Must to Know |
| 1.3 Organ | Must to Know |
| 2. Structure of Cell | |
| 2.1 Cell Membrane (C.M.) | Must to Know |
| 2.2 Composition of C.M. | Good To Know |
| 2.3Structured Model of C.M. | Desirable To Know |
| 2.4Cytoplasm | Must to Know |
| 2.5Organelle & Their functions | Must to Know |
| 2.6Nucleus | Must to Know |
| 3. Gene | |
| 3.1 Chromosome | Must to Know |
| 3.2 Chromatin | Must to Know |
| 3.3 Gene expression | Good To Know |
| 3.4 Genetic disorder | Desirable To Know |
| 4. Cell Death | Must to Know |
| 5. Cell Adaptation | Must to Know |
| 6. Cell Degeneration | Must to Know |
| 7. Cell Aging | Must to Know |
| 8. Cell Junction - Definition & Classification | Must to Know |
| 9. Tight junction | Must to Know |
| 10. Gap Junction | Must to Know |
| 11. Chemical Synapse | Must to Know |
| 12. Anchoring Junction | Good to know |
| 13. Cell Adhesion Molecule | Desirable to Know |
| 14. Transport Through Cell Membrane – Introduction | Must to Know |
| 15. Basic Mechanism | Must to Know |
| 16. Passive Transport | Must to Know |
| 17. Diffusion | |
| 17.1 Simple | Must to Know |
| 17.2 Facilitated | Must to Know |
| 18. Osmosis | Must to Know |
| 19. Bulk Flow | Good To Know |
| 20. Filtration | Good To Know |
| 21. Factor affecting diffusion | Must to Know |
| 22. Active Transport – Primary, Secondary | Must to Know |
| 23. Endocytosis – Pinocytosis, Phagocytosis | Must to Know |
| 24. Exocytosis | Must to Know |

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|---|---|
| 25. Receptor mediated endocytosis | Good To Know |
| 26. Transcytosis | Good To Know |
| 27. Molecular motors, Ion channel disease | Desirable To Know |
| 28. Homeostasis | |
| 28.1 Introduction | Must to Know |
| 28.2 Mileu Interior | Must to Know |
| 28.3 Claude Bernard Theory | Good to Know |
| 28.4 Mileu Exterior | Desirable to Know |
| 29. Role of Various system | Must to Know |
| 30. Feedback mechanism | Must to Know |
| 31. Regulation of feedback system | Good to Know |
| 32. Altered feedback system | Desirable to Know |
| 33. Acid – Base Balance – Introduction | Must to Know |
| 34. $H^+$ ion and pH | Must to Know |
| 35. Regulation of Acid –Base balance | Must to Know |
| 36. Determination of Acid | Good to Know |
| 37. Disturbance of Acid – Acidosis, Alkalosis | Good to Know |
| 38. Clinical Evaluation | Must to Know |
| 39. Body Fluids | |
| 39.1 Introduction | Must to Know |
| 39.2 Significance | Must to Know |
| 39.3 Composition | Must to Know |
| 39.4 Measurement | Good to Know |
| 39.5 Concentration | Good to Know |
| 39.6 Maintenance | Good to Know |
| 39.7Applied Physiology (Dehydration & Over hydration) | Desirable to Know |
| 40. Blood | |
| 40.1 Introduction | Must to Know |
| 40.2 Properties of blood | Must to Know |
| 40.3 Composition of blood | Must to Know |
| 40.4 Function | Must to Know |
| 40.5 Serum | Good to Know |
| 41. Plasma Protein | |
| 41.1 Introduction | Must to Know |
| 41.2 Normal Values | Must to Know |
| 41.3 Properties | Must to Know |
| 41.4 Origin | Must to Know |
| 41.5 Function | Must to Know |
| 41.6 Seperation | Good to Know |
| 41.7 Plasmapheresis | Desirable to Know |
| 42. RBC | |
| 42.1 Introduction | Must to Know |
| 42.2 Normal Values | Must to Know |
| 42.3 Properties | Must to Know |
| 42.4 Life span & Fate | Must to Know |

| | |
|---|---|
| 42.5 Function | Must to Know |
| 42.6 Physiological Variation in number | Must to Know |
| 42.7 Pathological Variation in number | Good to Know |
| 42.8 Variation in Size | Good to Know |
| 42.9 Variation in structure | Desirable to Know |
| 43. Erythropoesis | |
| 43.1 Definition | Must to Know |
| 43.2 Site of Erythropoesis | Must to Know |
| 43.3 Process of Erythropoesis | Good to Know |
| 43.4 Factors necessary for Erythropoesis | Desirable to Know |
| 44. Haemoglobin and Iron metabolism | |
| 44.1 Introduction | Must to Know |
| 44.2 Normal Value | Must to Know |
| 44.3 Function | Must to Know |
| 44.4 Structure | Must to Know |
| 44.5 Normal Haemoglobin | Must to Know |
| 44.6 Iron metabolism | Must to Know |
| 44.7 Abnormal Haemoglobin | Good to Know |
| 44.8 Synthesis and destruction | Good to Know |
| 44.9 Abnormal Haemoglobin Derivatives | Desirable to Know |
| 45. Erythrocyte Sedimentation Rate | |
| 45.1 Introduction | Must to Know |
| 45.2 Normal Values | Must to Know |
| 45.3 Significance | Must to Know |
| 45.4 Determination | Good to Know |
| 45.5 Variation | Good to Know |
| 45.6 Factors affecting | Desirable to Know |
| 46. Packed Cell Volume | |
| 46.1 Definition | Must to Know |
| 46.2 Significance | Must to Know |
| 46.3 Normal Value | Must to Know |
| 46.4 Blood Indices | Must to Know |
| 46.5 Determination | Good to Know |
| 46.6 Variation | Good to Know |
| 46.7 Calculation of blood indices | Good to Know |
| 47. Anaemia | |
| 47.1 Introduction | Must to Know |
| 47.2 Classification | Must to Know |
| 47.3 Sign and Symptoms | Must to Know |
| 47.4 Investigation | Good to Know |
| 47.5 Treatment | Good to Know |
| 48. Haemolysis and Fragility of RBCs | |
| 48.1 Definition | Must to Know |
| 48.2 Process of haemolysis | Must to Know |
| 48.3 Fragility test | Good to Know |

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|---|---|
| 48.4 Condition when haemolysis occur | Good to Know |
| 48.5 Haemolysin | Desirable to Know |
| 49. White Blood Cells | |
| 49.1 Introduction | Must to Know |
| 49.2 Classification | Must to Know |
| 49.3 Morphology | Must to Know |
| 49.4 Normal Count | Must to Know |
| 49.5 Physiological Variation | Must to Know |
| 49.6 Function | Must to Know |
| 49.7 Properties | Good to Know |
| 49.8 Lifespan & Fate | Good to Know |
| 49.9 Pathological Variation | Good to Know |
| 49.10 Leucopoiesis | Desirable to Know |
| 50. Immunity | |
| 50.1 Definition and Types | Must to Know |
| 50.2 Development & Processing of lymphocyte | Must to Know |
| 50.3 Antigen & Antibody | Must to Know |
| 50.4 Cell mediated immunity | Must to Know |
| 50.5 Antibody mediated immunity | Must to Know |
| 50.6 Natural Killer cell | Good to Know |
| 50.7 Cytokines | Good to Know |
| 50.8 Immunization | Good to Know |
| 50.9 Allergy | Good to Know |
| 50.10 Hypersensitivity | Desirable to Know |
| 50.11 Immune deficiency disease | Desirable to Know |
| 50.12 Autoimmune Disease | Desirable to Know |
| 51. Platelets | |
| 51.1 Introduction | Must to Know |
| 51.2 Structure & composition | Must to Know |
| 51.3 Normal Count | Must to Know |
| 51.4 Physiological Variation | Must to Know |
| 51.5 Function | Must to Know |
| 51.6 Life span & Fate | Must to Know |
| 51.7 Pathological variation | Good to Know |
| 51.8 Activators & Inhibitors | Good to Know |
| 51.9 Development | Good to Know |
| 51.10 Platelet disorder & management | Desirable to Know |
| 51.11 Purpura | Desirable to Know |
| 52. Hemostasis & Coagulation of Blood | |
| 52.1 Definition | Must to Know |
| 52.2 Stages of hemostasis | Must to Know |
| 52.3 Factors involved in clotting | Must to Know |
| 52.4 Sequence of clotting mechanism | Must to Know |
| 52.5 Blood clot | Must to Know |
| 53. Blood Groups & Blood transfusion | |

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|---|---|
| 53.1 Introduction | Must to Know |
| 53.2 ABO blood group system | Must to Know |
| 53.3 Rh Factor | Must to Know |
| 53.4 Importance of knowing blood group | Must to Know |
| 53.5 Inheritance of blood group | Good to Know |
| 53.6 Transfusion reaction | Good to Know |
| 53.7 Autologus transfusion | Good to Know |
| 53.8 Haemolytic disease of newborn | Desirable to Know |
| 53.9 Other blood group system | Desirable to Know |
| 53.10 Blood substitute | Desirable to Know |
| 54. Miscellaneous | |
| 54.1 Blood volume | Must to Know |
| 54.2 Reticuloendothelial system | Must to Know |
| 54.3 Spleen | Must to Know |
| 54.4 Lymphatic system & Lymph | Must to Know |
| 54.5 Tissue fluid &Oedema | Must to Know |
| 55. Nerve & Muscle Physiology | |
| 55.1 Classification of muscles | Must to Know |
| 55.2 Muscle Mass | Must to Know |
| 55.3 Muscle fiber | Must to Know |
| 55.4 Myofibril | Must to Know |
| 55.5 Sarcomere | Must to Know |
| 55.6 Contractile protein | Must to Know |
| 55.7 Sarcotubular system | Must to Know |
| 55.8 Other proteins of the muscle | Good to Know |
| 55.9 Composition | Desirable to Know |
| 56. Properties of Skeletal Muscle | |
| 56.1 Excitability | Must to Know |
| 56.2 Contractibility | Must to Know |
| 56.3 Refractory period | Must to Know |
| 56.4 Muscle Tone | Good to Know |
| 56.5 Length-Tension relationship | Good to Know |
| 56.6 Hypertonia | Desirable to Know |
| 56.7 Hypotonia | Desirable to Know |
| 57. Changes during muscular contraction | |
| 57.1 Introduction | Must to Know |
| 57.2 Electical Changes | Must to Know |
| 57.3 Physical Changes | Must to Know |
| 57.4 Compound action potential | Good to Know |
| 57.5 Graded potential | Good to Know |
| 57.6 Molecular basis of contraction | Good to Know |
| 57.7 Chemical changes | Good to Know |
| 57.8 Thermal Changes | Good to Know |
| 57.9 Patch clamp technique | Desirable to Know |
| 58. Neuromuscular Junction | |

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| 58.1 Definition & Structure | Must to Know |
| 58.2 NM transmission | Must to Know |
| 58.3 Motor unit | Must to Know |
| 58.4 NM Blocker | Good to Know |
| 58.5 NM Stimulator | Good to Know |
| 58.6 NM Disease | Desirable to Know |
| 59. Smooth Muscle | |
| 59.1 Distribution | Must to Know |
| 59.2 Function | Must to Know |
| 59.3 Types | Must to Know |
| 59.4 Contractile process | Must to Know |
| 59.5 Control | Must to Know |
| 59.6 Structure | Good to Know |
| 59.7 Electrical activity in single & multiple unit | Desirable to Know |
| 60. Electromyogram and Disorder of SK Muscle & Endurance of Muscle | |
| 60.1 Definition | Must to Know |
| 60.2 Electromyogram | Must to Know |
| 60.3 Endurance of Muscle | Good to Know |
| 60.4 Electromyographic technique | Good to Know |
| 60.5 Myopathy | Desirable to Know |
| 61. Digestive System | |
| 61.1 Introduction | Must to Know |
| 61.2 General structure | Must to Know |
| 61.3 Innervation | Must to Know |
| 61.3 Salivary gland | Must to Know |
| 61.4 Stomach | Must to Know |
| 61.5 Exocrine function & regulation of pancreas | Must to Know |
| 61.6 Liver | Must to Know |
| 61.7 Function & Regulation Gall Bladder | Must to Know |
| 61.8 Motor Movement of GIT – Peristalsis, Segmentation, Deglutition, Defaecation, Gastric Emptying | Must to Know |
| 61.9 Composition of saliva | Good to Know |
| 61.10 Composition of gastric juice | Good to Know |
| 61.11 Composition of Pancreatic juice | Good to Know |
| 61.12 Succus entericus | Good to Know |
| 61.13 Mastication | Good to Know |
| 61.14 Gastric filling | Good to Know |
| 61.15 Haustration | Good to Know |
| 61.16 Structure of salivary gland | Desirable to Know |
| 61.17 Peptic ulcer | Desirable to Know |
| 61.18 Pancreatitis | Desirable to Know |
| 61.19 Cholecystitis | Desirable to Know |
| 61.20 Structure of pancreas & gallbladder | Desirable to Know |
| 61.21 Liver structure | Desirable to Know |
| 61.22 Choleretics | Desirable to Know |

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|---|---|
| 61.23 Cholegogue | Desirable to Know |
| 61.24 Paralytic ileus | Desirable to Know |
| 62. Excretory System | |
| 62.1 Structure & function of kidney | Must to Know |
| 62.2 Functional unit : Nephron (Function of different part) | Must to Know |
| 62.3 Juxta Glomerular Apprarus | Must to Know |
| 62.3 Glomerular Filtration Rate – Definition, Normal Value, Factor affecting | Must to Know |
| 62.4 Tubular Reabsorption (Na,K, Glu, Water) | Must to Know |
| 62.5 Tubular secretion | Must to Know |
| 62.6 Counter current mechanism | Must to Know |
| 62.7 Counter current multiplier system | Must to Know |
| 62.8 Role of kidney in regulation of pH | Must to Know |
| 62.9 Micturition | Must to Know |
| 62.10 Renal blood flow | Good to Know |
| 62.11 Determination of GFR | Good to Know |
| 62.12 Acidosis | Good to Know |
| 62.13 Alkalosis | Good to Know |
| 62.14 Mechanism of concentration & dilution of urine | Good to Know |
| 62.15 Anatomy & Innervation of bladder | Good to Know |
| 62.16 Renal failure | Desirable to Know |
| 63. Body Temperature & Skin | |
| 63.1 Blood flow: AV Shunting | Must to Know |
| 63.2 Homeostasis of Temperature | Must to Know |
| 63.3 Anatomy | Good to Know |
| 63.4 Hypothlamic regulation (Set point) | Good to Know |
| 63.5 Themogenesis | Good to Know |
| 63.6 Pyrexia | Desirable to Know |
| 63.7 Pyrogens | Desirable to Know |
| 64. Endocrinology | |
| 64.1 General endocrinology | Must to Know |
| 64.2 Enumeration | Must to Know |
| 64.3 Hormone | Must to Know |
| 64.4 General function | Must to Know |
| 64.5 Properties | Must to Know |
| 66.6 Mechanism of secretion | Must to Know |
| 66.7 Transport | Must to Know |
| 66.8 Regulation | Must to Know |
| 66.9 Anterior Pituitary Hormone | Must to Know |
| 66.10 Posterior Pituitary Hormone | Must to Know |
| 66.11 Thyroid – Synthesis, Secretion, Transport, Action | Must to Know |
| 66.12 Adrenal Cortex & Medulla Hormone – Synthesis, Secretion, Action | Must to Know |
| 66.13 Regulation of Blood calcium level | Must to Know |
| 66.14 Chemistry | Good to Know |

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| 66.15 Metabolism | Good to Know |
| 66.16 Disorders of Anterior Pituitary Hormone | Desirable to Know |
| 66.17 Disorders of Posterior Pituitary Hormone | Desirable to Know |
| 66.18 Thyroid disorder | Desirable to Know |
| 66.19 Adrenal Disorder | Desirable to Know |
| 67. Reproductive System | |
| 67.1 Menstrual cycle | Must to Know |
| 67.2 Function of oestrogen& progesterone | Must to Know |
| 67.3 Pregnancy | Must to Know |
| 67.4 Parturition | Must to Know |
| 67.5 Lactation | Must to Know |
| 67.6 Spermatogenesis | Must to Know |
| 67.7 Family planning in Male & Female | Must to Know |
| 67.8 Function of placenta | Must to Know |
| 67.9 Anatomy of male & female sex organ | Good to Know |
| 67.10 Test of ovulation | Good to Know |
| 67.11 Function of ovary | Good to Know |
| 67.12 Fertilization | Good to Know |
| 67.13 Implantation | Good to Know |
| 67.14 Pregnancy test | Good to Know |
| 67.15 Composition of milk | Good to Know |
| 67.16 Milk ejection | Good to Know |
| 67.17 Semen | Good to Know |
| 67.18 Contraceptive pills | Good to Know |
| 67.19 Sex differentiation | Desirable to Know |
| 67.20 Factor controlling lactation | Desirable to Know |
| 67.21 Development of secondary sexual characters | Desirable to Know |
| 68. Cardiovascular System | |
| 68.1 Functional anatomy & innervations of heart | Must to Know |
| 68.2 Cardiac impulse | Must to Know |
| 68.3 Electrocardiogram (ECG) | Must to Know |
| 68.4 Heart Rate – Normal, Regulation | Must to Know |
| 68.5 Cardiac Output – Definition, Normal Values, Determinants, Regulation | Must to Know |
| 68.6 Arterial blood pressure – Definition, Normal Value, Determination, Regulation, Measurement | Must to Know |
| 68.7 Cardiac Cycle | Must to Know |
| 68.8 Volume changes in ventricle | Good to Know |
| 68.9 Jugular venous pulse (JVP) | Good to Know |
| 68.10 Arterial Pulse | Good to Know |
| 68.11 Heart block | Good to Know |
| 68.12 Murmurs | Good to Know |
| 68.13 Coronary circulation | Good to Know |
| 68.14 Two changes in ECG in Myocardial infarction | Good to Know |
| 68.15 Variation in HR | Good to Know |

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| 68.16 Variation in CO | Good to Know |
| 68.17 Measurement of CO | Good to Know |
| 68.18 Abnormal JVP | Desirable to Know |
| 68.19 Angina Pectoris | Desirable to Know |
| 68.20 Myocardial infarction | Desirable to Know |
| 68.21 Factors changing preload and afterload in heart | Desirable to Know |
| 69. Respiratory System | |
| 69.1 Physiology of respiration – External, Internal | Must to Know |
| 69.2 Respiratory movement | Must to Know |
| 69.3 Muscle of respiration (Diaphragm) | Must to Know |
| 69.4 Mechanics of Respiration | Must to Know |
| 69.5 Surfactant | Must to Know |
| 69.6 Compliance | Must to Know |
| 69.7 Spirometry – Volume, Capacity, Definition, Normal Value | Must to Know |
| 69.8 Exchanges of gases – Diffusion Capacity, Factor affecting | Must to Know |
| 69.9 Transport of Oxygen & CO2 in blood | Must to Know |
| 69.9.1 O2 – Co2 dissociation curve | Must to Know |
| 69.9.2 Bohr's effect | Must to Know |
| 69.9.3 Haldane Effect | Must to Know |
| 69.9.4 Double bohr's effect | Must to Know |
| 69.10 Regulation of respiration | Must to Know |
| 69.10.1 Neural (Medullary Pontine Centre) | Must to Know |
| 69.10.2 Chemical (Chemoreceptor) | Must to Know |
| 69.11 Functional anatomy & passage | Good to Know |
| 69.12 Accessory Muscle of respiration | Good to Know |
| 69.13 Intrapleural & Pulmonary pressure(changes in respiration) | Good to Know |
| 69.14 Work of breathing | Good to Know |
| 69.15 Factor affecting FEV & its variation | Good to Know |
| 69.16 Obstructive disease | Good to Know |
| 69.17 Restrictive disease | Good to Know |
| 69.18 Dyspnoea | Good to Know |
| 69.19 Pulmonary ventilation | Good to Know |
| 69.20 Alveolar ventilation | Good to Know |
| 69.21 Dead space ventilation | Good to Know |
| 69.22 Ventilation-Perfusion ratio | Good to Know |
| 69.23 Composition of inspired air, alveolar air, Expired air | Good to Know |
| 69.24 Ondine's Curse | Good to Know |
| 69.25 Prebotzinger's complex | Good to Know |
| 69.26 Hypoxia | Good to Know |
| 69.27 Dyspnoea | Good to Know |
| 69.28 Cyanosis | Good to Know |
| 69.29 Artificial Respiration | Good to Know |
| 69.30 Sleep apnoea | Desirable to Know |
| 69.31 Periodic breathing | Desirable to Know |
| 69.32 Pulmonary function test | Desirable to Know |

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| 70. Central Nervous System | |
| 70.1 Organization of CNS | Must to Know |
| 70.2 Neuronal organization at spinal cord level | Must to Know |
| 70.3 Ascending Tracts | Must to Know |
| 70.4 Descending Tracts | Must to Know |
| 70.5 Synapse | Must to Know |
| 70.6 Receptors | Must to Know |
| 70.7 Reflexes | Must to Know |
| 70.8 Sensation & Tracts | Must to Know |
| 70.9 Physiology of Pain | Must to Know |
| 70.10 Function of - Cerebral cortex, Cerebellum, CSF | Must to Know |
| 70.11 Autonomic nervous system – Fight & Flight response, Rest & Digest response | Must to Know |
| 70.12 Function of Hypothalamus | Good to Know |
| 70.13 Regulation of Autonomic function | Good to Know |
| 70.14 Higher function of brain – Memory, Learning, Motivation | Good to Know |
| 70.15 Function of limbic system | Good to Know |
| 70.16 Sleep (REM-NREM) | Good to Know |
| 70.17 Parkinson sign | Good to Know |
| 70.18 Function of Thalamus | Desirable to Know |
| 70.19 Applied physiology – Cerebellum, Basal Ganglia, Hypothalamus, Brainstem | Desirable to Know |
| 70.20 Autonomic function test | Desirable to Know |
| 70.21 Autonomic disturbance | Desirable to Know |
| 70.22 EEG | Desirable to Know |
| 71. Special Sense | |
| 71.1 Vision | Must to Know |
| 71.2 Hearing | Must to Know |
| 71.3 Physiology of hearing | Must to Know |
| 71.4 Function of cochlea, organ of corti | Must to Know |
| 71.5 Function of outer. middle, inner ear | Must to Know |
| 71.6 Taste & its types | Must to Know |
| 71.7 Taste buds | Must to Know |
| 71.8 Primary taste sensation | Must to Know |
| 71.9 Smell | Must to Know |
| 71.10 Receptors | Must to Know |
| 71.11 Anatomy of eyeball | Good to Know |
| 71.12 Function of iris | Good to Know |
| 71.13 Aqueous humor | Good to Know |
| 71.14 Visual pathway | Good to Know |
| 71.15 Anatomic consideration | Good to Know |
| 71.16 Auditory pathway & area | Good to Know |
| 71.17 Lesion of visual pathway | Desirable to Know |
| 71.18 Blindness | Desirable to Know |
| 71.19 Deafness | Desirable to Know |

| | | |
|---|---|---|
| 71.20 | Auditory function test | Desirable to Know |
| 71.21 | Altered taste sensation | Desirable to Know |
| 71.22 | Anosmia | Desirable to Know |
| 71.23 | Parosmia | Desirable to Know |

## B. Practical work quota

1. Practical exercise

| To be done by Students | | Hours |
|---|---|---|
| 1. | Study of Microscope and its uses | 02 |
| 2. | Collection of blood and study of haemocytometer | 02 |
| 3. | Haemoglobinometry | 02 |
| 4. | Determination of RBC count | 08 |
| 5. | Determination of WBC count | 04 |
| 6. | Determination of blood groups | 02 |
| 7. | Leishman's staining and differential leucocyte count | 10 |
| 8. | Calculation of blood indices | 02 |
| 9. | Determination of bleeding time | 01 |
| 10. | Determination of clotting time | 01 |
| 11. | Blood pressure recording | 04 |
| 12. | Auscultation of Heart sounds | - |

1. Demonstrations (only)

| | | |
|---|---|---|
| 1. | Determination of ESR | 02 |
| 2. | Determination of PCV | 02 |
| 3. | Determination of specific gravity | 02 |
| 4. | Fragility test for RBC | 02 |
| 5. | Clinical examination of chest | 02 |
| 6. | Determination of vital capacity | 02 |
| 7. | Artificial respiration | 02 |
| 8. | Demonstration of reflexes | 02 |

| | | |
|---|---|---|
| 9. | Activity of frogs heart and effects of drugs | 02 |
| | Total | 60 |

## C. Books Recommended

| Sr no. | Author | Name of Book | Edition | Publisher |
|---|---|---|---|---|
| 1. | Guyton | Textbook of Physiology | 12th Edition | Elsevier |
| 2. | Ganong | Review of Medical Physiology | 24rd Edition | Lange Basic Science |
| 3. | A.K.Jain | Human Physiology for BDS students | 1st Edition | Arya |
| 4. | Chaudhary | Concise Medical Physiology | 2nd Edition | NCBA |
| 5. | Indu Khurana | Textbook of Medical Physiology | 1st Edition | Elsevier |
| 6. | K Sembulingam | Essential of Medical Physiology | 5th Edition | Jaypee |
| 7. | Chaterjee | Human Physiology | 10th Edition | Current distribution |
| 8. | Vander | Human Physiology | 12th Edition | McGraw-Hill |

## REFERENCE BOOKS

| Sr. no. | Title | Author | Latest Edition | Publisher |
|---|---|---|---|---|
| 1 | Physiolgy | Berne & Levy | 6th Edition | Mosby/Elsevier |
| 2 | Physiological basis of medical practice | Best & Taylor | 10th Edition | Williams & Wilkins Co |
| 3 | Medical Physiology | Boron & Boulpaep | 2nd Edition | Elsevier |

PRACTICAL BOOKS FOR EXPERIMENTAL PHYSIOLOGY

| Author | Title | Edition | Publisher |
|---|---|---|---|
| Ranade | Practical Physiology | 4th Edition | |
| CL Ghai | A Textbook of Practical Physiology | 7th edition | jaypee |
| AK Jain | Manual Practical for BDS | 1st edition | Arya |
| GK Pal | Textbook of Practical Physiology | 3rd edition | Orient |
| Hutchison's | Clinical Method | 20th edition | SaunderElesevier |

## B. EXAMINATION SCHEME

c. INTERNAL EXAM

- First internal (Theory/Practical): 20 Marks
- Second internal (Theory/Practical): 20 Marks
- Third Internal (Theory/Practical): 60 Marks

d. University Exam:

As per University rules

## BIOCHEMISTRY

Aim:

The broad goal of the teaching of undergraduate students in Biochemistry is to provide a sound knowledge and make them understand the scientific basis of the life processes at the molecular level so that they can apply this acquired knowledge in solving clinical problems.

Objectives:

The objective is dealt under three headings,

(a) Knowledge and understanding,
(b) Skills and
(c) Attitudes which will be dealt during the course

Course outcomes assessed:

Were the students able to**:** Explain the normal functioning of all the organ systems and their interactions for well-co-ordinated total body function. Assess the relative contribution of each organ system towards the maintenance of the milieu interior. List the physiological principles underlying the pathogenesis and treatment of disease. Conduct experiments designed for the study of physiological phenomena. Interpret experimental and investigative data. Distinguish between normal and abnormal data derived as a result of tests which he/she has performed and observed in the laboratory.

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT:

1. Chemistry of Bioorganic Molecules

1.1 Carbohydrates Chemistry

1.1.1. Definition
1.1.2. Biological importance
1.1.3. Classification.
1.1.4. Monosaccharides
1.1.5. Isomerism
1.1.6. Glycosaminoglycans
1.1.7. Anomerism
1.1.8. Sugar derivatives
1.1.9. Disaccharides
1.1.10. Polysaccharides
1.1.11. Structures of starch and glycogen.

2. Lipids Chemistry

- 2.1. Definition biological
- 2.2. Importance and Classification
- 2.3. Fatty Acids.
- 2.4. Compound lipids.
- 2.5. Phospholipids
- 2.6. Lipoproteins
    - 2.6.1. Formation
    - 2.6.2. Function
- 2.7. Cholesterol
- 2.8. Micelle
- 2.9. Prostaglandins
- 2.10 Bimolecular leaflet.

3. Proteins Chemistry
    - 3.1. Biological importance
    - 3.2. Amino acids
        - 3.2.1. Classification.
        - 3.2.2. Introduction to peptides
    - 3.3. Proteins
        - 3.3.1. Simple and conjugated
        - 3.3.2. Globular and fibrous
        - 3.3.3. Classification of amino acids
    - 3.4. Plasma proteins
        - 3.4.1. Classification and separation.
        - 3.4.2. Functions of Albumin.
        - 3.4.3. A brief account of immunoglobulins.
        - 3.4.4. Denaturation.

4. Nucleic acids Chemistry
    - 4.1. Building units
    - 4.2. Nucleotides
    - 4.3. Outline structure of DNA and RNA.

5. Nutrition
    - 5.1. Energy needs
        - 5.1.1. Basal metabolic rate
        - 5.1.2. Dietary carbohydrates
        - 5.1.3. Fibers
        - 5.1.4. Dietary lipids
        - 5.1.5. Essential fatty acids
        - 5.1.6. Essential amino acids
        - 5.1.7. Nitrogen balance
    - 5.2. Balanced diet
        - 5.2.1. Fibers
        - 5.2.2. SDA
        - 5.2.3. Protein Energy Malnutrition

5.2.3.1. Kwashiorkor
5.2.3.2. Marasmus.

6. Vitamins
   6.1. Definition
   6.2. Classification of vitamins.
   6.3. Daily requirement, source and deficiency symptoms of fat & water soluble vitamins (brief account of water soluble vitamin is required with biochemical function
   6.4. Introduction to antivitamins and hypervitaminosis.

7. Energy metabolism
   7.1. Carbohydrates Metabolism
      7.1.1. Digestion and absorption
      7.1.2. Glucose Transporters
      7.1.3. Outlines of Glycolysis
      7.1.4. Pyruvate Oxidation
      7.1.5. Citric acid cycle.
      7.1.6. Importance of pentose phosphate pathway
      7.1.7. Formation of glucuronic acid.
      7.1.8. Gluconeogenesis.
      7.1.9. Rapoport Lubering cycle
      7.1.10. Glycogenesis
      7.1.11. Glycogenolysis
      7.1.12. Regulation of Blood Glucose.
      7.1.13. Diabetes mellitus and related disorders.
      7.1.14. Evaluation of glycaemic status
      7.1.15. Glycogen storage disorders
      7.1.16. Glucose 6-phosphate dehydrogenase deficiency

8. Lipid Metabolism
   8.1 Digestion and absorption
   8.2 Adipose tissue metabolism
   8.3. Beta oxidation of fatty acids
   8.4. Ketone body formation and utilization
   8.5 Lipogenesis
   8.6. Lipolysis.
   8.7. Biochemical evaluation.
   8.8. Hyperlipoproteinemia
   8.9. Atherosclerosis
   8.10. Fatty liver.

9. Protein Metabolism
   9.1. Digestion & absorption
   9.2. Nitrogen balance formation
   9.3. Fates of ammonia
   9.4. Ammonia metabolism

9.4.1. Deamination
9.4.2. Transmination
9.4.3. Transdeamination
9.4.4. Decarboxylation
9.4.5. Transmethylation

9.5. Urea formation

9.5.1. Brief introduction about metabolism of phenyl alanine, tyrosine, methionine, glycine. Phenylketonuria, Albinism, Alkaptonuria.

10. Metabolic interrelationship of carbohydrates, lipids and proteins metabolism.

11. Special Aspects of Metabolism

11.1 Detoxication mechanisms: Brief outline in the detoxification.

12. Biochemical Genetics and Protein Synthesis

12.1. Introduction to nucleotides

12.1.1. Formation and Degradation.

12.2. DNA as genetic material.

12.2.1. Introduction to replication and transcription.
12.2.2. Forms and functions of RNA.

12.3. Genetic code and mutation.
12.4. Outline of translation process.
12.5. Antimetabolites and antibiotics interfering in replication
12.6. Transcription
12.7. Translation.

13. Enzyme and Metabolic Regulation

13.1 Enzymes

13.1.1. Definition
13.1.2. Classification
13.1.3. Specificity
13.1.4. Active site
13.1.5. Cofactors.
13.1.6. Effect of pH
13.1.7. Temperature
13.1.8. Substrate concentration
13.1.9. Introduction to enzyme inhibitors
13.1.10. Proenzymes
13.1.11. Isoenzymes
13.1.12. Clinical enzymology
13.1.13. Introduction to allosteric regulation
13.1.14. Covalent modification and regulation by induction/repression.

14. Structural Components and Blood Proteins

14. 1. Connective tissue

14.1.1. Brief outline of structure

14.1.2. Synthesis
14.1.3. Function of collagen and elastin.

15. Kidney Function Test, Liver Function Test, Gastric Function Test 15.1. Brief introduction to kidney function tests
    15.1.1. Brief outline of Urea clearance test
    15.1.2. Creatinine Clearance test
    15.2. Liver function test
    15.2.1. Brief outline of tests for liver function
    15.2.2. Galactose tolerance test
    15.2.3. Van den Bergh reaction
    15.2.4. Albumin / Globulin Ratio
    15.2.5. Bromsulphathalein Excretion test
    15.2.6. Serum enzyme markers
    15.2.7. Jaundice
    15.3. Gastric function tests
    15.3.1. Gastric function
    15.3.2. Hydrochloric acid secretion
    15.3.3. Assessment of free and total acidity
    15.3.4. Brief outline of pancreatic function test

16. Acid Base Balance
    16.1. Acid base regulation (role of the buffer, kidney, lungs)
    16.2. Acid base imbalance.

17. Water and Electrolyte Balance
    17.1. A brief introduction to the following topics body water compartments
    17.2. Osmolality
    17.3. Electrolyte concentration of body fluid compartments
    17.4. Regulation of Sodium and water balance
    17.5. Renin Angiotensin system
    17.6. Clinical application of sodium, potassium, chloride.

18. Haemoglobin Chemistry and Metabolism
    18.1. Structure and functions.
    18.2. Types of normal and Haemoglobin derivatives.
    18.3. Brief introduction to heme synthesis and degradation.
    18.4. Hemoglobinopathies

19. Mineral
    19.1. Sources
    19.2. Absorption
    19.3. Transport
    19.4. Requirement
    19.5. Daily requirement
    19.6. Metabolism

19.7. Hormonal regulation of metabolism
19.8. Disorders
19.9. Toxicity associated with Calcium, Phosphorus, Iron, Iodine, fluoride.

20. Biological Oxidation
    20.1. General concept of oxidation and reduction.
    20.2. Role of mitochondria
    20.3. High energy compounds
    20.4. Electron transport chain.
    20.5. Substrate level
    20.6. Oxidative phosphorylation
    20.7. Role of uncouplers and inhibitors.

21. Cancer
    21.1. Introduction to cancer
    21.2. Etiology
    21.3. Chemical carcinogens
    21.4. Outline mechanism of carcinogenesis.
    21.5. Introduction to the following terms and their importance
        21.5.1. Tumour markers
        21.5.2. Oncogenes
        21.5.3. Viruses.

22. Hormone:
    22.1 Introduction to secondary messenger (cAMP, calcium ion, inositol triphosphate).
    22.2. Brief outline of mechanism of hormone action

APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction to biochemistry and its scope in dentistry | Desirable to Know |
| 2. Carbohydrates | |
| 2.1 Definition | Must to Know |
| 2.2 Classification | Must to Know |
| 2.3 Isomerism of Sugars | Must to Know |
| 2.4 Physiologically important mono, di and polysaccharides | Must to Know |
| 2.5 Glycogen, starch, cellulose | Must to Know |
| 2.6 Mucopolysaccharides - hyaluronic acid, chondroitin sulphate, heparin. | Must to Know |
| 3. Amino Acids | |
| 3.1 Classification based on structure and nutritional importance | Must to Know |
| 3.2 Optical activity | Must to Know |
| 3.3 Isoelectric pH | Must to Know |
| 3.4 Physiologically active peptides | Must to Know |
| 4. Proteins | |
| 4.1 Definition | Must to Know |
| 4.2 Functions | Must to Know |
| 4.3 Classification | Must to Know |
| 4.4 Structure | Must to Know |
| 4.5 Denaturation | Must to Know |
| 4.6 Plasma Proteins and their separation by electrophoresis | Must to Know |
| 4.7 Immunoglobulins | Must to Know |
| 4.8 Haemoglobin and its abnormal forms | Must to Know |
| 4.9 Special features and organisation of Proteins, collagen, structure and composition, muscle | Desirable to Know |
| 5. Lipids | |
| 5.1 Definition | Must to Know |
| 5.2 Functions | Must to Know |
| 5.3 Classification | Must to Know |
| 5.4 Fatty Acids | Must to Know |
| 5.5 Neutral Fats | Must to Know |
| 5.6 Phospholipids | Must to Know |
| 5.7 Cholesterol | Must to Know |
| 5.8 Lipoproteins | Must to Know |
| 6. Nucleic Acids | |
| 6.1 Composition | Must to Know |
| 6.2 Structure & Types of Deoxy ribonucleic acid (DNA) & Ribonucleic acid (RNA) | Must to Know |
| 6.3 Nucleosides and Nucleotides and their importance | Must to Know |
| 7. Vitamins | |
| 7.1 Definition | Must to Know |

| | |
|---|---|
| 7.2Classification, Chemistry, Sources, Requirement, Function, Metabolic role and Deficiency signs of vitamins: A, D, E, K, C,Thiamin, Riboflavin, Niacin, Pyridoxine, Folic Acid, Cyanocobalamin. | Must to Know |
| 8. Genetic Code | Desirable to know |
| 9. Enzymes | |
| 9.1 Definition | Must to Know |
| 9.2 Classification | Must to Know |
| 9.3 Chemical nature | Must to Know |
| 9.4 Enzyme specificity, mechanism of action | Must to Know |
| 9.5 Properties of enzymes | Must to Know |
| 9.6 Coenzymes and cofactors | Must to Know |
| 9.7 Holoenzyme | Must to Know |
| 9.8 Proenzyme | Must to Know |
| 9.9 Isoenzyme | Must to Know |
| 9.10 Factors influencing enzyme activity | Must to Know |
| 9.11 Enzyme inhibition-types and examples | Must to Know |
| 10. Diagnostic enzymes | Desirable to Know |
| 11. Carbohydrate Metabolism | |
| 11.1 Digestion and absorption of carbohydrates | Must to Know |
| 11.2 Glycolysis | Must to Know |
| 11.3 Cori's cycle | Must to Know |
| 11.4 Citric acid cycle | Must to Know |
| 11.5 Energetics of glucose oxidation | Must to Know |
| 11.6 Glycogenolysis | Must to Know |
| 11.7 Glycogenesis | Must to Know |
| 11.8 Hexose monophosphate shunt | Must to Know |
| 11.9 Regulation of blood glucose | Must to Know |
| 12.Fermentation, biochemical changes during muscular contraction, electron transport chain, oxidative phoaphorylation, respiratory poisons, oxygen toxicity, gluconeogenesis, glycogen storage disorders. | Desirable to know |
| 13. Lipid Metabolism | |
| 13.1 Digestion and absorption of lipid | Must to Know |
| 13.2 Beta oxidation of fatty acids and its energetic | Must to Know |
| 13.3 Ketone body formation | Must to Know |
| 13.4 Utilization | Must to Know |
| 13.5 Ketoacidosis | Must to Know |
| 14. Synthesis of palmitic acid and triglycerides, fatty liver, and lipotropic action, metabolism during starvation | Desirable to know |
| 15. Protein Metabolism | |
| 15.1 Digestion and absorption of Amino acids | Must to Know |
| 15.2 Synthesis of Proteins | Must to Know |
| 15.3 Deamination of mino acids | Must to Know |
| 15.4 Transamination | Must to Know |

| | |
|---|---|
| 15.5 Decarboxylation | Must to Know |
| 15.6 Production and fate of ammonia | Must to Know |
| 15.7 Urea cycle pathway | Must to Know |
| 15.8 Methionine metabolism | Must to Know |
| 15.9 Phenylalanine metabolism | Must to Know |
| 15.10 Phenylketonuria, albinism, Alkaptouria | Must to Know |
| 16. Glycine metabolism, Synthesis of important products like creatine, noradrenaline, adrenaline, thyroxin, serotonine, heme from amino acids. | Desirable to know |
| 17. Nutrition and Dietics | |
| 17.1 Dietary factors | Must to Know |
| 17.2 Basal metabolic rate | Must to Know |
| 17.3 Biological value of protein | Must to Know |
| 17.4 Glucose sparing action | Must to Know |
| 17.5 Essential amino acids | Must to Know |
| 17.6 Dietary fibre | Must to Know |
| 17.7 Essential fatty acids | Must to Know |
| 17.8 Balanced diet | Must to Know |
| 18. Principles of calorimetry, Respiratory quotient, Specific Dynamic Action of foods,protein- calorie malnutrition (kwashiorkor and marasmus),nitrogen balance, milk-composition and functions, determination of Basal Metabolic Rate (BMR) | Desirable to know |
| 19. Mineral metabolism<br>Distribution, sources, functions, requirements, aborption, metabolism, effect of deficiencies of - | |
| 19.1 Calcium and phosphorus | Must to Know |
| 19.2 Iron | Must to Know |
| 19.3 Iodine | Must to Know |
| 19.4 Fluorine | Must to Know |
| 20. Liver Function Tests | |
| 20.1 Liver function tests | Must to Know |
| 20.2 Importance of alkaline phosphatase | Must to Know |
| 20.3 Galacose tolerance test | Must to Know |
| 21.Van den Bergh reaction Albumin /Globulin Ratio, Bromsulphathalein, Excretion test Serum Glutamate, Pyruvate Transaminase (SGPT) and other enzymes | Desirable to know |
| 22. pH and its biological importance | |
| 22.1 Acids and bases | Must to Know |
| 22.2 Buffers | Must to Know |
| 22.3 Acid base balance | Must to Know |
| 22.4 Acidosis and alkalosis | Must to Know |
| 23. Henderson-Hasselbatch equation, role of the kidney in acid base balance. | Desirable to know |
| 24. Renal Function Test | |
| 24.1 Urea clearance test | Must to Know |

| | |
|---|---|
| 24.2 Creatinine Clearance | Must to Know |
| 25. Blood Constituents | |
| 25.1 Calcium and phosphorous | Must to Know |
| 25.2 Creatinine | Must to Know |
| 25.3 Alkaline and acid phosphatase | Must to Know |
| 26. Normal and abnormal variations of Urea, cholesterol, bilirubin, uric acid, transaminases. | Desirable to know |

## B. PRACTICALS:

1. Reactions of monosaccharides - glucose & fructose
2. Reactions of disaccharides - lactose, maltose and sucrose
3. Preparation of osazones from glucose, fructose, lactose & maltose
4. Reactions of polysaccharides - starch
5. Identification of unknown carbohydrate
6. Colourreactions of proteins - albumin
7. Colour reactions of proteins - gelatin & peptone
8. Colour reactions of proteins - casein
9. Precipitation reactions of albumin
10. Precipitation reactions of gelatin and peptone
11. Precipitation reactions of - casein
12. Identification of unknown protein
13. Reactions of urea, uric acid and creatinine
14. Identification of physiologically important constituents
15. Composition of saliva and starch digestion by salivary amylase
16. Qualitative analysis of gastric juice - normal and abnormal contents
17. Urine analysis - normal constituents
18. Urine analysis - abnormal or pathological constituents
19. Determination of titrable acidity and ammonia content in urine
20. Determination of creatinine content in urine, calculation of creatinine clearance
21. Estimation of Blood glucose

## DEMONSTRATION SESSIONS

1. Colorimeter
2. Electrophoresis & Chromatography
3. Estimation of Serum calcium and phosphorus
4. Estimation of Bilirubin
5. Estimation of Urea in blood
6. Estimation of total protein in blood serum
7. Preparation of haemin crystals
8. Discussion of clinical charts - Glucose Tolerance Test (GTT)
9. Spotting of specimens -
   Haemin, Osazone - Microscopy, Ryle's tube, Folin -wu tube,
   Urinometer, Tests - Biuret reaction,
   Millon's reaction, Jaffe's reaction, Barfoed's reaction.

## C. RECOMMENDED BOOKS

| Name of book & Title | Author | Publisher |
|---|---|---|
| A Text book of Biochemistry for Dental Students | Harbanslal | CBS Pub. |
| Concise Clinical Medical biochemistry | Pattabhiraman | Prithvi Pub.. |
| Fundamentals of Biochemistry | A. C. Deb | New Central Book Agency |
| Text Book of Biochemistry | AVS Rama Rao | UBSPD with LKS pub. |
| Textbook of Medical Biochemistry | S. Rama Krishnan<br>K.G.Prasannan<br>R. Rajan | Orient Longman |

## REFERENCE BOOKS

| Name of book & Title | Author | Publisher |
|---|---|---|
| Review of Biochemistry | Harpers | USA Appleton and Lange Pub. |
| Basic and Applied Dental Biochemistry | William R.D | Singapore Langman Pub |
| Elliot J.C. Principles of Biochemistry | Albert Lehninger | CBS pub. |

## C. EXAMINATION SCHEME

a. INTERNAL EXAM

- First internal (Theory/Practical): 20 Marks
- Second internal (Theory/Practical): 20 Marks
- Third Internal (Theory/Practical): 60 Marks

b. University Exam:

As per University rules

# DENTAL ANATOMY, EMBRYOLOGY, ORAL HISTOLOGY AND ORAL PHYSIOLOGY

## INTRODUCTION:

The Course Includes Instructions In The Subject Of Dental Morphology, Oral Embryology, Oral Histology And Oral Physiology, a Composite of Basic Dental Sciences & Their Clinical Applications.

AIM: The broad goal of the teaching of undergraduate students in dental morphology, oral embryology, oral histology and oral physiology is to provide a sound knowledge and make them understand the scientific basis of the oral anatomy, oral physiology and oral histology at the molecular level so that they can apply this acquired knowledge in solving clinical problems.

## OBJECTIVES:

The Subject of Dental Anatomy, Histology Including Embryology And Physiology Aims At Imparting Knowledge In Understanding The Structure, Function, Genesis, Morphology, Physiology And Histology Of Normal Tissues Associated With Oral Cavity.

a) KNOWLEDGE:

After a course on Dental Anatomy, Histology including Embryology and Physiology,

1) The Student Is Expected to Know Morphology, Histology, Physiology And Embryology With Clinical Applications So As To Impart This Understanding For Diagnosing Oral Diseases In Future.
2) The Student Should Understand the Histological Basis and Physiologic Aging Process In The Dental Tissues So As To Apply This Knowledge In Various Dental Treatment Procedures.
3) The Students Must Acquire the Basic Knowledge of Microscope and Various Methods Of Preservation Of Tissues (Hard And Soft Tissues), Different Staining Techniques And Their Visualization Under Microscope.

b) SKILLS:

1) Identification Of Deciduous & Permanent Teeth.
2) Age Estimation by Patterns of Teeth Eruption from Plaster Cast of Different Age Groups.
3) Microscopic Study of Oral Tissues.
4) Carving Of Crown and Root of Permanent Teeth In Wax.

## COURSE OUTCOMES ASSESSED:

Were the students able to: Describe the normal development, morphology, structure & functions of oral tissues & variations in different pathological/non-pathological states. Understand the histological basis of various dental treatment procedures and physiologic ageing process in the dental tissues. Describe various research methodologies. Carve crowns of permanent teeth in wax. Identify & Draw Microscopic appearances of Oral tissues. Identify Deciduous & Permanent teeth. Estimate age by patterns of teeth eruption from plaster casts of different age groups.

## A. COURSE CONTENT AND APPROACH TO THE SUBJECT:

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction To Dental Anatomy | |
| 1.1. Definitions, Meaning of Different Terms | Must to know |
| 1.2. Aims & Scope of Dental Anatomy | Must know |
| 1.3. Classification & Types | Good to know |
| 2. Maxillary incisors | |
| 2.1. Nomenclature Morphological Features | Good to know |
| 2.2. Set Traits Arch Traits Class Traits Type Traits | Must know |
| 2.3. Morphological Variation Clinical Considerations | Desirable to know |
| 3. Mandibular central incisor | |
| 3.1. Nomenclature Morphological Features | Good to know |
| 4. Set traits arch traits class traits type traits | Must know |
| 4.1. Morphological Variation Clinical Considerations | Desirable to know |
| 5. Maxillary canine | |
| 5.1. Nomenclature Morphological Features | Good to know |
| 5.2. Set Traits Arch Traits Class Traits Type Traits | Must to know |
| 5.3. Morphological Variation Clinical Considerations | Desirable to know |
| 6. Mandibular canine | |
| 6.1. Nomenclature Morphological Features | Good to know |
| 6.2. Set Traits Arch Traits Class Traits Type Traits | Must know |
| 6.3. Morphological Variation Clinical Considerations | Desirable to know |

| | |
|---|---|
| 7. Development of Head and Neck | |
| 7.1. Pharyngeal Arch Development, | Must to know |
| 7.2. Pituary Gland Development, | Must to know |
| 7.3. Thyroid gland, Ear Development | Must to know |
| 8. Development of Facial Structures | |
| 8.1. Palate Development | Must to know |
| 8.2. Development Of Maxilla | Must to know |
| 8.3. Development Of Mandible | Must to know |
| 8.3.1. Development Of Structural Component of The Head And Neck ( Vasculature, Skeletal Elements, Facial Muscles, Innervation) | Good to know |
| 8.4. Developmental Anomalies (Cervical Cysts And Fistulas, Thyroglossal Cysts And Fistulas, Mandibulofacial Dysostosis, Cleft Lip & Palate) | Must to know |
| 9. Development of Tooth | |
| 9.1. Development Of Dental Lamina | Must to know |
| 9.2. Stages Of Teeth Development (Bud, Cap, Bell, Advanced Bell Stages) | Must to know |
| 9.3. Hertwig's epithelial root sheath and root formation. | Good to know |
| 9.4. Clinical Considerations For Tooth Development With Histophysiologic Stages of Teeth Development | Must to know |
| 10. Enamel | |
| 10.1. Physical Properties of Enamel. | Must to know |
| 10.2. Histologic Structure of Enamel | Must to know |
| 10.3. Development of Enamel | Must to know |
| 10.4. Crystalline (Inorganic) Component | Good to know |
| 10.5. Organic Matrix | Good to know |
| 10.6. Enamel Rods | Good to know |
| 10.7. Transverse Striations | Good to know |

| | |
|---|---|
| 10.8. Direction Of Rods | Good to know |
| 10.9. Hunter-Schreger Bands | Must to know |
| 10.10. Incremental Lines of Retzius | Must to know |
| 10.11. Perikymata | Good to know |
| 10.12. Rod Ends | Good to know |
| 10.13. Imbrication Lines | Good to know |
| 10.14. Enamel Cracks | Must to know |
| 10.15. Enamel Cuticle | Must to know |
| 10.16. Enamel Lamellae | Must to know |
| 10.17. Enamel tufts | Must to know |
| 10.18. Dentin enamel junction | Must to know |
| 10.19. Enamel Spindles | Good to know |
| 10.20. Age Changes in Enamel | Good to know |
| 10.21. Clinical Considerations | Desirable to know |
| 10.22. Life Cycle of Ameloblasts | Must to know |
| 10.23. Amelogenesis (Matrix Formation and Mineralization) | Must to know |
| 10.24. Clinical Considerations | Desirable to know |
| 10.25. Ultra-Structural Features of Structure Of Enamel | Good to know |
| 11. Dentin | |
| 11.1. Formation | Must know |
| 11.2. Structure | Must know |
| 11.3. Classification | Desirable to know |
| 11.4. Clinical Consideration | Good to know |
| 11.5. Dentinogenesis | Good to know |
| 11.6. Dentinal Tubules & Odontoblasts | Good to know |
| 11.7. Types Of Dentin | Good to know |
| 11.8. Age Changes Associated | Good to know |
| 11.9. Epithelial- Mesenchymal Interactions in Odontogenesis | Must to know |
| 11.10. Types & Need for Such Classifications | Must to know |

| | |
|---|---|
| 11.11. Structural Changes | Must to know |
| 11.12 Anomalies Associated with Dentinogenesis | Desirable to know |
| 11.13. Location & Clinical Importance | Desirable to know |
| 11.14. Implications In Clinical Practice | Desirable to know |
| 12. Cementum. | |
| 12.1. Physical Characteristics Chemical Composition Structure Diffrence Between Cementocyte& Osteocyte Cemento enamel junction | Good to know |
| 12.2. Difference Between Acellular Extrinsic Fiber Cementum &Cellular Intrinsic Fiber Cementum, Cement dentinal junction, Function Hypercementosis | Must to know |
| 12.3. Clinical Consideration | Desirable to know |
| 13. Periodontal Ligament | |
| 13.1. Development | Must to know |
| 13.2. Cell Biology of Normal Periodontium | Must to know |
| 13.3. Periodontal Ligament Homeostasis | Must to know |
| 13.4. Relationship Between Cells | Must to know |
| 13.5. Clinical Consideration | Desirable to know |
| 14. Oral Mucosa | |
| 14.1. Introduction | Must to know |
| 14.2. Oral Epithelium | Must to know |
| 14.3. Lamina Propria | Must to know |
| 14.4. Classification | Must to know |
| 14.5. Junctions Of the Oral Epithelium | Must to know |
| 14.6. Age Changes and Development | Must to know |
| 14.7. Definition Of Oral mucous membrane and General Considerations boundries of oral cavity subdivisions of oral mucosa layers of oral | Must to know |

| | |
|---|---|
| mucosa<br>function: protection, sensory, secretory, thermal | |
| 14.8. Types Of Epithelium Components Of Epithelium Keratinization Pattern Proliferation And Maturation | Good to know |
| 14.9. Keratinocytes And Non Keratinocytes And Associated Function And Location | Good to know |
| 14.10 Structure and Two Zones Attatchment Of Lamina Propria | Good to know |
| 14.11. Masticatory Mucosa | Must to know |
| 14.12. Lining Mucousa | Must to know |
| 14.13. Specialized Mucosa | Good to know |
| 14.14. Muco Gingival Junction,Muco-Cutaneous Junction, Dento Gingival Junction | Good to know |
| 14.15. Clinical Changes ChangesOccuring In Epithelium And Connective Tissue | Good to know |
| 14.16. Clinical Features- Colour, Texture, Consistency, Other Features Like Contour (Scalloped, Straight, Interputtrd), Size, Shape And Position | Must to know |
| 14.17. Ultrastructural Features And Cellular Events of Cell Maturation Cell Layers Shape Of the Cell in Each Layer Intermediate Filaments Attachment Between Cell To Cell And Cell to Basement Membrane | Must to know |
| 14.18. Difference Between Keratinized and Non-Keratinized Mucosa | Must to know |
| 14.19. Interlocking Arrangement Basement Membrane and Basal Lamina | Must to know |
| 14.20. How they differ/functions limitations and boundaries types of keratinization with structure blood supply and nerve supply examples for the types of oral mucosa, | Must to know |
| 14.21. Histological Features (Epithelium,LaminaPropria, Submucosa | Must to know |

| | |
|---|---|
| 14.22. Development Of the Junctions Shifting Of The Junction | Must to know |
| 14.23. Symptoms Associated With Changes | Must to know |
| 14.24. Clinical Correlation | Desirable to know |
| 15. Maxillary sinus | Must to know |
| 15.1 Definition Development Anatomy Structure & Variation Microscopic Features Function Importance | Good to know |
| 15.2. Histology | Must to know |
| 15.3. Clinical Consideration | Desirable to know |
| 16. Eruption And Shedding | |
| 16.1. Eruption | Must to know |
| 17. Pattern | Good to know |
| 17.1. Mechanism | Must to know |
| 17.2. Clinical Consideration | Desirable to know |
| 17.3. Histology | Good to know |
| 17.4. Shedding | Good to know |
| 17.5. Chronology | Good to know |
| 18. Occlusion | |
| 18.1. Basics Of Occlusion | Must to know |
| 18.2. Compensatory Curves, Centric Jaw Relations And Occlusion | Must to know |
| 18.3. Overjet, Overbite | Must to know |
| 18.4. Malocclusion | Must to know |
| 19. Histochemistry | |
| 19.1. Tissue Fixation | Good to know |
| 19.2. Tissue Processing, Microtomy& Staining and Mounting | Good to know |
| 19.3. Materials Used in Fixation and Their Specific Use | Good to know |
| 19.4. Materials Used Their Specific Use | Good to know |
| 19.5. Mechanism Of Fixation | Must to know |
| 19.6. Mechanism Of Processing and Staining, Microtome Types And Mechanism | Must to know |

| | |
|---|---|
| 19.7. Different Fixative Used in Various Histochemical Technique | Desirable to know |
| 19.8. Technical Details of All Procedures | Desirable to know |

## B. SYLLABUS FOR PRACTICALS:

Demonstration:

- Crown morphology: Students are demonstrated on teeth carving of permanent natural teeth, following which the students carve the teeth and get it approved by respective mentors.
- Students are supposed to bring natural tooth with normal anatomy for the carving practicals.
- Students are shown variation in normal teeth pattern with the help of models, charts and extracted teeth.
- Normal oral histology slides are shown to the students which they are able to apply later in the preclinical and clinical settings.
- Assignments are given students in relation to variations in normal anatomy of individual teeth as well as their implications in forensic odontology and asked to search databases and find current and relevant literature evidences and make a report on the same.
- Students are given assignment in groups or in single to search for at least two relevant evidences related to variation in crown morphology of individual tooth

- Practical aspects of Histochemistry, tissue Fixation, tissue processing, microtomy, staining and mounting will be discussed in small groups and students will get hands on for histopathology processing so that they can understand it well.

## C. RECOMMENDED TEXT BOOKS:

| SR.NO. | AUTHOR | TITLE | EDITION |
|---|---|---|---|
| 1 | Antonio Nanci | Ten Cate`s Oral Histology Development,Structure,and Function | 7th |
| 2 | Prabhu S.R | Textbook of Oral & Maxillofacial Anatomy,Histology & Embryology | -- |
| 3 | Avery James K | Oral Development and Histology | 6th |
| 4 | Chandra Satish | Textbook of Dental and Oral Histology with | -- |

| | | | |
|---|---|---|---|
| | | Embryology | |
| 5 | Nanci Antonio | Oral histology | 7th |
| 6 | Kumar, G S | Orban's Oral Histology and Embryology | Twelfth |
| 7 | Ash Major M | Wheeler-s atlas of tooth form | 5th |
| 8 | Berkovitz B.K.B | Oral anatomy, histology and embryology | 4th |
| 9 | Woelfel Julian B | Dental anatomy its relevance to dentistry | N.A. |
| 10 | Manjunatha BS | Textbook of Dental Anatomy and Oral Physiology | -- |
| 11 | P.R. Garant | Oral cell & tissues | -- |

## D. SCHEME OF EXAMINATION

a. INTERNAL EXAM

- First internal (Theory/Practical): 20 Marks
- Second internal (Theory/Practical): 20 Marks
- Third Internal (Theory/Practical): 60 Marks

## b. UNIVERSITY EXAMINATION:

As per the university rules

Viva Voce (distribution of marks)

| SL NO | TOPIC | MARKS |
|---|---|---|
| 1 | Dental Anatomy and Oral Physiology | 10 |
| 2 | Dental Histology and Embryology | 10 |
| TOTAL | | 20 |

PRACTICAL EXAMINATION: (distribution of marks)

Practicals: 90 Marks

1. Carving 30 marks 1 hour 15 min
2. Spotters 48 marks (12 spotter) 1 hour 15 min
   - 06--histology and ground section slides---4 marks each
   - 03-tooth identification 4 marks each
   - 03-casts for identifications of teeth, numbering system and age assessment-4 marks each

3.Journal: 12 MARKS

## DENTAL MATERIALS

Dental material science refers to the art and science that deals with the physical nature, chemical basis, manipulation and biological behaviour of dental materials used as or in the fabrication of a restoration or prosthesis.

### AIMS:

1. To present basic chemical and physical properties of dental materials as they are related to its manipulation.
2. To teach the student the criteria of selection of dental material thus enabling him/her to discriminate between facts and propaganda with regards to claims of manufacturer.

### OBJECTIVES:

1. To understand the evolution and development of science of dental materials.
2. To explain purpose of course in dental materials to personnel concerned with the profession of dentistry, knowledge of the physical and chemical properties and biomechanical behaviour.
3. To make the student aware of laying down of standards or specifications of various materials.
4. To keep abreast with recent advances in materials.
5. To understand and evaluate claims made by manufacturers of dental materials.

### SCOPE OF THE SUBJECT:

The science of dental materials is imperative for the clinical and laboratory procedures involved in restorative dentistry such as Prosthodontics, Conservative dentistry, Periodontics, Orthodontics and Pedodontics.

### COURSE OUTCOMES ASSESSED:

Were the students able to: Understand the evolution and development of science of dental material. Explain purpose of course in dental materials to personnel concerned with the profession of the dentistry. Acquire knowledge of physical and chemical properties. Acquire knowledge of biomechanical requirements of particular restorative procedure. Search for newer and better materials which may answer our requirements with greater satisfaction. Evaluate the claims made by manufactures of dental materials

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Structure of Matter and Principles of Adhesion | |
| 1.1 Change of state | Must to Know |

| | |
|---|---|
| 1.2 Interatomic primary bond, secondary bond | Must to Know |
| 1.3 Inter atomic bond distance and bond energy, thermal energy | Desirable to Know |
| 1.4 Crystalline structure & Non crystalline structure | Good to Know |
| 1.5 Diffusion | Good to Know |
| 1.6 Adhesion & Bonding – General | Must to Know |
| 1.7 Adhesion and bonding to tooth structure | Must to Know |
| 2. Important Physical Properties - Applicable to Dental Materials | |
| 2.1 Physical properties are based on laws of mechanics, acoustics, optics, thermodynamics, electricity, magnetism, radiation, atomic structure or nuclear phenomenon, hue, value, chroma and translucency | Must to Know |
| 2.2 Thermal conductivity and coefficient of thermal expansion | Must to Know |
| 2.3 Stress, strain, proportional limit, elastic limit, yield strength, modulus of elasticity, | Must to Know |
| 2.4 Flexibility, Resilience, | Must to Know |
| 2.5 Strength: Impact strength, permanent deformation, flexure strength, static fatigue, | Must to Know |
| 2.6 Toughness, brittleness, hardness, | Must to Know |
| 2.7 Ductility and malleability, | Must to Know |
| 2.8 Abrasion resistance, | Must to Know |
| 2.9 Rheology, thixotrophy, static creep, dynamic creep, flow, | Must to Know |
| 2.10 Color: three dimensional color- hue, chroma, value, munsell system, metamerism, fluorescence, | Must to Know |
| 2.11 Physical property of tooth, | Must to Know |
| 2.12 Stress during mastication | Must to Know |
| 3. Biological Considerations in Use of Dental Materials | |
| 3.1 Materials used are with the knowledge of certain biological considerations for use in oral cavity. | Must to Know |
| 3.2 Requirement of materials from prospective of biological compatibility. Classification of material from prospective of biological compatibility E.g. contact with soft tissue, affecting vitality of pulp, used for root canal filling, affecting hard tissue of teeth, laboratory material that could be ingested or inhaled during handling | Must to Know |
| 3.3 Hazards associated with materials: PH effecting pulp, polymer causing chemical irritation, mercury toxicity etc. micro leakage, thermal changes, galvanism and toxic effect of materials. Biological evaluation for systemic toxicity, skin irritation, mutagenicity and cariogenicity. Disinfection of impression materials for infection control. | Must to Know |
| 4. Gypsum and Gypsum Products | |

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|---|---|
| 4.1 Gypsum- its origin, chemical formula, and products manufactured from gypsum | Must to Know |
| 4.2 Dental plaster, dental stone, die stone, high strength, high expansion stone | Must to Know |
| 4.3 Application and manufacturing procedure for each | Good to Know |
| 4.4 Macroscopic and microscopic structure of each | Must to Know |
| 4.5 Supplied as and commercial name | Must to Know |
| 4.6 Chemical setting, setting reaction, theories of setting, gauging water, microscopic structure of set material | Must to Know |
| 4.7 Setting time, working time, measurement of setting time and factors controlling setting time | Must to Know |
| 4.8 Setting expansion, hygroscopic setting expansion- factors affecting each | Must to Know |
| 4.9 Strength : wet strength, dry strength, factors affecting strength, tensile strength | Must to Know |
| 4.10 Slurry- need and use | Good to Know |
| 4.11 Care of cast | Must to Know |
| 4.12 ADA classification | Must to Know |
| 4.13 Description of impression plaster and dental investment | Must to Know |
| 4.14 Manipulation including recent methods and advanced methods | Must to Know |
| 4.15 Disinfection: infection control, liquids, sprays, radiation | Must to Know |
| 4.16 Methods of use of disinfectants | Good to Know |
| 4.17 Storage of material- shelf life | Must to Know |
| 5. Impression Materials used in Dentistry | |
| 5.1 Impression plaster | Must to Know |
| 5.2 Impression compound | Must to Know |
| 5.3 Zinc oxide eugenol impression paste | Must to Know |
| 5.4 Bite registration paste | Good to Know |
| 5.5 Non eugenol paste | Must know |
| 5.6 Hydrocolloids- Reversible and irreversible | Must to Know |
| 5.7 Elastomeric impression materials | |
| 5.7.1 Polysulfide | Must to Know |
| 5.7.2Condensation silicones | Must to Know |
| 5.7.3 Addition silicones | Must to Know |
| 5.7.4 Polyether | Must to Know |
| 5.7.5 Visible light cure polyethyl urethane dimethacrylate | Good to Know |
| 5.8Historical background and development of each impression material | Must to Know |

| | |
|---|---|
| 5.9 Definition of impressions, purpose of making impressions, application and uses, market and commercial names, composition, chemistry of setting, impression trays, adhesion to trays, manipulation and equipments required for manipulation, techniques of impressions, storage of impressions, compatibility with cast and die materials, recent advancement in materials and mixing devices, | Must to Know |
| 5.10 Study of individual and comparative properties | Must to Know |
| 6. Synthetic Resin used in Dentistry | |
| 6.1 Historical background and development of material, denture base materials and their classification and requirement | Must to Know |
| 6.2 Classification of resins | Must to Know |
| 6.3 Dental resins- requirements of dental resin, application, polymerization, polymerization mechanism, stages in addition polymerization, inhibition of polymerization, copolymerization, molecular weight, cross linking, plasticizers, physical properties of polymers, polymer structures type of resins | Must to Know |
| 6.4 Acrylic resin: mode of polymerization: heat activated, chemically activated, light activated, mode of supply, application, composition, polymerization reaction of each. | Must to Know |
| 6.5 Technical considerations | Must to Know |
| 6.6 Methods of manipulation of each type of resin | Must to Know |
| 6.7 Physical properties of each type of resin | Must to Know |
| 6.8 Miscellaneous resins and techniques: repair resins, relining and rebasing, short term and long term soft liners temporary crown and bridge resins, resin impression trays, tray materials, resin teeth, materials in maxillofacial prosthesis, denture cleansers, infection control in detail, biological properties and allergic reactions. | Good to Know |
| 7. Dental Waxes | |
| 7.1 Introduction and importance of waxes | Must to Know |
| 7.2 Sources of natural waxes and their chemical nature | Must to Know |
| 7.3 Classification of waxes | Must to Know |
| 7.4 Properties: melting range, thermal expansion, mechanical properties, flow, residual stresses, ductility | Must to Know |
| 7.5 Dental waxes: mode of supply, classification, composition, properties of following waxes | |
| 7.5.1 Bite registration wax | Must to Know |
| 7.5.2 Impression waxes for corrective impression | Must to Know |
| 7.5.3 Base plate wax | Must to Know |
| 7.5.4 Processing wax | Must to Know |

7.5.5 Boxing wax — Must to Know
7.5.6. Utility wax — Must to Know
7.5.7 Sticky wax — Must to Know
7.5.8 Casting wax — Must to Know

## B. SYLLABUS FOR PRACTICALS:

1. Gypsum Products:
    a. Dental plaster: Manipulation, Properties and Preparation of one cube 2” x 2”
    b. Dental Stone: Manipulation, Properties and Preparation of one cuboid 3” x 2”
    c. Die Stone: Vacuum mixing and properties
2. Impression Compound: Manipulation, Properties and making primary impression of finger
3. Shellac Baseplate: Manipulation, Properties and Preparation of one special tray
4. Zinc Oxide Eugenol Impression Paste: : Manipulation, Properties and making final impression of finger
5. Alginate-Irreversible Hydrocolloid: Manipulation, Properties and making impression of jaw typodont.
6. Agar Agar-Reversible Hydrocolloid: Demonstration of manipulation of agar for duplication
7. Polysulfide Elastomer, Polyether Elastomer, Condensation Silicone Elastomer, Addition Silicone Elastomer: composition, properties and Demonstration of manipulation
8. Auto Polymerizing Resin: Manipulation, Properties and stages of polymerisation
9. Heat Cure Acrylic Resin: Manipulation, Properties and stages of polymerisation
10. Dental Waxes: Modelling Wax, Beading & Boxing, Wax Blue Inlay Wax, Yellow Sticky Wax: Composition, Manipulation, Properties and uses.
11. EBES in Dental materials is practiced as generation of PICO on properties of Dental materials and superiority of manipulation techniques, literature search and reflective group discussions facilitated by teaching staff.

## C. RECOMMENDED BOOKS:

| Title | Author | Publisher |
|---|---|---|
| Science of Dental Material | Kenneth J Annusavice | W.B. Saunder's |
| Restorative Dental Materials | Robert G Craig | Mosby, USA |
| Dental Materials | Craig, Power and Wataha | |
| Notes on Dental Material | E C Combe | ChurchillLivingstone, UK |
| Basic Dental Material | Mannapalli | |

## D. EXAMINATIONS:

### a. INTERNAL ASSESSMENT

- No internal assessment for both theory and practical shall not be conducted for I BDS Dental Materials subject.

### b. UNIVERSITY EXAM

- University Exam (theory & practical) shall be conducted at the end of II BDS

## PROSTHODONTICS AND CROWN & BRIDGE

Prosthodontics is the dental specialty pertaining to the diagnosis, treatment planning, rehabilitation and maintenance of the oral function, comfort, appearance and health of patients with clinical conditions associated with missing or deficient teeth and/or maxillofacial tissues using biocompatible substitutes.

### AIM:

To train the dental student with adequate knowledge, necessary skills and reasonable attitudes which are required for carrying out procedures related to prosthodontic practice involving prevention, diagnosis and treatment of missing and associated structures in the oral and extra-oral region.

### OBJECTIVES:

1. To have an adequate knowledge of the science of prosthodontics
2. To understand the principles of biologic functioning and prosthodontic methods
3. To diagnose and treat the prosthodontic patient as a whole.
4. To evaluate and analyse scientifically and evidence based established facts and data.

### COURSE OUTCOMES ASSESSED:

Were the students able to: Mark anatomical landmarks in edentulous casts, classify partially edentulous arches and correlate to clinical picture. Identify instruments and equipment used for clinical and laboratory prosthodontic procedures. Perform all lab procedures to make a conventional complete denture, removable interim partial denture. Perform tooth preparation and wax patterns for crowns on typhodont teeth

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT:

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Terminology | Must to Know |
| 2. Anatomical Landmarks | Must to Know |
| 3. Pouring The Cast | Must to Know |
| 4. Special Tray | Must to Know |
| 5. Beading Boxing | Must to Know |
| 6. Record Base | Must to Know |
| 7. Occlusal Rim | Must to Know |
| 8. Articulators | Must to Know |
| 9. Impression Procedure In CD | Must to Know |

| | |
|---|---|
| 10. Teeth Selection | Must to Know |
| 11. Teeth Arrangement | Must to Know |
| 12. Lab Procedures In CD | Must to Know |
| 13. Characterization | Must to Know |

## B. SYLLABUS FOR PRACTICALS:

EXERCISES TO BE CONDUCTED

Part-I Complete Denture

1. Overview to prosthodontics
2. Introduction to complete dentures
3. Anatomical landmarks: maxillary arch
4. Anatomical landmarks: mandibular arch
5. Clinical and laboratory steps in fabrication of complete dentures.
6. Making of primary impression with medium fusing impression compound: maxilla
7. Making of primary impression with medium fusing impression compound: mandible
8. Demonstration for making primary impression with alginate making of primary impression with alginate for both maxillary and mandibular completely edentulous arches dies
9. Demonstration for making primary impression with addition silicone
10. Demonstration for making primary impression with agar agar
11. Pouring of primary cast: maxilla (inversion method)
12. Pouring of primary cast: mandible (inversion method)
13. Fabrication special trays with different spacer designs. (FLIPPED CLASSROOM)
14. Pouring of master cast
15. Fabrication denture bases with occlusion wax rims.
16. Transfer of jaw relations to mean value articulator (mounting of casts)
17. Selection of artificial teeth.
18. Arrangement of teeth in class I relation:
    - 18.1 Arrangement of upper anterior teeth
    - 18.2 Arrangement of lower anterior teeth
    - 18.3 Arrangement of upper posterior teeth
    - 18.4 Arrangement of lower posterior teeth
19. Wax up, carving and polishing
20. EBES in Pre-clinical Prosthodontics is practiced as generation of PICO on methods and techniques, literature search and group discussions facilitated by teaching staff.

## C. RECOMMENDED BOOKS

| TITLE | AUTHOR | PUBLISHER |
|---|---|---|
| Dental lab Procedures Part I: Complete dentures | Rudd & Murrow | - |
| Dental lab Procedures Part II: Removable Partial dentures | Rudd & Murrow | - |
| Dental lab Procedures Part I: Fixed Partial dentures | Rudd & Murrow | - |
| Manual for Pre-clinical Prosthodontics | S Lakshmi | Elsevier |
| Essential Manual of PreClinical Prosthodontics | Dr. Paranjay Prajapati<br>Dr. Sneha Kulkarni | Jaypee |

## D. EXAM SCHEME:

a. INTERNAL ASSESSMENT

- No internal assessment for both theory and practical shall not be conducted in I BDS.

b. UNIVERSITY EXAM

- University Exam (theory & practical) shall be conducted at the end of II BDS

## BEHAVIOURAL SCIENCES (20 HOURS OF INSTRUCTION)

### GOAL:

The aim of teaching behavioural sciences to undergraduate students is to impart such knowledge and skills that may enable him to apply principles of behaviour –

a) For all round development of his personality
b) In various therapeutic situations in dentistry

The students should be able to develop skills of assessing psychological factors in each patient, explaining stress, learning simple counselling techniques, and improving patients compliance behaviour.

### OBJECTIVES:

A) KNOWLEDGE AND UNDERSTANDING

At the end of the course, the student shall be able to:

1) Comprehend different aspects of normal behaviour like learning, memory, motivation, personality and intelligence.
2) Recognise difference between normal and abnormal behaviour.
3) Classify psychiatric disorders in dentistry.
4) Recognise clinical manifestations of dental phobia, dental anxiety, facial pain, oro-facial manifestation of psychiatric disorder, and behavioural problems in children. Addictive disorders, psychological disorders in various dental departments.
5) Have understanding of stress in dentistry and knowledge of simple counselling techniques.
6) Have some background knowledge of interpersonal, managerial and problem-solving skills which are an integral part of modern dental practice.
7) Have knowledge social context of dental care.

B) SKILLS

The student shall be able to :

1) Interview the patient and understand different methods of communication skills in dentist-patient relationship.
2) Improve patient compliance behaviour.
3) Develop better interpersonal, managerial and problem-solving skills.

4) Diagnose and manage minor psychological problems while treating dental patients.

## INTEGRATION:

The training in behavioural sciences shall prepare the students to deliver preventive, promotive, curative and rehabilitative services to the care of the patients both in family and community and refer advanced cases to specialised psychiatric hospitals.

Training should be integrated with all the departments of dentistry, medicines, pharmacology, psychology and biochemistry.

## PSYCHOLOGY:

1) Definition and need of behavioural science. Determinants of behaviour: Scope of behavioural science
2) Sensory process and perception perceptual process- clinical application.
3) Attention- Definition- Factors that determine attention. Clinical application.
4) Memory- Memory process- types of memory, forgetting.
   Methods to improve memory, clinical assessment of memory and clinical application.
5) Definition- Laws of Learning
   Type of Learning : Classical Conditioning, Operant Conditioning, Cognitive Learning, Insight Learning, Social Learning, Observational Learning, Principles of Learning- Clinical application.
6) Intelligence- Definition: Nature of Intelligence Stability of Intelligence
   Determinants of Intelligence, clinical application.
7) Thinking- Definition: Types of Thinking, delusions, problem solving
8) Motivation- Definition: Motive, Drive, needs classification of motives
9) Emotions-Definition differentiation from feelings- Role of Hypothalamus, cerebral cortex, adrenal glands, ANS. Theories of emotion, types of emotion.

Personality assessment of personality: Questionnaires, personality inventory, rating scales, Interview projective techniques- Rorshach ink blot test, RAT, CAT.

SOCIOLOGY:

Social class, social groups- family, types of family, types of marriages, communities and Nations and Institutions.

## REFERENCE BOOKS:


1) General psychology – S.K.Mangal
2) General psychology – Hans Raj Bhatia
3) General psychology – Munn
4) Behavioural sciences in Medical Practice – Manju Mehta
5) Sciences basic to Psychiatry – Basanth Puri and Peter J Tyrer

## MANAGEMENT SCIENCE

1. To describe and discuss the elements of effective management.
2. To comprehend details about the basic Organizational Behavioural Science, Human resource Management, Accounting& Finance Management, Marketing Management and Hospital Administration processes in understanding entire concept of management science.
3. To identify environmental issues as they impact management and develop strategies to adapt to these environments.
4. To Identify and explain issues involved in managing a diverse workforce and conduct necessary research to address these issues.
5. Todiscuss and apply the planning, organizing and control processes.
6. To educate students of management with different concept of accounting.
7. To develop ability among management student to evaluate and use accounting information which assist in decision making for manager
8. To Understand Concepts of Marketing and Customer Value
9. To equip students with basic understanding finance and its utility
10. To enable students to take decisions related with financial feasibility and working capital management
11. To Identify, discuss and/or describe various theories related to the development of Work Teams in organizations.
12. Duration of each session is one hour.

## COURSE CONTENTS

**MODULE I**: **Managerial Functions &Organizational Behavior (10 sessions)**

Concept and foundations of Management science, Evolution of Management thoughts; Managerial Functions – Planning, Organizing, Directing, Controlling, and Decision Making: Role of Managers, Managerial Skills; Social Responsibility and Managerial Ethics.

Concept of Organizational Behavior; Individual and organizational Behavior; Personality; Value and Attitude; Perception; Motivation; Learning and Reinforcement; Work stress and stress Management; Leadership process and styles; Conflict and Negotiation; Managing Cultural Diversity.

**MODULE II Accounting and Finance- Part I (6 Sessions)**

Meaning & Role of Accounting & Finance in Hospital Management: Basic Concepts and Terminology of Accounting & Finance: Accounting Statements: Understanding & Importance.

**MODULE III: Marketing Management (9 sessions)**

Defining Marketing; Importance, Scope, Core Marketing, New Marketing; Developing & Implementing Marketing Strategies & Plans; Marketing and Customer Value, Corporate and Division Strategic Planning, Business Unit Strategic Planning, the Marketing Plan & Marketing Performance: Creating Customer Value, Satisfaction and Loyalty; Building Customer Value & Satisfaction, Cultivating Customer Relationships; Crafting Brand Positioning & Dealing with Competition; Developing & Communicating Positioning Strategy, differentiation Strategies, Competitive Forces, Analyzing Competitors, and Competitive Strategies; Designing and Managing Services; The nature of Services, marketing strategies, managing service quality, managing service brands, managing product services.

**MODULE IV; Accounting and Finance Part –II (5 sessions)**

Cost Accounting for Hospitals: Understanding of Corporate Finance for Hospital Managers: Source of Financing, Cost of Capital & Capital Budgeting: Purchase & Inventory Management: Budgeting & Budgetary Control; Investment, Financial Markets & Services;

**MODULE V Human Resource Management (5sessions)**

Human Resource Management: Introduction; HRM functions; HR planning; Job Analysis; Job Evaluation; Recruitment & Selection; Training and Development; Performance Management and Compensation: Industrial Relation and Labour laws; HRIS

**MODULE VI: Hospital Services Management/Administration (15 sessions)**

Introduction to Hospitals, Hospital Administration: A contemporary Overview, building a hospital and challenges faced in setting up of hospital, Energy Conservation. Clinical Services: Out Patient Department, Emergency Service Department, Operation Theater and ICU, In Patients Department. Diagnostic Services: Radiology and Laboratory Services. Support and other utility services: Pharmacy services, Medical Record Department, Dietary and Housekeeping services. Material and Equipment Management, Quality and Safety management: Occupational Safety and Hospital Acquired Infections, Hospital Waste Management and Quality Management. Recent Advances in Hospital Administration

## SECOND BDS
## GENERAL PATHOLOGY AND MICROBIOLOGY

### GENERAL PATHOLOGY:

### DEFINITION:

"Pathology is the study (logos) of disease (pathos). More specifically, it is devoted to the study of the structural, biochemical and functional changes in cells, tissue and organ that underlie disease."

### AIM:

At the end of the course in General Pathology the student should be able to understand how the cells and the tissues of the body respond to various types of injury and how these structural and functional abnormalities bring about the various clinical manifestations with which the patient present to the healthcare professional.

### OBJECTIVES:

Enabling the student

I. To demonstrate and apply basic fact, concepts and theories in the field of pathology.
II. To recognize and analyse pathological changes at macroscopically and microscopical levels and explain their observations in term of disease processes.
III. To integrate knowledge from the basic science, clinical medicine and dentistry in the study of Pathology.
IV. To demonstrate understanding of the capabilities and limitations of morphological Pathology in its contribution to medicine, dentistry and biological research.
V. To demonstrate ability to consult resource materials outside lectures, laboratory and tutorial classes.

### SCOPE:

By the use of molecular, microbiological, immunological and morphologic techniques, pathology attempts to explain the ways and wherefores of the sign and symptoms manifested by patients while providing a rational basis for clinical care and therapy. It thus serves as the bridge between the basic sciences and clinical medicine and is the scientific foundation for all of medicine.

### COURSE OUTCOMES ASSESSED:

Were the students able to Apply the scientific study of disease processes, which result in morphological and functional alterations in cells, tissues and organs to the study of pathology and the practice of dentistry. Demonstrate and apply basic facts, concepts and theories in the field of Pathology. Recognize and analyze pathological changes at macroscopically and microscopical levels and explain their observations in terms of disease processes. Integrate knowledge from the basic sciences, clinical medicine and dentistry in the study of Pathology. Demonstrate

understanding of the capabilities and limitations of morphological Pathology in its contribution to medicine, dentistry and biological research. Demonstrate ability to consult resource materials outside lectures, laboratory and tutorial classes. Understand the basics of various branches of microbiology and able to apply the knowledge relevantly. Apply the knowledge gained in related medical subjects like General Medicine and General Surgery and Dental subjects like Oral Pathology, Community Dentistry, Periodontics, Oral Surgery, Pedodontics, Conservative Dentistry and Oral medicine in higher classes. Understand and practice various methods of Sterilisation and disinfection in dental clinics. Able to diagnose infectious diseases and lesions in the oral cavity. Should be able to select, collect and transport clinical specimens to the laboratory. Should be able to carry out proper aseptic procedures in the dental clinic.

## A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction to Pathology | |
| 1.1 Terminologies | Must to Know |
| 1.2 The cell in health | Must to Know |
| 1.3 The normal cell structure | Must to Know |
| 1.4 The cellular functions | Must to Know |
| 2. Etiology and Pathogenesis of Disease | |
| 2.1 Cell Injury | Must to Know |
| 2.2 Types – congenital | Must to Know |
| 2.3 Acquired | Must to Know |
| 2.4 Mainly Acquired causes of disease | Must to Know |
| 2.5 Hypoxic injury, chemical injury, physical injury, immunological injury | Must to Know |
| 3. Degenerations | |
| 3.1 Amyloidosis | Must to Know |
| 3.2 Fatty change | Must to Know |
| 3.3 Cloudy swelling | Must to Know |
| 3.4 Hyaline change, mucoid degeneration | Must to Know |
| 4. Cell death: Necrosis & Apoptosis | |
| 4.1 Def, causes, features and types of necrosis | Must to Know |
| 4.2 Gangrene - Dry, wet, gas | Must to Know |
| 4.3 Pathological Calcifications | Must to Know |
| 4.4 Dystrophic and metastatic | Must to Know |
| 5. Inflammation | |
| 5.1 Definition, causes types, and features | Must to Know |
| 5.2 Acute inflammation | Must to Know |

| | |
|---|---|
| 5.2.1 The vascular response | Must to Know |
| 5.2.2 The cellular response | Must to Know |
| 5.2.3 Chemical mediators | Must to Know |
| 5.2.4 The inflammatory cells | Must to Know |
| 5.2.5 Fate | Must to Know |
| 5.3 Chronic inflammation | Must to Know |
| 5.4 Granulomatous inflammation | Must to Know |
| 6. Healing | |
| 6.1 Regeneration | Must to Know |
| 6.2 Repair | Must to Know |
| 6.2.1 Mechanisms | Must to Know |
| 6.2.2 Healing by primary intention | Must to Know |
| 6.2.3 Healing by secondary intention | Must to Know |
| 6.2.4 Fracture healing | Must to Know |
| 6.2.5 Factors influencing healing process | Must to Know |
| 6.2.6 Complications | Must to Know |
| 7. Tuberculosis | |
| 7.1 Epidemiology | Must to Know |
| 7.2 Pathogenesis (Formation of tubercle) | Must to Know |
| 7.3 Pathological features of Primary and Secondary TB | Must to Know |
| 7.4 Complications and Fate | Must to Know |
| 8. Syphilis | |
| 8.1 Epidemiology | Desirable to know |
| 8.2 Types and stages of syphilis | Desirable to know |
| 8.3 Pathological features | Desirable to know |
| 8.4 Diagnostic criterias | Desirable to know |
| 8.5 Oral lesions | Good to know |
| 9. Typhoid | |
| 9.1 Epidemiology | Desirable to know |
| 9.2 Pathogenesis | Desirable to know |
| 9.3 Pathological features | Desirable to know |
| 9.4 Diagnostic criterias | Desirable to know |
| 10. Thrombosis | |
| 10.1 Definition, Pathophysiology | Must to Know |
| 10.2 Formation, complications & Fate of a thrombus | Must to Know |
| 11. Embolism | |
| 11.1 Definition | Must to Know |

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|---|---|
| 11.2 Types | Must to Know |
| 11.3 Effects | Must to Know |
| 12. Ischaemia and Infraction | |
| 12.1 Definition, etiology, types | Must to Know |
| 12.2 Infraction of various organs | Must to Know |
| 13. Derangements of body fluids | |
| 13.1 Oedema – pathogenesis | Good to know |
| 13.2 Different types | Good to know |
| 14. Disorders of circulation | |
| 14.1 Hyperaemia | Good to know |
| 14.2 Shock | Good to know |
| 15. Nutritional Disorders | |
| 15.1 Common Vitamin Deficiencies | Good to know |
| 16. Immunological mechanisms in disease | |
| 16.1 Humoral& Cellular immunity | Good to know |
| 16.2 Hypersensitivity &autommunity | Good to know |
| 17. AIDS and Hepatitis. | Must to Know |
| 18. Hypertension | |
| 18.1 Definition, classification | Must to Know |
| 18.2 Pathophysiology | Must to Know |
| 18.3 Effects in various organs | Must to Know |
| 19. Diabetes Mellitus | |
| 19.1 Def, Classification, Pathogenesis, Pathology in different organs | Must to Know |
| 20. Adaptive disorders of growth | |
| 20.1 Atrophy & Hypertrophy, Hyperplasia, Metaplasia and Dysplasia | Must to Know |
| 21. General Aspects of Neoplasia | |
| 21.1 Definition, terminology, classification | Must to Know |
| 21.2 Differences between benign and malignant neoplasms | Must to Know |
| 21.3 The neoplastic cell | Good to Know |
| 21.4 Metastasis | Must to Know |
| 21.5 Etiology and pathogenesis of neoplasia, Carcinogenesis | Good to Know |
| 21.6 Tumour biology | Good to Know |

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| 21.7 Oncogenes and anti-oncogenes | Good to Know |
| 21.8 Diagnosis | Must to Know |
| 21.9 Precancerous lesions | Must to Know |
| 21.10 Common specific tumours, Sq papilloma &Ca, Basal cell Ca, Adenoma &Adenoca,Fibroma&Fibrosarcoma, Lipoma and liposarcoma | Must to Know |
| 22 Anaemias | |
| 22.1 Iron Deficiency anaemia, Megaloblastic anaemia | Must to Know |
| 23. Leukaemias | |
| 23.1 Acute and chronic leukaemias, Diagnosis and clinical features | Good to Know |
| 24. Diseases of Lymph nodes | |
| 24.1 Hodgkin's disease, Non Hodgkins lymphoma, Metastatic carcinoma | Good to know |
| 25. Diseases of oral cavity | |
| 25.1 Lichen planus, Stomatitis, Leukoplakia, Sq cell Ca, Ameloblastoma | Must to Know |
| 26. Diseases of salivary glands | |
| 26.1 Normal structure, Sialadenitis, Tumours | Must to Know |
| 27. Common diseases of Bones | |
| 27.1 Osteomyelitis, Metabolic bone diseases, Bone Tumours. | Desirable to know |
| 28. Diseases of Cardiovascular system | |
| 28.1 Atherosclerosis | Good to know |
| 28.2 Ischaemic heart Disease | Good to know |
| 29. Haemorrhagic Disorders | |
| 29.1 Coagulation cascade | Must to Know |
| 29.2 Coagulation disorders | Must to Know |
| 29.3 Platelet function | Must to Know |
| 29.4 Platelet disorders | Must to Know |
| 30. Blood Transfusion | |
| 30.1 Donor selection criteria | Good to know |
| 30.2 Blood grouping and cross matching | Good to know |
| 30.3 Blood transfusion reaction | Good to know |

## B. PRACTICALS

1. Urine Abnormal constituents

1.1. Physical
1.2. Chemical
    1.2.1. Sugar
    1.2.2. Albumin
    1.2.3. bile salts
    1.2.4. Bile pigments
    1.2.5. Ketone bodies
1.3. Microscopy

2. Haemoglobin (Hb) estimation
3. Total WBC count
4. Differential WBC Count
5. Packed cell volume (PCV)
6. Erythrocyte sedimentation Rate (ESR)
7. Bleeding Time & clotting Time
8. Histopathology Tissue Processing Staining
9. Histopathology slides
    9.1. Acute appendicitis
    9.2. Granulation tissue
    9.3. Fatty liver
    9.4. CVC lung,
    9.5. CVC liver
    9.6. Kidney amyloidosis
    9.7. Tuberculosis
    9.8. Actionomycosis
    9.9. Rhinosporidiosis
    9.10. Papilloma,
    9.11. Basal cell Carcinoma
    9.12. Squamous cell Carcinoma
    9.13. Osteosarcoma
    9.14. Osteoclastoma
    9.15. Fibrosarcoma
    9.16. Malignant melanoma
    9.17. Ameloblastoma
    9.18. Adenoma
    9.19. Mixed parotid tumour
    9.20. Metastatic carcinoma in lymph node

Specimens:

1. Acute Appendicitis.
2. Tuberculosis Lymph node.
3. Fatty liver.
4. Infarction spleen.
5. Chronic Venous Congestion (C.V.C.) Liver
6. Squamous papilloma
7. Basal cell carcinoma
8. Lipoma
9. Squamous cell carcinoma

10. Malignant Melanoma
11. Adenocarcinoma
12. Osteosarcoma
13. Osteoclastoma.
14. Gangrene

## C. RECOMMENDED BOOKS

| Sr. No. | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Robbins Basic Pathology | Vinay Kumar | - | 8th | 2011 |
| 2 | Textbook Of Pathology | Harsh Mohan | - | 6th | 2010 |
| 3 | Wheater's Basic Histopathology- A Color Atlas And Text | Alan Stevens | Churchill Livingstone | 4th | 2002 |
| 4 | Pathology Practical Book | Harsh Mohan | Jaypee Brother | 2nd | 2007 |
| 5 | Clinical Pathology | SabitriSanyal | Elsevier | 3rd | 2012 |
| 6 | Wintrobe's Clinical Hematology | - | Lippincott Williams & Wilkins | 11th | 2004 |
| 7 | Currans Atlas Of Histopathology | R. C. Curran | Oxford University Press | 4th | 2005 |
| 8 | Clinical Diagnosis And Management By Laboratory Methods | John Bernard Henry | Saunders | 12th | 2001 |
| 10 | Textbook Of Medical Laboratory Technology | P.B.Godkar | Bhalani Publishing House | 2nd | 2003 |
| 11 | Pathology Quick Review And Mcqs Based On Harsh Mohans Textbook Of Pathology | Harsh Mohan | Jaypee Brother | 5th | 2005 |
| 12 | Viva Voce In Pathology,Bacteriology And Haematology | K.N Sachdev | - | 3rd | |
| 13 | Pathology | Ivan Damjanov | - | 1st | |

| | | | | | |
|---|---|---|---|---|---|
| 14 | Anderson's Pathology | Ivan Damjanov | - | 10th | 1995 |
| 15 | Practical Hematology For BDS | KomalMarwala | - | 1st | 2002 |
| 16 | Medical Laboratory Technology Methods And Interpretations | RamnikSood | - | 6th | |
| 17 | De Gruchys Clinical Haematology In Medical | Frank Firkin | Wiley India | 5TH | 2008 |

## D. SCHEME OF EXAMINATION:

a. INTERNAL EXAM

- First internal (Theory/Practical): 20 Marks
- Second internal (Theory/Practical): 20 Marks
- Third Internal (Theory/Practical): 60 Marks

b. University Exam:

As per University rules

## MICROBIOLOGY

### 1. DEFINITION:

"Microbiology is the science of living organisms that are only visible under the microscope. Medical Microbiology deals with the causative agents of infectious diseases of man, his reaction to such infections, the ways in which they produce disease and the methods for their diagnosis."

### 2. AIM & OBJECTIVES:

The aim is to introduce the students to the exciting world of microbes and make them aware of various branches of Microbiology, importance, significance and contribution of each to mankind and other fields of medicine.

A. Knowledge and understanding:

At the end of Microbiology course, the student is expected to:

1. Understand the basics of various branches of microbiology and be able to apply the knowledge relevantly.
2. Apply the knowledge gained in related medical subjects like General Medicine and General Surgery and Dental subjects like oral pathology, community dentistry, periodontics, oral surgery, pedodontics, conservative dentistry and oral medicine in higher classes.
3. Understand and practice various methods of sterilization and disinfection in dental clinics.
4. Have a sound understanding of various infectious diseases and lesions in the oral cavity.

B. SKILLS:

1. Students should have acquired the skill to diagnose and differentiate various oral lesions
2. Should be able to select, collect and transport clinical specimens to the laboratory
3. Should be able to carry out proper aseptic procedures in the dental clinic.

The objectives of teaching microbiology can be achieved by various techniques such as:

a. Lectures
b. Lecture Demonstrations
c. Practical Exercises
d. Audio Visual Aids
e. Small group discussion with regular feedback from the students

### COURSE OUTCOMES ASSESSED:

Were the students able to: Apply the scientific study of disease processes, which result in morphological and functional alterations in cells, tissues and organs to the study of pathology and the practice of dentistry. Demonstrate and apply basic facts, concepts and theories in the field of Pathology. Recognize and analyse pathological changes at macroscopically and microscopical levels and explain their observations in terms of disease processes. Integrate knowledge from the basic sciences, clinical medicine and dentistry in the study of Pathology. Demonstrate understanding of the capabilities and limitations of morphological Pathology in its contribution to medicine, dentistry and biological research. Demonstrate ability to consult resource materials outside lectures, laboratory and tutorial classes. Understand the basics of various branches of microbiology and able to apply the knowledge relevantly. Apply the knowledge gained in related medical subjects like General Medicine and General Surgery and Dental subjects like Oral Pathology, Community Dentistry, Periodontics, Oral Surgery, Pedodontics, Conservative Dentistry and Oral medicine in higher classes. Understand and practice various methods of Sterilisation and disinfection in dental clinics. Able to diagnose infectious diseases and lesions in the oral cavity. Should be able to select, collect and transport clinical specimens to the laboratory. Should be able to carry out proper aseptic procedures in the dental clinic.

## A. COURSE CONTENT AND APPROACH TO SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction | |
| **1.1** Definition of Microbiology | Must to Know |
| **1.2** Terminologies used in Microbiology | Must to Know |
| **1.3** Importance of subject | Must to Know |
| 2. History | |
| 2.1 Scientists & their contributions | Good to know |
| 3. Morphology and Physiology of bacteria | |
| 3.1 Definition | Must to Know |
| 3.2 Difference between prokaryotes & eukaryotes | Must to Know |
| 3.3 Structure of Bacterial Cell | Good to Know |
| 3.4 Classification based on morphology | Good to Know |
| 3.5 Growth requirements of bacteria | Must to Know |
| 3.6 Bacterial Growth Curve | Must to Know |
| 4. Sterilization and Disinfection | |
| 4.1 Definitions | Must to Know |
| 4.2 Methods | Good to Know |
| 4.3 Applications/Uses | Must to Know |
| 5. Culture Media and Culture Techniques | |
| 5.1 Types | Must to Know |
| 5.2 Methods | Good to Know |
| 5.3 Anaerobic Culture Methods | Must to Know |

6. Collection & Transport

6.1. Basic knowledge of selection, collection & transport of Must to Know specimens

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|---|---|
| 6.2 Basic knowledge of processing of clinical specimens | Must to Know |
| 6.3 Basic knowledge of identification of bacteria | Good to Know |
| 7. Bacterial Genetics | |
| 7.1 Structure of DNA | Good to know |
| 7.2 Plasmid | Desirable to know |
| 7.3 Drug Resistance in bacteria | Desirable to know |
| 8. Infection | |
| 8.1 Definition | Must to Know |
| 8.2 Classification | Must to Know |
| 8.3 Sources & Modes of Transmission | Must to Know |
| 8.4 Types of Infectious Diseases | Must to Know |
| 9. Immunity | |
| 9.1 Definition | Good to Know |
| 9.2 Types of Immunity | Must to Know |
| 9.3 Vaccines | Must to Know |
| | |
| 10.1 Structure of Immune System | Good to Know |
| 10.2 Functions of Immune System | Good to Know |
| 10.3 Briefly Immune Response | Good to Know |
| 11. Antigen | |
| 11.1 Definition | Good to Know |
| 11.2 Types | Good to Know |
| 11.3 Factors/Determinants of antigenicity | Good to Know |
| 12. Immunoglobulins/Antibodies | |
| 12.1 General structure | Must to Know |
| 12.2 Types | Must to Know |
| 12.3 Role played by each one in the defence mechanism of the body | Good to Know |
| 13. Complement System | |
| 13.1 Definition | Must to Know |
| 13.2 Biological functions | Must to Know |
| 13.3 Pathways | Good to Know |
| 14. Antigen-Antibody Reactions | |
| 14.1 Principles of various Ag-Ab. Reactions | Must to Know |
| 14.2 Clinical applications of each one | Must to Know |
| 15. Immunodeficiency Disorders | |
| 15.1 Brief knowledge of immunodeficiency disorders | Good to Know |
| 15.2 Sound knowledge of immunodeficiency disorders relevant to dentistry | Must to Know |
| 16. Hypersentivity | |
| 16.1 Definition | to Know |
| 16.2 Types of reactions | Must to Know |

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| 17. Autoimmune Disorders | |
| 17.1 Basic knowledge of various types | Good to Know |
| 17.2 Sound knowledge of autoimmune disorders of oral cavity and related structures | Must to Know |
| 18. Immunology of Transplantation & Malignancy | Good to Know |
| 19. Immunehaematology | Good to Know |
| 20. Pyogenic Cocci | |
| 20.1 Staphylococcus | Must to Know |
| 20.2 Streptococcus: Cariogenic Streptococci | Must to Know |
| 20.3 Pneumococcus | Good to Know |
| 20.4 Gonococcus | Good to Know |
| 20.5 Meningococcus | Must to Know |
| 20.6 Mode of spread | Must to Know |
| 20.7 Laboratory diagnosis | Godd to Know |
| 20.8 Chemotherapy | Must to Know |
| 20.9 Prevention | Must to Know |
| 21. Corynebacterium diphtheria | |
| 21.1 Mode of spread | Must to Know |
| 21.2 Important clinical features | Must to Know |
| 21.3 Laboratory diagnosis | Must to Know |
| 21.4 Chemothearpy | Must to Know |
| 21.5 Immunisation/Immunoprophylaxis | Must to Know |
| 22. Mycobacteria | |
| 22.1 Tuberculosis | Must to Know |
| 22.2 Leprosy | Good to Know |
| 22.3 Mode of spread | Must to Know |
| 22.4 Important clinical features | Must to Know |
| 22.5 Laboratory diagnosis | Must to Know |
| 22.6 Prevention | Must to Know |
| 23. Clostridium | |
| 23.1 Gas gangrene | Must to Know |
| 23.2 Tetanus | Must to Know |
| 23.4 Morphology | Must to Know |
| 23.5 Laboratory diagnosis | Must to Know |
| 23.6 Immunoprophylaxis | Must to Know |
| 24. Non-sporing Anaerobes | |
| 24.1 Classification | Must to Know |
| 24.2 Morphology | Must to Know |
| 24.3 Dental Pathogens | Must to Know |
| 24.4 Mechanism of disease production | Must to Know |
| 24.5 Prevention | Must to Know |
| 25. Gram Negative Bacilli | |
| 25.1 E.coli | Must to Know |
| 25.2 Kelbsiella | Good to Know |
| 25.3 Salmonella | Must to Know |

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|---|---|
| 25.4 Shigella | Good to Know |
| 25.5 Vibrio | Good to Know |
| 25.6 Infections caused by them | Good to Know |
| 25.7 Mode of spread | Good to Know |
| 25.8 Laboratory diagnosis | Good to Know |
| 25.9 Prevention | Must to Know |
| 26. Spirochetes | |
| 26.1 Treponema pallidum | Must to Know |
| 26.2 Oral lesions of Syphilis | Must to Know |
| 26.3 Laboratory diagnosis | Must to Know |
| 26.4 Borrelia vincentii | Must to Know |
| 27. Actinomycetes | |
| 27.1 Morphology | Must to Know |
| 27.2 Clinical features | Good to Know |
| 27.3 Laboratory diagnosis | Good to Know |
| 28. Virology | |
| 28.1 General properties | Good to Know |
| 28.2 Cultivation | Good to Know |
| 28.3 Host-virus interaction | Must to Know |
| 28.4 Interferon | Good to Know |
| 28.5 Laboratory diagnosis | Must to Know |
| 28.6 Chemotherapy | Good to Know |
| 28.7 Immunoprophylaxis | Must to Know |
| 29. Bacteriophage | |
| 29.1 Structure | Good to Know |
| 29.2 Significance | Good to Know |
| 30. Hepatitis viruses | |
| 30.1 Hepatitis B | Must to Know |
| 30.2 Morphology | Good to Know |
| 30.3 Clinical features | Must to Know |
| 30.4 Laboratory diagnosis | Good to Know |
| 30.5 Immunoprophylaxis | Must to Know |
| 30.6 Brief account of other Hepatitis viruses | Must to Know |
| 31. Human Immunodeficiency virus (HIV) | |
| 31.1 Morphology | Must to Know |
| 31.2 Modes of transmission | Must to Know |
| 31.3 Clinical features | Must to Know |
| 31.4 Opportunistic infections (briefly) | Must to Know |
| 31.5 Laboratory diagnosis | Must to Know |
| 31.6 Prevention | Must to Know |
| 32. Herpes virus | Must to Know |
| 33. Mumps virus | Good to Know |
| 34. Measles & Rubella viruses (briefly) | Good to Know |
| 35. Rabies | |
| 35.1 Morphology | Must to Know |

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| 35.2 Pathogenesis | Must to Know |
| 35.3 Prophylaxis | Must to Know |
| 35.4 Prevention | Must to Know |
| 36. Mycology | |
| 36.1 Classification | Must to Know |
| 36.2 Morphology | Must to Know |
| 36.3 Infection | Must to Know |
| 37. Candida | |
| 37.1 Morphology | Must to Know |
| 37.2 Clinical manifestations | Must to Know |
| 37.3 Laboratory diagnosis | Must to Know |
| 38. Fungi causing oral lesions of systemic mycoses | Must to Know |
| 39. Parasitology | |
| 39.1 Classification | Good to Know |
| 39.2 Modes of transmission | Good to Know |
| 39.3 Prevention | Good to Know |
| 39.4 Protozoans and Helminths commonly seen in the region | Good to Know |
| 40. Entamoeba histolytica | |
| 40.1 Mode of transmission | Must to Know |
| 40.2 Morphological forms | Must to Know |
| 40.3 Life cycle | Must to Know |
| 40.4 Amoebiasis | Must to Know |
| 40.5 Laboratory diagnosis | Must to Know |
| 41. Malaria | |
| 41.1 species | Must to Know |
| 41.2 Morphological forms | Must to Know |
| 41.3 Life cycle | Must to Know |
| 41.4 Clinical features | Must to Know |
| 41.4 Laboratory diagnosis | Must to Know |
| 41.5 Prevention | Must to Know |
| 42. Round worm (Ascaris lumbricoides) | |
| 42.1 Morphological forms | Good to Know |
| 42.2 Life cycle | Good to Know |
| 42.3 Clinical features | Good to Know |
| 42.4 Laboratory diagnosis | Good to Know |
| 42.5 Prevention | Good to Know |
| 43. Hook worm (Ancylostoma duodenale) | |
| 43.1 Morphological forms | Good to Know |
| 43.2 Life cycle | Good to Know |
| 43.3 Clinical features | Good to Know |
| 43.4 Laboratory diagnosis | Good to Know |
| 43.5 Prevention | Good to Know |
| 44. Hospital Acquired Infections (HAI) | |
| **44.1** Definition | Must to Know |
| **44.2** Various HA Infections | Must to Know |

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|---|---|
| **44.3** Methods of prevention & control of HAI | Must to Know |
| 45. Universal Work Precautions | |
| 45.1 Definition | Must to Know |
| 45.2 Various precautions | Must to Know |
| 46. Biomedical Waste Management | |
| 46.1 Definition | Must to Know |
| 46.2 Categories | Must to Know |
| 46.3 Methods of disposal | Must to Know |
| 46.4 Use of correct color-coded bags | Must to Know |

## B. Practical:

1. Microscope
   1.1 Parts & Functions of Compound Microscope
   1.2 Other Microscopes & their uses
   1.3 Demonstration of Microscope, its parts & slides

2. Morphology of Bacteria
   2.1 Classification
   2.2 Bacterial Cell
   2.3 Demonstration of slide of various micro-organisms

3. Staining:
   3.1 Types of staining
   3.2 Gram & Acid Fast (ZN) Staining
   3.3 Principles
   3.4 Methods & Reagents
   3.5 Observations
   3.6 Interpretations
   3.7 Demonstration of staining methods
   3.8 Demonstration of slides for both the types of staining methods

4. Sterilization & Disinfection
   4.1 Definitions
   4.2 Methods
   4.3 Demonstration of eqipments & their working used for sterilization

5. Culture Media
   5.1 Types
   5.2 Uses
   5.3 Demonstration of media

6. Culture Methods/Isolation of bacteria
   6.1 Anaerobic culture methods in details
   6.2 Demonstration of methods of inoculation & culture plates

7. Identification of bacteria/Biochemical
   Tests 7.1 Different biochemical tests
   7.2 Utility of these tests
   7.3 Demonstration of various biochemical tests

   Immunology
8. Serological Reactions
   8.1 Different serological tests
   8.2 Application of these tests for diagnosis
   8.3 Demonstration of various

   tests Systemic Bacteriology

9. Staphylococci & Streptococci
   9.1 Morphology
   9.2 Infections they produce
   9.3 Briefly Lab. Diagnosis
   9.4 Demonstration of slides, culture plates & tests

10. Neisseriae
    10.1 Morphology
    10.2 Infections they produce
    10.3 Briefly Lab. Diagnosis
    10.4 Demonstration of slides, culture plates & tests

11. Gram Negative
    Bacilli 11.1 E.coli
    11.2 Klebsiella
    11.3 Salmonella
    11.4 Shigella
    11.5 Vibrio cholerae
    11.6 Briefly account of:
    11.7 Infectious syndromes
    11.8 Laboratory diagnosis
    11.9 Demonstration of slides, culture plates & tests

12. Corynebacterium diphtheriae:
    12.1 Morphology
    12.2 Infections
    12.3 Laboratory diagnosis
    12.4Immunopropylaxis
    12.5 Demonstration of slides, culture plates & tests

13. Clostridium welchii& Clostridium tetani

13.1 Morphology
13.2 Infections
13.3 Laboratory diagnosis
13.4 Immunopropylaxis
13.5 Demonstration of slides

14. Spirochetes
14.1 Syphilis
14.2 Laboratory diagnosis
14.3 Demonstration of tests used in diagnosis

15. Mycology
15.1 Classification
15.2 Candida: Morphology & laboratory diagnosis
15.3 Demonstration of slides, culture plates &

tests Parasitology

16. Protozoa
16.1 Entamoeba histolytica
16.2 Malaria
16.3 Morphology
16.4 Life cycle
16.5 Laboratory diagnosis
16.6 Demonstration of slides of various morphological forms
16.7 Charts diplaying life cycle

17. Helminths
17.1 Ascaris lumbricoides
17.2 Ancylostoma duodenale
17.3 Morphology
17.4 Life cycle
17.5 Laboratory diagnosis
17.6 Demonstration of slides of various morphological forms
17.7 Charts displaying life cycle

## C. RECOMMENDED BOOKS:

| Title | Author | Publisher |
|---|---|---|
| Textbook of Microbiology | R. Ananthanaryan& C.K. Jayram Paniker | Orient Longman Private Ltd. Chennai |
| Textbook of Microbiology for Dental Students | -- | C. P |

| | | |
|---|---|---|
| Medical Microbiology Volume I | Cruickshank | Medical Division Orient Longman group Edinburg |
| Text Book of Bacteriology | Fair Brothers | -- |

| | | |
|---|---|---|
| Bacteriology for Dental Students | T.H. Merville and G.L. Slack | Medical Book Ltd. London |
| Bacteriology for students of Dental Surgery | R.B. Lucas and Ivor R.H.Kramer | -- |
| Oral Microbiology and Infectious Diseases | Burnett and Scherp | Oxford Book Company |
| Immunology | Donald M Weir | Longman Singapore |
| Medical Parasitology | N. C. Dey and T.K.Dey | New Central Book Agency Pvt.Ltd. Calcutta |
| Notes on Medical Virology | Morag C.Timbury | -- |
| Manual of Clinical Mycology | Conant and Smith | -- |

## EXAMINATION SCHEME

a. INTERNAL EXAM

- First internal (Theory/Practical): 20 Marks
- Second internal (Theory/Practical): 20 Marks
- Third Internal (Theory/Practical): 60 Marks

b. University Exam:

As per University rules

## GENERAL & DENTAL PHARMACOLOGY AND THERAPEUTICS

### Definition:

It is the science of drugs which deals with interaction of exogenously administered drugs with living systems.

### Aim:

The broad goal of teaching undergraduate students in pharmacology is to inculcate rational and scientific basis of therapeutics keeping in view of dental curriculum and profession.

### Objectives:

a. Knowledge

At the end of the course the student shall be able to,

I. Describe the pharmacokinetics and pharmacodynamics of essential and commonly used drugs in general and in dentistry in particular.
II. List the indications, contraindications, interactions and adverse reactions of commonly used drugs with reason.
III. Tailor the use of appropriate drugs in disease with consideration to its cost, efficacy and safety for individual and mass therapy needs.
IV. Indicate special care in prescribing common and essential drugs in special medical situations such as pregnancy, lactation, old age, renal hepatic damage and immune compromised patients.
V. Integrate the rational drug therapy in clinical pharmacology.
VI. Indicate the principles underlying the concepts of “essential drugs”.

b. Skills:

At the end of the course the student shall be able to,

I. Prescribe drugs for common dental and related medical ailments.
II. To appreciate adverse reactions and drug interactions of commonly used drugs.
III. Observe experiments designed for study of effects of drugs.
IV. Critically evaluate drug formulations and be able to interpret the clinical pharmacology of marketed preparations commonly used in dentistry.

c. Integration:

Acquire knowledge and skills on use of drugs in clinical practice through integrated teaching with clinical departments.

Note: All the above includes the scope for dental pharmacology.

## Course outcomes assessed:

Were the students able to: Describe the pharmacokinetics and pharmacodynamics of essential and commonly used drugs in general and in dentistry in particular. List the indications, contraindications; interactions, and adverse reactions of commonly used drugs with reason. Tailor the use of appropriate drugs in disease with consideration to its cost, efficacy, safety for individual and mass therapy needs. Indicate special care in prescribing common and essential drugs in special medical situations such as pregnancy, lactation, old age, renal, hepatic damage and immuno compromised patients. Integrate the rational drug therapy in clinical pharmacology. Indicate the principles underlying the concepts of "Essential drugs". Prescribe drugs for common dental and medical ailments. Appreciate adverse reactions and drug interactions of commonly used drugs. Infer from experiments designed for study of effects of drugs. Critically evaluate drug formulations and interpret the clinical pharmacology of marketed preparations commonly used in dentistry.

## A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. General Pharmacology | |
| 1.1 Definitions: Pharmacology, drug, Pharmacy, sources of drug with examples. | Must to Know |
| 1.2 Pharmacokinetics with clinical implications. | Must to Know |
| 1.3 Routes of administration: oral, inhalation, intra-dermal, subcutaneous, intramuscular, intravenous, intra-thecal, peri-neural & newer drug regimes. (Advantages and disadvantages with the examples of drug administered). | Must to Know |
| 1.4 Pharmacodynamics:mechanism of action, factors, modifying drug actions with emphasis on factors like- age, sex, dose, frequency & route of administration, presence of other drugs, pharmacogenetics and pathological conditions. | Must to Know |
| 1.5 Therapeutics: principles of drug therapy, adverse drug reactions and drug interactions. | Must to Know |
| 2. ANS Drugs | |
| 2.1 Sympathomimetics | Must to Know |
| 2.2 Sympatholytics- alpha blockers, Beta- blockers. | Must to Know |
| 2.3 Cholinomimetics. | Must to Know |

| | |
|---|---|
| 2.4 Anti cholinergics. | Must to Know |
| 1. Detailed Pharmacology of | |
| 3.1 Clinically used opioid and non-opioid analgesics. | Must to Know |
| 3.2 Local anaesthetics and preanaesthetic medication. | Must to Know |
| 4. Detailed pharmacology & enumeration of clinically used agents, their brief pharmacology, clinical uses along with dental uses if any , and specific adverse effects of: | |
| 4.1 Ethyl alcohol- actions, uses and drug interactions. | Good to Know |
| 4.2 General anaesthetics | Good to Know |
| 4.3 Antipsychotics | Desirable to Know |
| 4.4 Antidepressants | Desirable to Know |
| 4.5 Anxiolytics | Must to Know |
| 4.6 Sedative hypnotics | Desirable to Know |
| 4.7 Anti epileptics | Desirable to Know |
| 5. CVS Drugs | |
| 5.1 Cardiac glycosides | Desirable To Know |
| 5.2 Anti anginal drugs | Good To Know |
| 5.3 Anti hypertensives. | Must Know |
| 5.4 Diuretics | Good To Know |
| 5.5 Pharmacotherapy of shock-anaphylactic, cardiogenic, hypovolemic & septic. | Must to Know |
| 6. Blood | |
| 6.1 Coagulants, anticoagulants, fibrinolytics, antiplatlet drugs and styptics | Must to Know |
| 6.2 Hematinics: Iron preparation Vit B12, Folic acid Vit.C | Must to Know |
| 6.3 Vit.D& Calcium Preparations | Must to Know |
| 4. Endocrine | |
| 7.1 Drugs used in diabetes mellitus | Must to Know |
| 7.2 Corticosteroids | Must to Know |
| 8. Chemotherapy | |
| 8.1 Sulfonamides | Must to Know |
| 8.2 Beta-lactam antibiotics | Must to Know |
| 8.3 Macrolides | Must to Know |
| 8.4 Aminoglycosides | Desirable to Know |
| 8.5 Broad spectrum antibiotics | Must to Know |
| 8.6 Antifungal and antiviral (acyclovir) agents | Desirable to Know |
| 8.7 Metronidazole and fluroquinolones | Must to Know |
| 8.8 Anti neoplastic drugs: Alkylating agents, Anti metabolites, Radioactive Isotopes, Vinka Alkaloids, Anticancer antibiotics. | Desirable to Know |
| 8.9 Drug therapy of Tuberculosis, Leprosy & Malaria | Good to Know |

5. Other Drugs

| | |
|---|---|
| 9.1 Antihistamines and antiemetics | Good To Know |
| 9.2 Drugs used in bronchial asthma and cough | Good To Know |
| 9.3 Drugs used in peptic ulcer | Good To Know |
| 9.4 Chelating agents- BAL, EDTA & Penicillamine | Desirable To Know |
| 9.5 Anti helminthics | Desirable To Know |
| 10. Dental Pharmacology | |
| 10.1 Fluoride pharmacology | Must to Know |
| 10.2 Antiseptics, astringents &sialogogues | Must to Know |
| 10.3 Obtundents, Mummifying and disclosing agents | Must to Know |
| 10.4 Prevention and drug therapy of emergencies in dental practice | Must to Know |
| 10.5 Seizures | Must to Know |
| 10.6 Anaphylaxis | Must to Know |
| 10.7 Severe bleeding | Good to Know |
| 10.8 Shock | Must to Know |
| 10.9 Tetany | Must to Know |
| 10.10 Status asthmaticus | Must to Know |
| 10.11 Acute addisonian crisis | Must to Know |
| 10.12 Diabetic Ketoacidosis | Must to Know |

## B. Practical

1. Introduction
   1.1 Equipment used in dispensing pharmacy
   1.2 Prescription parts and model prescription

2. Demonstration of common dosage forms used in clinical practice

3. Mixtures
   3.1 Simple mixtures (salicylate mixture)
   3.2 Diffusible (Bismuth Kaolin/ Chalk) mixtures

6. Emulsion- Types and example (Liniment turpentine/ shark liver oil) of emulsion

7. Powders- toothpowder

8. Paints
   6.1 Mandle's paint/ Gum paint
   6.2 Percentage dilution- concept and calculations with suitable examples

7. Mouthwashes

   7.1 Alkaline mouthwash
   7.2 Antiseptic mouthwash
   7.3 Astringent mouthwash

8. Toothpastes

9. Prescription writing for 15 general conditions commonly encountered in clinical practice. e.g. Bronchial asthma, hypertension congestive heart failure, angina pectoris, peptic ulcer, bacillary dysentery, pseudomembranous colitis, diabetes mellitus, diabetic coma, osteoarthritis, anaphylaxis, status asthmaticus, status epilepticus, iron deficiency & pernicious anaemia

10. Dental prescriptions for about fifteen dental conditions commonly encountered in practice e.g. Acute necrotising ulcerative gingivitis, acute herpetic gingivitis/stomatitis, acute gingival abscess, peri coronal abscess (impacted teeth), dental caries, aphthous ulcers, hypersensitive dentine, dentoalveolar abscess, xerostomia, acute toothache, postoperative pain, post extraction pain with swelling, oral candidacies, scurvy etc.

## C. RECOMMENDED BOOKS

1. R.S.Satoskar, Kale Bhandarkar's Pharmacology and Pharmacolherapentics, 10th Edition, Bombay Popular Prakashan 1991.
2. Bertam G Katzung, Basic and Clinical pharmacology 6th ed. Appleton & Lange 1997
3. Lauerence D.R. Clinical Pharmacology 8th ed. Churchill Livingstone 1997
4. Satoskar R.S. & Bhandarkar S.D., Pharmacology and Pharmaco Therapeutics part I & part ii, 13th Popular Prakashan Bombay 1993
5. Tripathi K.D., Essentials of Medical Pharmacology 4th ed Jaypee Brothers 1999.

## D.SCHEME OF EXAMINATION

a. INTERNAL EXAM

- First internal (Theory/Practical): 20 Marks
- Second internal (Theory/Practical): 20 Marks
- Third Interna (Theory/Practical)l: 60 Marks

b. University Exam:

As per University rules

## DENTAL MATERIALS

### Course outcomes assessed:

Were the students able to: Understand the evolution and development of science of dental material. Explain purpose of course in dental materials to personnel concerned with the profession of the dentistry. Acquire knowledge of physical and chemical properties. Acquire knowledge of biomechanical requirements of particular restorative procedure. Search for newer and better materials which may answer our requirements with greater satisfaction. Evaluate the claims made by manufactures of dental materials

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT

The change in II BDS Dental Material theory syllabus shall be as following:

1. To introduce Reverse Engineering/CAD-CAM as desirable to

know These will enable students to stay up-to-date with advances

in dentistry.

The change in II BDS Dental Materials theory syllabus shall be as following:

1. Biomedical waste management of dental materials used in prosthodontics under desirable to know section

These will enable students to handle the material waste with caution.

The change in II BDS Dental Materials theory syllabus shall be as following:

1. To incorporate optical physics, recent advances in tooth coloured restoration and endodontic related materials like EDTA, gutta percha, irrigants as desirable to know.

These will enable students to stay up-to-date with advances in endodontics.

| TOPIC | DISTRIBUTION |
|---|---|
| . 1. Metals and Alloys | |
| 1.1 Structure and behavior of metals | Must to Know |
| 1.2 Solidification of metals | Must to Know |
| 1.3 Mechanism of crystallization- amorphous & crystalline | Must to Know |
| 1.4 Classification of alloys | Must to Know |
| 1.5 Solid solution | Good to Know |
| 1.6 Constitutes and equilibrium phase diagrams: electric alloys, physical properties, peritectic alloys, solid state reaction other binary system | Good to Know |
| 1.7 Metallography and heat treatment | Good to Know |
| 1.8 Tarnish and corrosion | Must to Know |
| 1.9 Corrosion of dental restorations | Must to Know |
| 1.10 Clinical significance of galvanic current | Must to Know |
| . 2.Dental Casting Alloys | |
| 2.1 Historical background | Must to Know |
| 2.2 Desirable properties of casting alloys | Must to Know |
| 2.3 CAD-CAM technology | Good to Know |
| 2.4 Classification of casting alloys: by function and description | Must to Know |
| 2.5 Recent classification: high noble, noble and predominantly base metal | Must to Know |
| 2.6 Alloys for crown and bridge, metal ceramic and removable partial denture | Must to Know |
| 2.7 Composition, function, constituents and application, each alloy both noble and base metal | Must to Know |
| 2.8 Properties of alloys: melting range, mechanical properties, hardness, elongation, modulus of elasticity | Must to Know |
| 2.9 Casting shrinkage and compensation of casting shrinkage | Must to Know |
| 2.10 Biocompatibility- handling hazards & precautions of base metal alloys | Must to Know |
| 2.11 Casting investments used | Must to Know |
| 2.12 Heat treatment- softening and hardening heat treatment | Must to Know |
| 2.13 Recycling of metal | Good to Know |
| 2.14 Titanium alloys and their application, properties and advantages | Good to Know |
| 2.15 Technical considerations in casting- heat source and furnaces | Desirable to Know |
| 3. Dental Casting Investments | |
| 3.1 Definition, requirement, classification | Must to Know |

| | |
|---|---|
| 3.2 Gypsum bonded, phosphate bonded, silica bonded - Classification | |
| 3.3 Mode of supply- composition, application, setting mechanism, setting time, and factors controlling it. | Must to Know |
| 3.4 Expansions: setting expansion, hygroscopic setting expansion and thermal expansion | Must to Know |
| 3.5 Factors affecting properties: strength, porosity and fineness and storage | Must to Know |
| 3.6 Technical considerations for casting procedures, | Must to Know |
| 3.7 Preparation of die, wax pattern, spruing, investing,(FLIPPED CLASSROOM) control of shrinkage compensation, wax burnout and heating the investing ring | Must to Know |
| 3.8 Casting, casting machines, source of heat for melting the alloy | Must to Know |
| 3.9 Casting defects | Must to Know |
| 4.Dental Ceramic | |
| 4.1 Historical background & general applications | Good to Know |
| 4.2 Definition, classification, application, mode of supply, manufacturing procedures, methods of strengthening. | Must to Know |
| 4.3 Properties of fused ceramic: Strength and factor affecting, Modulus of Elasticity, Surface Hardness, Wear Resistance, Thermal Properties, Specific Gravity, Chemical Stability, Esthetic Properties, Biocompatibility, Technical Considerations | Must to Know |
| 4.4 Metal ceramics (PFM) alloys: Types and Composition. | Must to Know |
| 4.5 Metal ceramic bond<br>4.5.1 Nature of bond<br>4.5.2 Bonding using electro deposition, foil coping, bonded platinum foil, swaged gold alloy foil coping.<br>4.5.3 Technical considerations for porcelain and porcelain used metal restorations. Recent advances- all porcelain restorations, manganese core, injection molded, castable ceramics, glass infiltrated alumina core, in Ceram, ceramic veneer, inlays and onlays and CAD-CAM ceramic. Chemical attack of ceramic by fluoride. Porcelain furnaces. | Must to Know |
| 4.6 Recent Advances<br>4.6.1 All porcelain restorations<br>4.6.2Manganese core<br>4.6.3 Injection moulded<br>4.6.4 Castable ceramics<br>4.6.5Glass infiltrated alumina core<br>4.6.6 In Ceram<br>4.6.7 Ceramic veneer<br>4.6.8 Inlays and onlays and CAD-CAM ceramic<br>4.6.9 Chemical attack of ceramic by fluoride | Desirable to Know |

4.6.10 Porcelain furnaces
4.6.11 Zirconia as an all ceramic restoration

5.Die and Die Materials

| | |
|---|---|
| 5.1 Types: Gypsum, Epoxy Resin, Cement and Amalgam | Must to Know |
| 5.2 Electroforming and electro polishing | Must to Know |
| 6.Abrasive and Polishing Agents | |
| 6.1 Definition | Must to Know |
| 6.2 Need | Must to Know |
| 6.3 Finishing, polishing and cleaning | Must to Know |
| 6.4 Types of abrasives: | |
| 6.4.1 Diamond | Must to Know |
| 6.4.2 Emery | Must to Know |
| 6.4.3 Aluminum oxide | Must to Know |
| 6.4.4 Garnet | Good to Know |
| 6.4.5 Pumice | Must to Know |
| 6.4.6 Kieselgurh | Good to Know |
| 6.4.7 Tripoli | Good to Know |
| 6.4.8 Rouge | Must to Know |
| 6.4.9 Tin oxide | Good to Know |
| 6.4.10 Chalk | Good to Know |
| 6.4.11 Chromium oxide | Good to Know |
| 6.4.12 Sand | Must to Know |
| 6.4.13 Carbides | Good to Know |
| 6.4.14 Zirconium silicates | Good to Know |
| 6.4.15 Zinc oxide | Good to Know |
| 7.Dental Implant | |
| 7.1 Evolution, Types and Materials | Must to Know |
| 8. Biomedical Waste Management of Dental materials used in Prosthodontics<br>8.1.Gypsum Products<br>8.2. Dental Silicone<br>8.3. Acrylic Resin<br>8.4. Miscellaneous | Desirable to know |
| 9. Dental Cements: Definitions, classifications, setting-mechanism, properties, factors affecting setting, manipulations, mode of supply, mode of adhesion, modifications & recent advances, clinical implications of : | |
| 9.1 Silicate Cement | Must to Know |
| 9.2 Glass Ionomer, | Must to Know |

| | |
|---|---|
| 9.3 Zinc Phosphate, | Must to Know |
| 9.4 Zinc Oxide Eugenol, | Must to Know |
| 9.5 Calcium Hydroxide, | Must to Know |
| 9.6 Zinc Polycarboxylate, | Must to Know |
| 9.7 Gutta-Percha & Varnish | Must to Know |
| 10. Dental Amalgam | |
| 10.1 History, | Good to Know |
| 10.1 Definitions, classifications | Must to Know |
| 10.1 Manufacturing | Good to Know |
| 10.1 Compositions, setting reaction | Must to Know |
| 10.1 Properties, microlekage, manipulations, | Must to Know |
| 10.1 Effect of dimensional changes, finishing & polishing | Must to Know |
| 10.1 Mercury toxicity & hygiene | Must to Know |
| 10.1 Clinical implications | Must to Know |
| 10.1 Biocompatibility | Must to Know |
| 11. Direct Filling Gold | |
| 11.1 Properties | Good to Know |
| 11.2 Mode of adhesions | Good to Know |
| 11.3 Classifications, | Good to Know |
| 11.4 Manipulations | Good to Know |
| 11.5 Removal of surface impurities | Good to Know |
| 11.6 Mode of supply | Good to Know |
| 11.7 Clinical performance | Good to Know |
| 12.Abrasion and Polishing Agents | |
| 12.1 Definition, Needs and Types | Must to Know |
| 12.2 Desirable characteristics of an abrasive | Must to Know |
| 12.3 Rate of abrasion, | Must to Know |
| 12.4 Size of particle | Must to Know |
| 12.5 Pressurized speed | Must to Know |
| 12.6 Polishing materials, | Must to Know |
| 12.7 electrolytic polishing and burnishing | Must to Know |
| 13.Tarnish and Corrosion | |
| 13.1 Definition, | Must to Know |
| 13.2 Corrosion types | Must to Know |
| 13.3 Methods to overcome | Must to Know |
| 13.4 Corrosion | Must to Know |

14.Adhesion

| | |
|---|---|
| 14.1 Need for bonding, | Must to Know |
| 14.2 Types of bonding, clinical factors affecting bonding, | Must to Know |
| 14.3 Advantage & disadvantages of bonding | Must to Know |
| 14.4 Acid etch techniques | Must to Know |
| 14.5 Enamel bonding | Must to Know |
| 14.6 Dentin bonding agents | Must to Know |
| 15. Optical physics | Desirable to Know |
| 16. Recent advances in tooth colored restorations | Desirable to Know |
| 17. Endodontic related materials like EDTA, Gutta percha, Irrigants | Desirable to Know |

## B. SYLLABUS FOR PRACTICALS:

1. Investment Materials: Composition, Manipulation, Properties and demonstration of investing procedure.
2. Dental Casting Alloys, Wrought Metal Alloys: identification and composition and properties
3. Dental Porcelain: Manipulation, Properties and demonstration.
4. Dental Implants: types and properties
5. Materials For Maxillo-Facial Prosthesis:
6. Tissue Conditioner: Composition, and manipulation and use
7. Soft Liner: Composition, and manipulation and use
8. Separating Media: Composition, and manipulation and use
9. Finishing And Polishing Agents :identification, Types and use
10. Manipulation of Silver Amalgam.
    - 10.1. Demonstration of proportioning.
    - 10.2. Demonstration of trituration, mulling, condensation, carving, finishing and polishing of dental amalgam.
    - 10.3. Students are demonstrated to do restoration in Class I amalgam cavity.
11. Manipulation of Zinc Phosphate Cement.
    - 11.1. Demonstration of powder: liquid ratio, method of mixing, consistency, application as a base into the cavity.
12. Manipulation of Glass Ionomer Cement.
    - 12.1. Demonstration of powder: liquid ratio, method of mixing, consistency, application as a base into the Class IV cavity in restorative and luting consistency.
13. Manipulation of Zinc Polycarboxylate Cement.

13.1. Demonstration of powder: liquid ratio, method of mixing, consistency, application as a base into the cavity.

14. Manipulation of Zinc Oxide Eugenol Cement.
    14.1. Demonstration of powder: liquid ratio, method of mixing, consistency, application as a base into the cavity in restorative and luting consistency.

15. Discussion and Demonstration of application of calcium hydroxide powder and/or Dycal as sub base and pulp capping agent.
16. Discussion and Demonstration and application of dental varnish.
17. Demonstration of composite resin- acid etching, bonding procedure, incremental build-up of Class IV/V composite resin. Light curing procedures and finishing and polishing.

## C. RECOMMENDED BOOKS:

| Title | Author | Publisher |
|---|---|---|
| Science of Dental Material | Kenneth J Annusavice | W.B. Saunder's |
| Restorative Dental Materials | Robert G Craig | Mosby, USA |
| Dental Materials | Craig, Power and Wataha | |
| Notes on Dental Material | E C Combe | ChurchillLivingstone, UK |
| Basic Dental Material | Mannapalli | |

## D. SCHEME OF EXAMINATION

a. INTERNAL EXAM:

- First internal (Theory/Practical): 20 Marks
- Second internal (Theory/Practical): 20 Marks
- Third Internal (Theory/Practical): 60 Marks

b. UNIVERSITY EXAM

The change in II BDS Dental Material university exam shall be as following:

These will enable students to develop analytical thinking.

## Practical Examination: (distribution of marks)

| SR. NO | PARTICULARS | MARK |
|---|---|---|
| 1 | Spotters- 10 X 2 | 20 |
| 2 | Exercise No-1 (Based on OSPE) Prosthodontic: Any one exercise from the following:<br>Manipulation of:<br>s. Impression Compound<br>t. Alginate Impression Material<br>u. Zinc Oxide Eugenol Impression Paste<br>v. Dental Stone<br>w. Dental Plaster<br>x. Acrylic resin | 30 |

| | | |
|---|---|---|
| 3 | Exercise No:2 (Based on OSPE)<br>Conservative: Any one from following<br>Manipulation of:<br>p. Silver Amalgam<br>q. Zinc Oxide Eugenol(Luting and Base consistency)<br>r. Zinc Phosphate Cement (Luting and Base consistency)<br>s. Glass Ionomer Cement Type I/II (Luting/Filling consistency)<br>t. Polycarboxylate Cement (Luting consistency) | 30 |
| 4 | Journal | 10 |
| | Total (Practical) | 90 |
| 5 | VIVA VOCE | 20 |

## ORAL PATHOLOGY & MICROBIOLOGY

### DEFINITION:

Oral Pathology deals with the nature of oral diseases, their causes, processes and effects. It relates the clinical manifestation of oral diseases to physiologic and anatomic changes associated with these diseases. It deals with commonly occurring pre malignancies and malignancies and serves commonly with the scientifically based information. It also deals with application of dental science to the administration of law and the furtherance of justice.

### AIM:

To make undergraduate student training program effective so as to develop independent capabilities in a student, to learn and apply the knowledge of Oral Pathology in identifying the problems and diagnosis with sound scientific knowledge and skills.

### OBJECTIVES

At end of Oral Pathology &Microbiology course, the student should be able to:

i. Identify the different types of pathological processes that involve the Orofacial tissues.
ii. Comprehend the manifestations of common diseases, their diagnosis & correlation with clinical pathological processes.
iii. Understand the oral manifestations of systemic diseases and correlate with the system physical signs & laboratory findings.
iv. Understand the underlying biological principles governingtreatment oforaldiseases.
v. Understand the principles of certain basic aspects of Forensic Odontology.

### SKILLS

The Following skills are to be developed:

i. Microscopic study of common lesions affecting oral tissues through microscopic slides &projection slides
ii. Study of the disease process by surgical specimens
iii. Study of teeth anomalies/polymorphisms through tooth specimens & plaster casts.
iv. Microscopic study of plaque pathogens
v. Study of haematological preparations (blood films) of anaemias& leukemias
vi. Basic exercises in Forensic Odontology such as histological methods of age estimation and appearance of teeth in injuries

### SYLLABUS

IInd Year: students appriciate basic oral patholgoy in slides casts and specimen.

Students are assigned with formulating research, questions to the oral pathology and search for related evidences.

- Identify pathology of oral region- hard &soft tissue.
- Assignment incorporating available literature evidences& searching relevant database for evidence.
- Application of evidence in diagnosing the pathology.

EBEs incorporation in other UG activities:

In addition to the above students are encouraged to discuss evidences of oral pathological conditions while examining histopathological slides.

Assignments are given related to oral pathological lesions and students are asked to search databases and find current and relevant literature evidences and make a report on the same

## Course outcomes assessed:

Were the students able to**:** Describe the different types of pathological processes, that involve the oral cavity. Describe the manifestations of common diseases, their diagnosis & correlation with clinical pathological processes. Explain the oral manifestations of systemic diseases should help in correlating with the systemic physical signs & laboratory findings. Explain the underlying biological principles governing treatment of oral diseases. Explain the principles of basic aspects of Forensic Odontology. Describe the laboratory procedures in histo-pathology. Identify the pathologies on basis of histopathological observations and correlate them with clinical picture.

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## A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Developmental disturbances of oral and paraoral structures | |
| 1.1. Developmental disturbances of Jaws | Must to Know |
| 1.1.1. Agnathia | Good to Know |
| 1.1.2. Micrognathia | Must to Know |
| 1.1.3. Macrognathia | Must to Know |
| 1.1.4. Facial Hemihypertrophy | Good to Know |
| 1.1.5. Facial Hemiatropy | Good to Know |
| 1.2 Developmental Disturbances of lips and palate | |
| 1.2.1 Congenital Lip pits and Commissural pits and fistulas | Desirable to Know |
| 1.2.2 Cheilitis Granulomatosa | Good to Know |
| 1.2.3 Hereditary Intestinal Polyposis | Good to Know |

| | |
|---|---|
| 1.2.4 Hereditary Melanotic Macule | Good to Know |
| 1.2.5Double lip,Cleft lip,cleft Palate,Chelitis Glandularis | Desirable to Know |
| 1.3 Developmental disturbances of Oral Mucosa | |
| 1.3.1 Fordyce's Granules | Must to Know |
| 1.3.2 Focal epithelial Hyperplasia | Good to Know |
| 1.4 Developmental disturbances of gingiva | |
| 1.4.1 Fibromatosis Gingiva | Must to Know |
| 1.4.2 Retrocuspid Papilla | Good to Know |
| 1.5 Developmental Disturbances Of Tongue | |
| 1.5.1 Macroglossia | Must to Know |
| 1.5.2 Microglossia | Must to Know |
| 1.5.3 Ankyloglossia | Must to Know |
| 1.5.4 Cleft Tongue | Must to Know |
| 1.5.5 Fissured Tongue | Must to Know |
| 1.5.6 Median Rhomboid Glossitis | Must to Know |
| 1.5.7 Benign Migratory Glossitis | Must to Know |
| 1.5.8 Hairy Tongue | Must to Know |
| 1.6 Development disturbances of lymphoid tissue | |
| 1.6.1 Reactive lymphoid aggregates | Good to Know |
| 1.6.2 Lymphoid hamartoma | Good to Know |
| 1.6.3 Angiolymphoid Hyperplasia | Good to Know |
| 1.6.4 Lympho-epithelial cyst | Good to Know |
| 1.7 Developmental disturbances of salivary glands | |
| 1.7.1 Aplasia | Desirable to Know |
| 1.7.2 Xerostomia | Must to Know |
| 1.7.3 Hyperplasia of the palatal glands | Desirable to Know |
| 1.7.4 Atresia | Desirable to Know |
| 1.7.5 Abberrancy, Stafine'scyst | Must to Know |
| 1.8 Developmental disturbances in size of teeth | |
| 1.8.1 Microdontia | Must to Know |
| 1.8.2 Macrodontia | Must to Know |
| 1.9 Developmental disturbances in the shape of the teeth | |
| 1.9.1 Fusion | Must to Know |
| 1.9.2 Germination | Must to Know |
| 1.9.3 Concrescence | Must to Know |
| 1.9.4 Dilacerations | Must to Know |
| 1.9.5 Talon'sCusp | Must to Know |
| 1.9.6 Dens in Dente | Must to Know |
| 1.9.7 Dens Evaginatus | Must to Know |
| 1.9.8 Taurodontism | Must to Know |
| 1.9.9 Supernumerary roots | Must to Know |
| 1.9.10Enameloma | Must to Know |
| 1.10 Developmental Disturbances in number of teeth | |
| 1.10.1 Anodontia | Must to Know |
| 1.10.2 Supernumerary teeth | Must to Know |

| | |
|---|---|
| 1.10.3 Predecidious Dentition | Must to Know |
| 1.10.4 Post Permanent Dentition | Must to Know |
| 1.11 Developmental Disturbances in Structure of Teeth | |
| 1.11.1 Amelogenesis Imperfecta | Must to Know |
| 1.11.2 Enamel Hypoplasia | Must to Know |
| 1.11.3 Dentinogenesis Imperfecta | Must to Know |
| 1.11.4 Dentinal dysplasia | Must to Know |
| 1.11.5 Regional Odontodysplasia | Must to Know |
| 1.11.6 Shell Teeth | Good to Know |
| 1.12 Developmental Disturbances in eruption of teeth | |
| 1.12.1 Premature Eruptions | Must to Know |
| 1.12.2 Eruption Sequestrum | Must to Know |
| 1.12.3 Delayed eruption | Must to Know |
| 1.12.4 Impaction | Must to Know |
| 2. Dental caries | |
| 2.1 Theories | Must to Know |
| 2.2 Clinical features | Must to Know |
| 2.3 Classification | Must to Know |
| 2.4 Histopathology | Must to Know |
| 2.5 Microbiology of Dental caries | Desirable to Know |
| 2.6 Immunology | Desirable to Know |
| 2.7 Caries activity tests | Desirable to Know |
| 2.8 Factors influencing caries | Must to Know |
| 3. Diseases of Pulp & Periapical tissues | |
| 3.1 Diseases of the Dental Pulp | Must to Know |
| 3.1.1 Pulpitis | Must to Know |
| 3.1.2 Focal Reversible Pulpitis | Must to Know |
| 3.1.3 Chronic Pulpitis | Must to Know |
| 3.1.3 Pulp Polyp | Must to Know |
| 3.2 Diseases of the Periapical Tissues | |
| 3.2.1 Periapical Granuloma | Must to Know |
| 3.2.2 Periapical Abscess | Must to Know |
| 3.2.3 Periapical Cyst | Must to Know |
| 3.3 Osteomyelitis | |
| 3.3.1 Acute Suppurative Osteomyelitis | Must to Know |
| 3.3.2 Chronic Focal and Diffuse | Must to Know |
| 3.3.3 Sclerosing Osteomyelitis | Must to Know |
| 3.3.4 Garre's Ostemyelitis | Must to Know |
| 3.4 Sequalae of periapical abscess | |
| 3.4.1 Summary of space infections | Must to Know |
| 3.4.2 Systemic complications & significance | Desirable to Know |
| 3.5 Cellulitis | Must to Know |
| 3.6 Ludwig’s angina | Must to Know |
| 3.7 Intracranial complication of dental infection | Desirable to Know |
| 3.8 Maxillary sinusitis | Must to Know |

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|---|---|
| 3.9 Focal infection and foci of infection | Must to Know |
| 4. Spread of Oral Infection | Must to Know |

## B. PRACTICALS:

II BDS ORAL PATHOLOGY

LIST OF SLIDES FOR ORAL PATHOLOGY

| NO. | | NAME OF SLIDE |
|---|---|---|
| 1 | SPECIAL STAINS | HEMATOXYLIN AND EOSIN STAIN |
| | | PERIODIC ACID SCHIFF STAIN |
| | | MALLORY'S STAIN |
| | | VAN GIESON'S STAIN |
| | | PAPANICOLAOU STAIN |
| 2 | DENTAL CARIES | |
| | | SMOOTH SURFACE CARIES |
| | | PIT AND FISSURE CARIES |
| | | DENTINAL TUBULES (BEADED APPEARANCE) |
| | | LIQUEFACTION FOCI OF MILLER'S |
| 3 | PULP AND PERIAPICAL LESIONS | PULP POLYP |
| | | PULP STONES |
| | | NECROSIS OF PULP |
| | | PERIAPICAL GRANULOMA |
| | | HYALINE DEGENERATION PULP |
| | | RADICULAR CYST |

LIST OF MODELS

1 GEMINATION
2 FUSION
3 TAURODONTISM
4 DILACERATION
5 CONCRESCENCE
6 TALON CUSPS
7 BIFID ROOTS, SUPERNUMERARY ROOTS
8 MESIODENS
9 ENAMEL PEARLS
10 SUPERNUMARARY TEETH CAST

11 PARA PREMOLARES OR PARAMOLARS CAST
12 CLEFT LIP AND CLEFT PALATE CAST
13 COMPLETE OR PARTIAL ANODONTIA CAST
14 PIT & FISSURE CARIES
15 PROXIMAL CARIES
16 CERVICAL CARIES
17 ATTRITION TOOTH SPECIMEN
18 ABRASION TOOTH SPECIMEN
19 EROSION TOOTH SPECIMEN
20 LOCALISED OR GENERALISED GINGIVAL ENLARGEMENT CAST

## C. RECOMMENDED BOOKS:

Refer to page no.

## D. SCHEME OF EXAMS:

The examination shall be conducted at the end of III BDS.

## PRECLINICAL CONSERVATIVE

Course outcomes assessed:

Were the students able to: Identify hand and rotary cutting instruments. Prepare cavity designs to receive various restorative materials on typhodont teeth in skill laboratory

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction to operative dentistry | |
| 1.1Definition, factors | Must to Know |
| 1.2Radiologic indications | Must to Know |
| 1.3Dynamics of operative dentistry | Must to Know |
| 1.4Future demand | Must to Know |
| 2. Scope of subject and nomenclature | |
| 2.1Terminologies | Must to Know |
| 2.2Nomenclature of cavities | Must to Know |
| 2.3Classification of cavities | Must to Know |
| 2.4Nomenclature, various surfaces of tooth | Good to Know |
| 2.5Systems with similar and different notations in each segment | Good to Know |
| 3. Tooth Structures | |
| 3.1Enamel and Dentin. | Must to Know |
| 3.2Histological features | Must to Know |
| 3.3Clinical considerations | Must to Know |
| 3.4Applied anatomy. | Good to Know |
| 4. Dental Caries | |
| 4.1Introduction | Must to Know |
| 4.2Classification | Must to Know |
| 4.3Histopathology | Good to Know |
| 4.4Etiology | Must to Know |
| 4.5Contributory factors in dental caries | Must to Know |
| 4.6Caries of enamel, dentin and Cementum | Must to Know |
| 4.7Morphological and chemical events in caries process | Must to Know |
| 4.8Epidemiology | Must to Know |
| 4.9Microbiology and histopathology | Must to Know |
| 5. Caries Diagnosis | |
| 5.1Assessment tools | Must to Know |
| 5.2Procedures | Must to Know |
| 5.3Diagnosis of pits and fissures, smooth surface, root surface caries | Must to Know |
| 5.4Caries activity test | Must to Know |
| 5.5FOTI | Good to Know |

| | |
|---|---|
| 5.6 UV illumination | Good to Know |
| 5.7 Laser auto fluorescence | Desirable to Know |
| 5.8 Endoscopy | Good to Know |
| 5.9 Electrical resistance | Good to Know |
| 5.10 Ultrasonic imaging and die penetration | Good to Know |
| 6. Caries prevention and radiology | |
| 6.1 Fluoride exposure | Must to Know |
| 6.2 Immunization | Desirable to Know |
| 6.3 Diet | Must to Know |
| 6.4 Salivary flow | Must to Know |
| 6.5 Oral hygiene | Must to Know |
| 6.6 Anti microbial agent | Must to Know |
| 6.7 Pit and fissure sealants | Must to Know |
| 6.8 Restoration | Must to Know |
| 6.9 Enameloplasty | Must to Know |
| 7. Instruments in operative dentistry | |
| 7.1 Classification of hand instruments, rotary instruments-detail Features | Must to Know |
| 7.2 Application, techniques | Must to Know |
| 7.3 Sterilization of instruments | Must to Know |
| 7.4 Speeds in operative dentistry | Must to Know |
| 7.5 Powered cutting instruments | Must to Know |
| 7.6 Hazards with cutting instruments | Must to Know |
| 7.7 Cutting mechanism | Must to Know |
| 7.8 Sharpening of hand instruments | Must to Know |
| 7.9 Dental burs | Must to Know |
| 7.10 Bladed and abrasive cutting | Must to Know |
| 7.11 Eye and ear inhalation | Must to Know |
| 7.12 Pulp and soft tissue protection | Must to Know |
| 7.13 Aerosols | Must to Know |
| 7.14 Design characteristics | Must to Know |
| 7.15 Recent advances-lasers | Desirable to Know |
| 8. Biological considerations in operative dentistry | |
| 8.1 Risk and effect of infection | Must to Know |
| 8.2 HIV | Must to Know |
| 8.3 Hepatitis B | Must to Know |
| 8.4 Medical history | Must to Know |
| 8.5 Biomedical waste disposal | Must to Know |
| 8.6 Operative asepsis | Must to Know |
| 8.7 Sterilization- methods of sterilizing dental instruments | Must to Know |
| 8.8 Dental unit waterline | Must to Know |
| 8.9 Infection control for impressions | Must to Know |
| 8.10 Epidemiology | Desirable to Know |
| 9. Gnathological concepts of restorations | |
| 9.1 Definition | Must to Know |

| | |
|---|---|
| 9.2 Classification of human teeth form | Must to Know |
| 9.3 Radiology | Must to Know |
| 9.4 Structure of teeth | Must to Know |
| 9.5 Physiology of tooth form | Must to Know |
| 9.6 Occlusion- general description, articulator | Must to Know |
| 9.7 Tooth contacts during MD movement | Must to Know |
| 9.8 Mechanics | Must to Know |
| 10. Contact and contours | |
| 10.1 Definitions | Must to Know |
| 10.2 Types of contacts between teeth, | Must to Know |
| 10.3 Hazards of faulty contact and contours. | Must to Know |
| 11. Choice of materials | |
| 11.1 Amalgam | Must to Know |
| 11.2 Composites | Must to Know |
| 11.3 Cements | Must to Know |
| 11.4 Bonded restoration | Must to Know |
| 11.5 Cast restoration | Must to Know |
| 12. Tooth separation, wedges, matrices | |
| 12.1 Capacity of motion | Must to Know |
| 12.2 Types of separation | Must to Know |
| 12.3 Classification | Must to Know |
| 12.4 Uses | Must to Know |
| 12.5 Application of matrices and wedges | Must to Know |
| 13. Principles of cavity preparation | |
| 13.1 Definition of tooth preparation | Must to Know |
| 13.2 Need for restoration | Must to Know |
| 13.3 Nomenclature | Must to Know |
| 13.4 Objectives of tooth preparation | Must to Know |
| 13.5 Stages and steps | Must to Know |
| 13.6 Factors affecting tooth preparation | Must to Know |
| 13.7 Pulp protection | Must to Know |
| 13.8 Forces exerted during occlusion or mastication | Must to Know |
| 13.8 Mechanical function of marginal ridges | Must to Know |
| 13.9 Application of stress and their distribution | Must to Know |
| 14. Finishing and polishing of restoration | |
| 14.1 Micro and macro abrasion-burnishing | Must to Know |
| 14.2 Objectives of finishing and polishing, | Must to Know |
| 14.3 Health hazards during finishing and polishing | Must to Know |
| 14.4 Finishing and polishing instruments | Must to Know |
| 14.5 Abrasive materials. | Must to Know |
| 15. Isolation of operative field | |
| 15.1 Moisture from soft tissues | Must to Know |
| 15.2 Direct and indirect methods with examples | Must to Know |
| 15.3 Gingival retraction cords | Must to Know |
| 15.4 Mechanical, chemical, surgical, electrosurgical means | Must to Know |

B. PRACTICAL PRE-CLINICAL WORK QUOTA:

| Exercise | Work quota |
|---|---|
| Plaster model work | |
| Class I +extension | 6 |
| Class II | 4 |
| Class III | 2 |
| Class IV | 1 |
| Class V | 2 |
| ClassVI | 1 |
| Exercises on typhodont teeth | |
| Class I | 5 |
| Class I extension | 2 |
| Class II (FLIPPED CLASSROOM) | 10 |
| Class II mod | 2 |
| Class V-GIC | 2 |
| Class V amalgam | 2 |
| Class III GIC | 2 |
| Exercises on extracted teeth | |
| Class I | 4 |
| Class I extension | 2 |

| | |
|---|---|
| Class II | 4 |
| Class V | 2 |
| Cast restorations | |
| Class II-inlay with wax pattern,spruing, investing, Finishing &cementation on extracted teeth | 1 |
| Root canal treatment | |
| Maxillary central incisor –RCT with accesses opening, WL, BMP,obturation&post-obturation | 1 |
| Demonstration of class III & V composite on extracted teeth | |
| Plaster work+typhodont+extracted | 16+25+14=55 |
| Peer to peer teaching and small group discussion | 1 |

## C. Recommended books

| Sr. No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Textbook of Dental Material Science | Phillip | Elsevier |
| 2 | Restorative Dental Materials | Craig | Elsevier Mosby |
| 3 | Arts and Science of Operative Dentistry | Sturdevant's | Mosby |

Reference books

| Sr. no. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Dental Materials | Hattrik | Saunders Elsevier |
| 2 | Atlas of Glass Ionomer Cement | Graham | Dunitz |
| 3 | Textbook of Operative Dentistry | Marzouk | IshiyakuEuroAmerica,Inc Publishers |
| 4 | Pre-clinic Manual of Conservative Dentistry | V.Gopikrishna | Emmess |

D. SCHEME OF EXAMINATION:

INTERNAL EXAMINATION SCHEME:

| First Internal (Theory/Practical) | Second Internal (Theory/Practical) | Third Internal (Theory/Practical) |
|---|---|---|
| Max marks – 20 Marks | Max marks – 20Marks | Max Marks – 60Marks |

## UNIVERSITY PRACTICAL EXAMINATION

Exam pattern for preclinical practical----- 100 marks

Internal-20

Practical-80

| | |
|---|---|
| Class II amalgam cavity preparation, Matrix with retainer & base and Restoration, carving & finishing | - 30 |
| Spotters | - 20 |
| Viva-voce | - 20 |
| Journal | - 10 |

## PROSTHODONTICS & CROWN AND

## BRIDGE

Course outcomes assessed:

Were the students able to: Mark anatomical landmarks in edentulous casts, classify partially edentulous arches and correlate to clinical picture. Identify instruments and equipment used for clinical and laboratory prosthodontic procedures. Perform all lab procedures to make a conventional complete denture, removable interim partial denture. Perform tooth preparation and wax patterns for crowns on typhodont teeth

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Complete Denture | |
| 1.1 Applied Anatomy & Physiology | |
| 1.1.1 Introduction | Must to Know |
| 1.1.2 Biomechanics of the edentulous state | Good to Know |
| 1.1.3 Residual ridge resorption | Good to Know |
| 1.2 Communicating with the patient | |
| 1.2.1 Understanding the patients | Must to Know |
| 1.2.2 Mental attitude | Good to Know |
| 1.2.3 Instructing the patients | Must to Know |
| 1.3 Diagnosis and treatment planning for the patients:<br>- With some teeth remaining<br>- With no teeth remaining | |
| 1.3.1 Systemic status | Must to Know |
| 1.3.2 Local factor | Must to Know |
| 1.3.3 Geriatric patient | Must to Know |
| 1.3.4 Diagnostic procedures | Must to Know |
| 1.3.5 Articulators – discussion | Must to Know |
| 1.4 Improving the patient's denture foundation and ridge relation – an overview | |
| 1.4.1 Pre-operative examination | Must to Know |
| 1.4.2 Initial hard tissue and soft tissue procedure | Must to Know |
| 1.4.3 Secondary hard and soft tissue procedure | Good to Know |
| 1.4.4 Implant procedure | Desirable to Know |
| 1.4.5 Congenital deformities | Good to Know |
| 1.4.6 Post-operative procedure | Must to Know |
| 1.4.7 Principles of retention, support and stability | Must to Know |
| 1.5 Impressions – detail | |
| 1.5.1 Muscles of facial expression | Must to Know |
| 1.5.2 Biologic considerations for maxillary and mandibular impressions including anatomical landmarks and their interpretation | Must to Know |

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|---|---|
| 1.5.3 Impression objectives | Must to Know |
| 1.5.4 Impression material | Must to Know |
| 1.5.5 Impression techniques | Must to Know |
| 1.5.6 Maxillary and mandibular impression procedures:<br>1.5.6.1 Preliminary Impression<br>1.5.6.2 Final Impression | Must to Know |
| 1.5.7 Laboratory procedures involved with impression making (Beading & boxing, Cast preparation) | Must to Know |
| 1.6 Record bases and Occlusal rims – in detail | |
| 1.6.1 Materials and techniques | Must to Know |
| 1.6.2 Useful guidelines and ideal parameters | Must to Know |
| 1.6.3 Recording and transferring bases and occlusal rims | Must to Know |
| 1.7 Biological consideration in jaw relation & jaw movements – craniomandibular Relations | |
| 1.7.1 Maxillo-mandibular relation including vertical and horizontal jaw Relations | Must to Know |
| 2. Removable Partial Dentures | |
| 2.1 Introduction | Must to Know |
| 2.2 Classification(FLIPPED CLASSROOM) | Must to Know |
| 2.3 Components | Must to Know |
| 3. Fixed Partial Dentures | |
| 3.1 Introduction | Must to Know |
| 3.2 Classification | Must to Know |
| 3.3 Components | Must to Know |

## B. SYLLABUS FOR PRACTICALS:

EXERCISES TO BE CONDUCTED IN II BDS

Part-I Complete Denture

1. Arrangement of teeth in class I relation. (Minimum 10 teeth arrangements)
2. Wax up, carving and polishing
3. Processing of waxed up denture (minimum 01)
4. Demonstration of arrangement of teeth for retrognathic ridge relation(class II) (01 teeth arrangement)
5. Demonstration of arrangement of teeth for prognathic ridge relation (class III) (01 teeth arrangement)
6. Repair of fractured complete denture (minimum 01 repair)
7. Demonstration for relining and rebasing complete dentures

Part-II Removable Partial Denture

1. Introduction to removable partial dentures
2. Components of removable partial dentures

3. Surveying of partially edentulous casts
4. Designing removable partial dentures
5. Clinical and laboratory steps in fabrication of cast partial denture.
6. Fabrication of anterior acrylic partial denture
7. Fabrication of posterior acrylic partial denture with clasps.

Part-III Fixed Partial Denture

1. Introduction to fixed partial denture
2. Steps in fabrication of fixed partial denture
3. Demonstration for preparation of anterior & posterior tooth to receive a porcelain jacket crown (FLIPPED CLASSROOM)
4. Preparation of maxillary central incisor typhodont tooth to receive porcelain jacket crown (mimimum 04 preparation)
5. Preparation of posterior typhodont tooth to receive complete metal crown. (mimimum 04 preparation)
6. Demonstration for preparation of anterior &posterior tooth to receive a partial veneer crown
7. Demonstration for fabrication of a dowel crown
8. Demonstration of casting
9. Fabrication of wax patterns (anterior and posterior) minimum 04 each.
10. EBES in Pre-clinical Prosthodontics is practiced as generation of PICO on manipulation techniques, literature search and reflective group discussions facilitated by teaching staff.

## C. RECOMMENDED BOOKS:

| TITLE | AUTHOR |
|---|---|
| Dental lab Procedures Part I: Complete dentures | Rudd & Murrow |
| Dental lab Procedures Part II: Removable Partial dentures | Rudd & Murrow |
| Dental lab Procedures Part I: Fixed Partial dentures | Rudd & Murrow |
| Manual for Pre-clinical Prosthodontics | S Lakshmi |
| Essential Manual of PreClinical Prosthodontics | Dr. ParanjayPrajapati<br>Dr. Sneha Kulkarni |

## D. EXAM SCHEME:

The internal assessment marks in the subject of Pre-clinical Prosthodontics and shall be calculated out of 20 marks.

. INTERNAL ASSESSMENT: 20 MARKS

i. First internal (Theory/Practical): 20 Marks
ii. Second internal (Theory/Practical): 20 Marks
iii. Third Internal (Theory/Practical): 60 Marks

b. University Exam:

(University Practicals-80 Marks + Internal-20 Marks=100 Marks)

1. The University Practical Examination will be of Total 80 marks and will consist of:

| SR. NO | PARTICULARS | MARKS |
|---|---|---|
| 1 | Exercises: Total Duration-3 Hours<br>i. Teeth arrangement for complete denture: (40)<br>ii. Viva voce + Journal (40) | 80 |
| 2 | Internal marks (40% - CCES + 60% - Average of all internal assessment) | 20 |

## THIRD BDS

*The change in III BDS practicals for all dental subjects shall be as following:* ***Training of II BDS students on***

1. ***Functioning of dental chairs***
2. ***Aseptic and infection control in clinics***

***This will enable students to manage their dental practice more efficiently.***

## GENERAL MEDICINE

### Definition of the Subject: -

It is discipline of medical specialty which deals with diagnosis, treatment and prevention of adult disease. The specialty of General Medicine deals with management of patient who have undifferentiated or multi system disease process and is one of the core subjects in relation to medical education and research which has to be learnt by almost all discipline of medical specialty including dentistry.

Aim: - The broad goal of the teaching undergraduate dental students, the subject of Gen. Medicine is to have the knowledge, skills and behavioral attributes such that it would lead to function effectively with patients who come to them with dental problem with or without medical disorders.

### Objective and scope of the subject: -

(a) Knowledge : At the end of the course, the students shall be able to:

1. Know and understand common medical disorders with or without dental problem.

2. Outline clinical symptoms, signs and complications of general and multisystem disorders like hypertension, diabetes, and other endocrinal disorders, genetic and

environmental medical disorders, nutriional disorders, infectious diseases including sexually transmitted diseases, tropical and other systemic disorders pertaining to cardiovascular, respiratory, gastrointestinal, neurological, hematological and immune system.

3. Propose diagnostic as well as investigative procedures and ability to interpret them.

4. Familiarize themselves with treatment protocol and management strategies of medical disorder such that they are able to know dosage schedule. Interaction and side effects of various drugs with their beneficial effect.

5. Provide first level management of acute medical emergencies which is encountered in dental practice and able to decide timings and level of level of referral if required

6. Recognize and correlate dental disorders and practices with multisystem and medical disorders in holistic, comprehensive and through manner

## Course outcomes assessed:

Were the students able to**:** Explain special precautions/ contraindication of anaesthesia and various dental procedures in different systemic diseases. Explain Oral manifestations of systemic diseases. Explain Medical emergencies in dental practice. Able to record the arterial pulse, blood pressure. Able to diagnose through case history and general examination of the body, the diseases of the heart, lungs, kidneys, blood etc. Handle medical emergencies encountered in dental practice

## A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction | |
| 1.1 Aims of medicine & Definitions of sings, Symptoms, Diagnosis, Differential diagnosis, treatment & prognosis/ Evidence based practice in medicine | Must to Know |
| 2. Infections | |
| 2.1 Enteric fever | Must to Know |
| 2.2 AIDS/ Universal precaution consequences/management | Must to Know |
| 2.3 Herpes simplex | Must to Know |
| 2.4 Herpes Zoster | Must to Know |
| 2.5 Malaria | Must to Know |
| 2.6 Tetanus and lock jaw | Must to Know |
| 2.7 Diphtheria | Good to Know |
| 2.8 Infectious mononucleosis | Desirable to Know |
| 2.9 Mumps | Desirable to Know |
| 2.10 Measles | Desirable to Know |
| 2.11 Rubella | Desirable to Know |
| 2.12 Syphilis | Desirable to Know |
| 2.13 Prevention of Infectious diseases: vaccines, mask and various strategies. | Desirable to Know |
| 3. G.I.T | |
| 3.1 Stomatitis and vitamin deficiency related oral lesions | Must to Know |
| 3.2 Gingival hyperplasia | Must to Know |
| 3.3 Acid peptic disease | Must to Know |
| 3.4 Jaundice | Must to Know |
| 3.5 Acute hepatitis | Must to Know |
| 3.6 Cirrhosis of liver | Must to Know |
| 3.7 Ascites | Must to Know |
| 3.8 Dysentery | Good to Know |
| 3.9 Amoebiasis | Good to Know |
| 3.10 Dysphasia | Desirable to Know |
| 3.11 Malabsorption | Desirable to Know |
| 3.12 Health care associated infection and their prevention | Desirable to Know |
| 4. CVS | |
| 4.1 Acute rheumatic fever | Must to Know |
| 4.2 Rheumatic valvular heart disease | Must to Know |
| 4.3 Hypertension | Must to Know |
| 4.4 Ischemic heart disease/chest pain | Must to Know |
| 4.5 Infective endocarditic | Must to Know |
| 4.6 Common arrhythmias | Good to Know |
| 4.7 Congestive cardiac Failure | Good to Know |

| | |
|---|---|
| 4.8 Congenital heart disease | Desirable to Know |
| 5. Respiratory System | |
| 5.1 Pneumonia | Must to Know |
| 5.2 COPD | Must to Know |
| 5.3 Pulmonary TB | Must to Know |
| 5.4 Bronchial asthma/Dyspnea and immunology | Must to Know |
| 5.5 Pleural effusion | Good to Know |
| 5.6 Lung Abscess | Desirable to Know |
| 5.7 Pneumothorax | Desirable to Know |
| 5.8 Bronchiectasis | Desirable to Know |
| 5.9 Lung cancers | Desirable to Know |
| 6. Haematology | |
| 6.1 Iron deficiency anaemia | Must to Know |
| 6.2 Megaloblastic anaemias | Must to Know |
| 6.3 Hemolytic anaemia | Must to Know |
| 6.4 Bleeding & clotting disorders | Must to Know |
| 6.5 Oral manifestations of hematologic disorders | Must to Know |
| 6.6 Leukemias | Good to Know |
| 6.7 Lymphomas | Good to Know |
| 6.8 Agranulocytosis | Good to Know |
| 6.9 Splenomegaly | Good to Know |
| 6.10 Generalised lymphadenopathy | Good to Know |
| 6.11 Auto immune disorders including rheumatoid arthritis | Desirable to Know |
| 7. Renal System | |
| 7.1 Acute nephritis | Must to Know |
| 7.2 Nephrotic syndrome | Must to Know |
| 7.3 Renal Failure | Good to Know |
| 8. Nutrition | |
| 8.1 Avitaminosis | Must to Know |
| 8.2 Balanced diet | Good to Know |
| 8.3 PEM | Desirable to Know |
| 9. CNS | |
| 9.1 Facial palsy | Must to Know |
| 9.2 Facial pain including trigeminal neuralgia | Must to Know |
| 9.3 Epilepsy | Good to Know |
| 9.4 Headache including migraine | Good to Know |
| 9.5 Meningitis | Desirable to Know |
| 9.6 Examination of comatose patient | Desirable to Know |
| 9.7 Examination of cranial nerves | Desirable to Know |
| 10. Endocrine | |
| 10.1 Diabetes Mellitus | Must to Know |
| 10.2 Hypothyroidism | Good to Know |
| 10.3 Thyrotoxicosis | Good to Know |
| 10.4 Calcium metabolism and parathyroid/flurosis | Good to Know |
| 10.5 Addison's disease | Desirable to Know |

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|---|---|
| 10.6 Cushing's syndrome | Desirable to Know |
| 10.7 Acromegaly | Desirable to Know |
| 11. Critical Care | |
| 11.1 Syncope | Must to Know |
| 11.2 Cardiac arrest | Must to Know |
| 11.3 CPR | Must to Know |
| 11.4 Shock | Must to Know |
| 11.5 Medical emergencies in dental practice | Must to Know |
| 11.6 Anaphylactic Shock | Must to Know |
| 11.7 Acute LVF | Good to Know |
| 11.8 ARDS | Good to Know |
| 11.9 Alcohol abuse, overdose and substance abuse | Desirable to Know |

## B. PRACTICALS:

## C. RECOMMEND BOOKS:

Suggested General Medicine text books for 3rd BDS

Sr.No Name of book

1. Davidson's Text book of Medicine
2. API Text book of Medicine
3. Harrison's principal of internal Medicine

Suggested General Medicine Clinical books for 3rd BDS

4. Hutchinson's Medicine
5. Golwala's General Medicine

## D. SCHEME OF EXAMINATION:

i. First internal (Theory/Practical): 20 Marks
ii. Second internal (Theory/Practical): 20 Marks
iii. Third Internal (Theory/Practical): 60 Marks

As per the university rules

Practical &Clinical:(marks distribution)

- The University Practical Examination will be of Total 90 Marks and will consist of :

| Sr.no | Particulars | Marks |
|---|---|---|
| 1. | Long Case | 45 |
| 2. | Short Case | 25 |
| 3. | X-ray & Drug Spotters | 20 |

## GENERAL SURGERY

### Aims & Objectives:

To acquaint the student with various diseases, which may require surgical expertise and to train the student to analyse the history and be able to do a thorough physical examination of the patient. The diseases as related to head and neck region are to be given due importance, at the same time other relevant surgical problems are also to be given due the end of one year of study the student should have a good theoretical knowledge of various ailments, and be practically trained to differentiate benign and malignant diseases and be able to decide which patient requires further evaluation.

### Course outcomes assessed:

Were the students able to: Diagnose diseases, which may require surgical expertise. Analyse the history and be able to do a thorough physical examination of the patient. Explain features and differential diagnosis, investigations and treatments of diseased conditions, differentiate benign and malignant diseases and be able to decide which patient requires further evaluation.

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Principles of Surgery, Tissue care, Asepsis and anti sepsis, Theatre technique, Sterilization, Suture materials, diathermy, Laser. | Must to Know |
| 2. Introduction – History of Surgery | Good to Know |
| 3.Classification of Diseases, General Scheme of Studying a diseases- Etio-Pathology, Clinical features, Investigations, Diagnosis, Management, Complications, Prognosis. | Desirable to Know |
| 4.Wounds- Classification,Clinical Assessment, Treatment, Complications, wound healing | Must to Know |
| 5. Skin Grafting | Good to Know |
| 6. Parathyroid - Hyperparathyrodism, Tetany, Calcium Metabolism | Desirable to Know |
| 7. Inflammation and infection – Definition, Etiology, Pathology, Classification | Must to Know |

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| 8. Chronic Infections – Nonspecific, and Specific – Tuberculosis, Syphilis, Actinomycosis, Leprosy. | Good to Know |
| 9. Pituitary Gland | Desirable to Know |
| 10. Acute Infections- Non-specific, and Specific – Aerobic and Anaerobic abscess, Cellilities. Carbuncle, Erysipelas, Anthrax, Gonorrhea, Gas Gangrene, Tetanus, CancrumOris, Ludwig's Angina | Must to Know |
| 11. AIDS | Good to Know |
| 12. Diseases of Arteries and Veins in general - Varicose Veins, Atherosclerosis, Anuersym, Carotid Body Tumours | Desirable to Know |
| 13. Hemorrhage – Classification, emergency Management, Definitive Treatment, Assessment of Blood Loss. | Must to Know |
| 14. Bacteraemia, Septicemia, Pyaemia, Toxaemia | Good to Know |
| 15. Nervous System - Nerve Injury, Regeneration, Repair, Nerve Grafting. Facial Nerve Palsy, Trigeminal Neuralgia | Desirable to Know |
| 16. Syncope, Shock ,Cardiac Arrest – Causes, Clinical Features, Haemodynamic Changes, emergency Care, Monitoring, Definitive Treatment, Septic Shock (warm shock), Anaphylaxis. | Must to Know |
| 17. Bleeding Disorders – Coagulation Mechanism | Good to Know |
| 18. Principles of Anesthesia | Desirable to Know |
| 19. Tumours – Definition, Classification, Etiology of Cancer, Spread of Cancer, Early Diagnosis, Investigations, Modalities of Treatment and Prognosis, Recent Advances. | Must to Know |
| 20.Blood Group – Blood Transfusion – Complications of Transfusion and Management, Massive Transfusion. | Good to Know |
| 21.Brief Surgical Anatomy of Pharynx, Esophagus, Paranasal. Diseases related to Obstruction to Ones in Pharynx and Esophagus. | Desirable to Know |
| 22. Blood Fractions and their uses. | Good to Know |
| 23. Introduction to – Oncology, Radiotherapy, Surgery and Genetic Engineering. | Desirable to Know |
| 24.Diseases of Mouth, Lip, Tongue, Palate & Tonsils | |
| 24.1 Ulcers, Stomatitis, Leukoplakia, Carcinoma of Lip, Check, Tongue | Must to Know |
| 24.2 Ranula | Must to Know |
| 24.3 Tonsilitis, Quinsy | Must to Know |
| 25. Ulcers – Definition, Classification, etiology, Nonseptic, Ulcers, Specific Ulcer – Tuberculous Ulcer, Syphilitic Ulcer, Malignant Ulcers – Squmous cell Carcinoma, Basal Cell Carcinoma, Malignant Melanoma, Marjolin's Ulcer, Diabetic Ulcer. | Good to Know |
| 26. Sinus and Fistula | Good to Know |
| 27. Salivary Glands | |
| 27.1 Acute and Chronic Infection- Parotid Abscess, Salivary Calculus | Must to Know |
| 27.2Salivary Tumours – Classification, Mixed Parotid Tumours – | Must to Know |

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|---|---|
| Carcinoma, Adenolymphoma, Sjogren's Disease | |
| 28. Gangrene – Gas Gangrene, Dry Gangrene, Moist Gangrene – Causes, Management. | Good to Know |
| 29.Cyst-Definition, Classification, Clinical Features, Complications, Management. | Good to Know |
| 30. Neck Swellings – Midline and Lateral Swellings, Cystic and Solid Swellings : Classification, Differential diagnosis, Treatment. | Must to Know |
| 31. Common Cyst – Mucous Cyst, Sebaceous Cyst, Dermoid Cyst, Ranula, Cystic Hygroma, Branchial Cyst, Thyroglossal Cyst, Ganglion. | Good to Know |
| 32. Facio – Maxillary Injuries | Must to Know |
| 33. Common Being and Malignant Tumors of head and Neck Region – Lipoma, Fibroma, Neurofibroma, Haemangioma, Lymphangioma Osteoma, Carcinoma, Sarcoma. | Good to Know |
| 34. Fractures of Mandible | Must to Know |
| 35. Biopsy – Indication and Methods | Good to Know |
| 36. Jaw Swellings – Equlis, Odontomes, Bone Cysts and Tumours, Burkitfs Lymphoma | Must to Know |
| 37. Diseases of Lymphatic and Lymph nodes | |
| 37.1Lymphangitis – Acute and Chronic, chronic Lymphoedema | Good to Know |
| 37.2 Lympadenopathy – Classification | Good to Know |
| 37.3 Inflammatory – Acute and Chronic, Non – specific and specific – Tubercular Lymphadenitis, Cold abscess – Collar Stud Abscess | Good to Know |
| 37.4 Malignant Tumours: Primary ; Hodgkin's Diseases, Non Hodgkin's Lymphoma | Good to Know |
| 37.5 Secondary carcinoma | Good to Know |
| 38. Osteomyelitis of Mandible | Must to Know |
| 39. Head Injury Management | Good to Know |
| 40. Management of Severely Injures Patient - Resuscitation | Good to Know |
| 41. Fractures and Dislocations – Causes, General Principles of Management, Healing of Fractures and Complications | Good to Know |
| 42.Thyroid Gland – Development, Congenital anomalies, Classification of goiters. Acute and Chronic Thyroditis, Hashimoto's Disease, Reidel's Thyroiditis, Hyperparathyrodism, Hypothyrodism, Adenoma, Carcinoma. | Good to Know |
| 43. Tracheostomy – Indications, Steps of Operation, Post Operative Care | Must to Know |
| 44. Burns and Scalds | Good to Know |
| 45. Development of Face – Cleft Lip and Palate repair | Good to Know |

## B. PRACTICALS:

1. Clinical approach to the patient
2. History taking

3. Clinical Examination of
    1) Swelling
    2) Ulcer
    3) Gangrene
    4) Neck Swelling
    5) Oral Cavity Examination
    6) Tracheostomy
4. Common X rays of Head & Neck, Chest
5. Common ward Procedure appliances
6. Common Instruments in Surgery Identification & uses.
7. Common minor Operative Procedures. & Ward Procedures.

## C. RECOMMENDED BOOKS:

| Title | Author | Publisher |
|---|---|---|
| A Manual on Clinical Surgery | Somen Das | Dr.S.Das Calcutta |
| Bailey & Love's Short Practice of Surgery | Charles V. M. Ann | Oxford University Press |
| Hamilton Baileys Demonstrations of Physical signs in Clinical Surgery | Hamilton Bailey | Butterworth Heinemann U.K. |

## Reference Books:

1. Oxford Text Book of Surgery
2. Text Book of Surgery by Devita
3. Surgery by Sebastin
4. Surgery by somalal
5. Text Book of Surgery by Chatterjee
6. Surgical Anatomy by Heereggor
7. Diseases of Eye by Parson
8. Text Book of Ophthalmology by Vasudev Anand Rao

9. E.N.T. Diseases by Mohammed Muqbool
10. E.N.T. Diseases by N.C.Day
11. E.N.T. Diseases by K.K.Ramalingam

## D. SCHEME OF EXAMINATION:

i. First internal (Theory/Practical): 20 Marks
ii. Second internal (Theory/Practical): 20 Marks
iii. Third Internal (Theory/Practical): 60 Marks

As per the university rules

Practical & Clinical : (distribution of marks)

| Sr.no | Particulars | Marks |
|---|---|---|
| 1. | Case History | 10 |
| 2. | Clinical Examination | 30 |
| 3. | Suggested Investigations | 10 |
| 4. | Diasgnosis, DD | 20 |
| 5. | Management | 10 |

## ORAL PATHOLOGY & MICROBIOLOGY

Lectures are taken on various topics pertaining to Oral Pathology. These lectures are incorporated by literature evidences form published data in various scientific databases, pertaining to the subject taught.

The students take up peer teaching exercises during lectures and a topic ispriorly allocated to them for this.

Students are given assignments on completed topics wherein they are asked to incorporate best possible evidence.

Students are also encouraged to incorporate evidences in undergraduate seminar.

Lectures are taken on various topics pertaining to Oral Pathology. These lectures are incorporated by literature evidences form published data in various scientific databases, pertaining to the subject taught.

The students take up peer teaching exercises during lectures and a topic ispriorly allocated to them for this.

Students are given assignments on completed topics wherein they are asked to incorporate best possible evidence.

Students are also encouraged to incorporate evidences in undergraduate seminar.

### Course outcomes assessed:

Were the students able to: Describe the different types of pathological processes, that involve the oral cavity. Describe the manifestations of common diseases, their diagnosis & correlation with clinical pathological processes. Explain the oral manifestations of systemic diseases should help in correlating with the systemic physical signs & laboratory findings. Explain the underlying biological principles governing treatment of oral diseases. Explain the principles of basic aspects of Forensic Odontology. Describe the laboratory procedures in histo-pathology. Identify the pathologies on basis of histopathological observations and correlate them with clinical picture.

A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Odontogenic tumours | |
| 1.1 Benign tumors | |
| 1.1.1 Odontogenic epithelium without odontogenic ectomesenchyme | |
| 1.1.1.1 Ameloblastoma | Must to Know |
| 1.1.1.2 Calcifying Epithelial Odontogenic Tumour | Must to Know |
| 1.1.1.3 Adenomatoid Odontogenic Tumour | Must to Know |
| 1.1.1.4 Squamous Odontogenic tumour | Desirable to Know |
| 1.1.2 Odontogenic epithelium with Odontogenic ectomesenchyme | |
| 1.1.2.1 Ameloblastic fibroma | Desirable to Know |
| 1.1.2.2 Ameloblastic Fibro-odontoma, Odontoma | Desirable to Know |
| 1.1.2.3 Ghost cell Tumour | Desirable to Know |
| 1.1.3 Odontogenicectomesenchymewithorwithoutincludedodontogenicepithelium | |
| 1.1.3.1 Peripheral and Central odontogenic fibroma | Desirable to Know |
| 1.1.3.2 Odontogenic Myxoma | Desirable to Know |
| 1.1.3.3 Benign cementoblastoma | Must to Know |
| 1.2 Malignant tumors | |
| 1.2.1 Metastasizing ameloblastoma | Good to Know |
| 1.2.2.Ameloblastic carcinoma | Good to Know |
| 1.2.3 Odontogenic sarcoma | Good to Know |
| 2. Non- Odontogenic Tumours | |
| 2.1 Benign Tumours of Epithelial Origin | |
| 2.1.1 Papilloma | Must to Know |
| 2.1.2 Keratoacathoma | Desirable to Know |
| 2.1.3 Nevus | Desirable to Know |
| 2.2 Premalignant Lesions & Conditions | |

| | |
|---|---|
| 2.2.1 Definition | Must to Know |
| 2.2.2 Classification | Must to Know |
| 2.2.3 Epithelial Dysplasia | Must to Know |
| 2.2.4 Leukoplakia | Must to Know |
| 2.2.5 Carcinoma in situ | Must to Know |
| 2.2.5 Erythroplakia | Must to Know |
| 2.2.6 Oral Submucous Fibrosis | Must to Know |
| 2.3 Malignant Tumours of Epithelial Origin | |
| 2.3.1 Basal Cell Carcinoma | Must to Know |
| 2.3.2 Epidermoid Carcinoma | Must to Know |
| 2.3.2.1 Epidemiology | Must to Know |
| 2.3.2.2 Etiology | Must to Know |
| 2.3.2.3 Clinical Features | Must to Know |
| 2.3.2.4 Histology | Must to Know |
| 2.3.2.5 Grading & TNM Staging | Must to Know |
| 2.3.3 Verrucous Carcinoma | Must to Know |
| 2.3.4 Malignant Melanoma | Must to Know |
| 2.3.5 Recent advances in diagnosis | Must to Know |
| 2.3.6 Management & Prevention of Oral Cancer | Desirable to Know |
| 2.4 Benign tumours of connective tissue origin | |
| 2.4.1 Fibroma | Must to Know |
| 2.4.2 Giant Cell Fibroma | Must to Know |
| 2.4.3 Peripheral & Central Ossifying Fibroma | Must to Know |
| 2.4.4 Lipoma | Must to Know |

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| 2.4.5 Hemangioma | Must to Know |
| 2.4.6 Chondroma | Must to Know |
| 2.4.7 Osteoma | Desirable to Know |
| 2.4.8 Osteoid Osteoma | Must to Know |
| 2.4.9 Benign Osteoblastoma | Must to Know |
| 2.4.10 Tori & Multiple Exostoses | Must to Know |
| 2.5 Tumour like lesions of connective tissue origin | |
| 2.5.1 Peripheral Ossifying Fibroma | Desirable to Know |
| 2.6 Malignant tumours of Connective tissue origin | |
| 2.6.1 Fibrosarcoma | Desirable to Know |
| 2.6.2 Chondrosarcoma | Must to Know |
| 2.6.3 Kaposi's Sarcoma | Must to Know |
| 2.6.4 Ewing's Sarcoma | Must to Know |
| 2.6.5 Osteosarcoma | Must to Know |
| 2.6.6 Lymphomas | Desirable to Know |
| 2.6.6.1 Hodgkin's lymphoma | Desirable to Know |
| 2.6.6.2 Non – Hodgkins's lymphoma | Desirable to Know |
| 2.6.6.4 Burkitt's lymphoma | Desirable to Know |
| 2.6.7 Myeloma | Desirable to Know |
| 2.6.7.1 Multiple Myeloma | Desirable to Know |
| 2.6.7.2 Solitary Plasmacytoma | Desirable to Know |
| 2.7 Benign tumours of Muscle tissue origin | |
| 2.7.1 Leiomyoma | Desirable to Know |
| 2.7.2 Rhabdomyoma | Desirable to Know |
| 2.7.3 Congenital Epulis of New born | Desirable |

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|---|---|
| | to Know |
| 2.7.4 Granular cell tumour | Desirable to Know |
| 2.8 Benign & Malignant tumours of nerve tissue origin | |
| 2.8.1 Neurofibroma& Neurofibromatosis | Good to Know |
| 2.8.2 Schwamoma | Good to Know |
| 2.8.3 Melanotic neuroectodermal tumour of infancy | Good to Know |
| 2.8.4 Malignant Schwamoma | Good to Know |
| 2.9 Metastatic tumours of Jaws & Soft tissue of oral cavity | Good to Know |
| 3. Salivary gland tumours | |
| 3.1 Neoplastic salivary gland diseases | |
| 3.1.1 Benign | |
| 3.1.1.1 Pleomorphic adenoma | Must to Know |
| 3.1.1.2 Warthins tumour | Must to Know |
| 3.1.1.3 Myoepithelioma | Good to Know |
| 3.1.1.4 Canalicular adenoma | Good to Know |
| 3.1.1.5 Oncocytoma | Good to Know |
| 3.1.2 Malignant | |
| 3.1.2.1 Adenoid Cystic Carcinoma | Must to Know |
| 3.1.2.2 Mucoepidermoid Carcinoma | Must to Know |
| 3.1.2.3 Acinic Cell Carcinoma | Desirable to Know |
| 3.1.2.4 Polymorphous Low Grade Adenocarcinoma | Desirable to Know |
| 3.1.2. 5 Carcinoma ex Pleomorphic Adenoma | Desirable to Know |
| 3.2 Non neoplastic Salivary Gland Diseases | |
| 3.2.1 Sialolithiasis | Must to Know |
| 3.2.2 Sialosis, Sialadenitis | Must to Know |
| 3.2.3 Xerostomia & Ptylism | Must to Know |

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| 3.2.4 Sjogren's Syndrome | Must to Know |
| 3.2.5 Benign Lymphoepithelial Lesion | Good to Know |
| 3.2.6 Necrotising Sialometaplasia | Good to Know |
| 4. Cysts of Oral & Paraoral Region - Classification, etiopathogenesis, clinical features,histopathology, laboratory& radiological features | |
| 4.1 Odontogenic cysts | |
| 4.1.1 Odontogenic Keratocyst | Must to Know |
| 4.1.2 Dentigerous Cyst | Must to Know |
| 4.1.3 Primordial Cyst | Must to Know |
| 4.1.4 Dental Lamina Cyst of Newborn | Must to Know |
| 4.1.5 Gingival cyst of adults | Must to Know |
| 4.1.6 Lateral periodontal cyst | Must to Know |
| 4.1.7 Calcifying odontogenic cyst | Must to Know |
| 4.1.8 Radicularcyst | Must to Know |
| 4.2 Non-Odontogeniccysts | |
| 4.2.1 Pseudo cysts of jaws | Desirable to Know |
| 4.2.2 Aneurysmal bone cyst | Desirable to Know |
| 4.2.3 Traumatic bone cyst | Desirable to Know |
| 4.2.4 Soft tissue cysts of oral& paraoral region | Desirable to Know |
| 5. Traumatic, reactive & regressive lesions of Oral Cavity | |
| 5.1 Pyogenic granuloma | Must to Know |
| 5.2 Peripheral & Central Giant cell granuloma | Must to Know |
| 5.3 Exostoses | Desirable to Know |
| 5.4 Fibrous Hyperplasia | Desirable to Know |
| 5.5 Traumatic Ulcer | Desirable to Know |

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| 5.6 Traumatic Neuroma | Desirable to Know |
| 5.7 Attrition | Must to Know |
| 5.8 Abrasion | Must to Know |
| 5.9 Abfraction | Must to Know |
| 5.10 Erosion | Desirable to Know |
| 5.11 Bruxism | Desirable to Know |
| 5.12 Hypercementosis | Desirable to Know |
| 5.13 Dentinal changes | Desirable to Know |
| 5.14 Pulp calcifications | Desirable to Know |
| 5.15 Resorption of teeth | Good to Know |
| 5.16 Radiation effects of oral cavity | Good to Know |
| 5.17 Allergic reactions of the oral cavity | Good to Know |
| 5.18 Angioedema | Good to Know |
| 5.19 Stomatitis medicamentosa | Good to Know |
| 5.20 Stomatitis venenata | Good to Know |

6. Microbial infections of oral soft tissue-Microbiology,defence mechanisms including immunological aspects, oral manifestations, histopathogy and laboratory diagnosis of common bacterial, viral & fungal infections namely

6.1 Bacterial

| | |
|---|---|
| 6.1.1 Scarlet fever | Desirable to Know |
| 6.1.2 Diphtheria | Desirable to Know |
| 6.1.3 Tuberculosis | Must to Know |
| 6.1.4 Syphilis | Must to Know |
| 6.1.5 Actinomycoses & Its complications | Desirable to Know |
| 6.1.6 Cancrum Oris | Desirable |

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|---|---|
| | to Know |
| 6.1.7 Tetanus | Desirable to Know |
| 6.1.8 Noma | Desirable to Know |
| 6.2 Viral | |
| 6.2.1 Herpes Simplex | Must to Know |
| 6.2.2 Varicella zoster | Desirable to Know |
| 6.2.3 Measles | Desirable to Know |
| 6.2.4 Mumps | Desirable to Know |
| 6.2.5 HIV infection and Oral manifestation of AIDS | Must to Know |
| 6.3 Fungal | |
| 6.3.1 Candidiasis | Must to Know |
| 6.3.2 Histoplasmosis | Good to Know |
| 6.4 Immunological diseases | |
| 6.4.1 Reccurent Aphthous stomatitis | Must to Know |
| 6.4.2 Bechet’s syndrome | Desirable to Know |
| 6.4.3 Reiter’s syndrome | Desirable to Know |
| 6.4.4 Sarcoidosis | Good to Know |
| 7. Common non – inflammatory disease involving jaws | |
| 7.1 Fibrous dysplasia | Must to Know |
| 7.2 Cherubism | Must to Know |
| 7.3 Osteogenesis Imperfecta | Desirable to Know |
| 7.4 Paget's bone disease | Must to Know |
| 7.5 Cleidocranial dysplasia | Must to Know |
| 7.6 Rickets | Desirable to Know |
| 7.7 Achondroplasia | Good to Know |

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|---|---|
| 7.8 Marfan's syndrome | Good to Know |
| 7.9 Down's syndrome | Desirable to Know |
| 7.10 Histiocytosis X disease | Good to Know |
| 8. Biopsy, Cytology & Healing of Wounds | |
| 8.1 Factors affecting healing of wounds Healing of extraction wound | Must to Know |
| 8.2 Dry socket | Desirable to Know |
| 8.3 Biopsy techniques | Must to Know |
| 8.4 Healing of biopsy wound | Must to Know |
| 8.5 Exfoliative Cytology | Must to Know |
| 8.5.1 Indications | Must to Know |
| 8.5.2 Staining and Interpretation | Desirable to Know |
| 9. Systemic Diseases involving Oral Cavity | |
| 9.1 Brief review &oral manifestations, diagnosis & significance of common Blood,Nutritional Hormonal & Metabolic diseases of Oral cavity , | Must to Know |
| 9.2 Blooddy scrasias-Clinico-pathological aspects and oral manifestations | Must to Know |
| 9.2.1 Anemias | Must to Know |
| 9.3.2 Polycythemia | Desirable to Know |
| 9.3.3 Leukopenia | Must to Know |
| 9.3.4 Neutropenia | Must to Know |
| 9.3.5 Agranulocytosis | Must to Know |
| 9.3.6 Chediak- Higashi syndrome | Desirable to Know |
| 9.3.7 Leukocytosis | Must to Know |
| 9.3.8 Infectious mononucleosis | Must to Know |
| 9.3.9 Leukemias | Must to Know |
| 9.3.10 Purpura Haemophilia | Must to |

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| | Know |
| 9.3 Oral aspects of Disturbances in Mineral Metabolism | Good to Know |
| 9.4 Oral aspects of Avitaminosis and Hypervitaminoses | Good to Know |
| 9.5 Oral Aspects of Endocrine Dysfunction | Must to Know |
| 10. Mucocutenous Lesions | |
| 10.1 Lichen Planus | Must to Know |
| 10.2 Lupus Erythematosus | Must to Know |
| 10.3 Pemphigus & Pemphigoid lesions | Desirable to Know |
| 10.4 Erythema Multiforme | Must to Know |
| 10.5 Psoriasis,Scleroderma | Good to Know |
| 10.6 Ectodermal Dysplasia | Good to Know |
| 10.7 Epidermolysis bullosa | Good to Know |
| 10.8 White sponge nevus | Good to Know |
| 11. Periodontal Diseases | |
| 11.1 Stains | Must to Know |
| 11.2 Calculus | Must to Know |
| 11.3 Gingivitis | Must to Know |
| 11.4 Gingival enlargements | Desirable to Know |
| 11.5 ANUG | Must to Know |
| 11.6 Chronic Desquamative gingivitis | Desirable to Know |
| 11.7 Periodontitis and Juvenile periodontitis | Desirable to Know |
| 11.8 Basic immunological mechanisms of periodontal disease to be highlighted | Good to Know |
| 12. Diseases of Temporomandibular Joint | |
| 12.1 Ankylosis | Desirable to Know |
| 12.2 Luxation and Subluxation | Desirable to Know |

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| 12.3 Summary of different types of arthritis & other developmental malformations | Good to Know |
| 12.4 Traumatic injuries | Desirable to Know |
| 12.5 Myofascial pain dysfunction syndrome (MPDS) | Must to Know |
| 13. Diseases of Nerves | |
| 13.1 Facial neuralgias – Trigeminal, Sphenopalatine &Glossopharyngeal neuralgias, VII nerve paralysis, Causalgia | Must to Know |
| 13.2 Psychogenic facial pain | Good to Know |
| 13.3 Burning mouth syndrome | Desirable to Know |
| 14. Pigmentations of Oral tissues | Desirable to Know |
| 15. Diseases of Maxillary Sinus | Desirable to Know |
| 16. Principles of Forensic Odontology | |
| 16.1 Introduction, definition, aim & scope | Must to Know |
| 16.2 Sex and ethnic(racial) differences into morphology and histological age estimation | Must to Know |
| 16.3 Determination of sex & blood groups from buccal mucosa/ 16.4 saliva | Desirable to Know |
| 16.4Dental DNA methods Bitemarks, rugae patterns & lip prints | Must to Know |
| 16.5Dental importance of poisons and corrosives | Good to Know |
| 16.6 Overview of forensic medicine and toxicology | Good to Know |

B. PRACTICALS:

Group discussions are taken to discuss the Oral Pathology slides. Students need to identify slides and also identify various pathologies of hard & soft tissue.

The students are detailed on various casts and specimens, pertaining to the practical topics.

They are also assigned topics for peer teaching.

A clinical problem is presented to them, following which they are asked to search for related databases for evidences related to the problem, critically analyze the evidences and find answers.

Students are asked to do Critical appraisal of different types of research papers as per the hierarchy of evidence.

Students also are taught to make use of evidence in diagnosing the pathology.

A Clinical scenario in written format with history is presented to the students and a slide given for microscopic identification to the students. This is followed during revision of slides during practical and then can be implemented in the internal practical examination

| III BDS ORAL PATHOLOGY | | |
|---|---|---|
| 1 | Cysts | Dentigerous Cyst |
| | | Keratocyst |
| | | Calcified Odontogenic Cyst |
| | | Aneurismal Bone Cyst |
| | | Mucous Retention Cyst |
| 2 | Diseases Of Bone | Ossifying Fibroma |
| | | Fibrous Dysplasia |
| | | Cemento-Ossifying Fibroma |
| 3 | Benign And Malignant Tumors | Papilloma |
| | | Lymphangioma |
| | | Hyperkeratotic Lesion |
| | | Carcinoma In Situ |
| | | Oral Sub Mucous Fibrosis |
| | | Squamous Cell Carcinoma |
| | | Verrucous Carcinoma |
| | | Malignant Melanoma |
| | | Fibroma |
| | | Peripheral Giant Cell Granuloma |
| | | Central Giant Cell Granuloma |
| | | Hemangioma |
| | | Neurofibroma |

| | | |
|---|---|---|
| | | Neurilemmoma |
| | | Fibrosarcoma |
| 4 | Odontogenic Tumors | Follicular Ameloblastoma |
| | | Plexiform Ameloblastoma |
| | | Acanthomatous Ameloblastoma |
| | | Granular Cell Ameloblastoma |
| | | Unicystic Ameloblastoma |
| | | Adenomatoid Odontogenic Tumor |
| | | Pindborg's Tumor |
| | | Ameloblastic Fibroma |
| | | Odontoma |
| 5 | Salivary Gland Tumors | Pleomorphic Adenoma |
| | | Cylindroma |
| | | Warthin Tumor |
| 6 | Skin Lesions | Lichen Planus |
| | | Pemphigus Vulgaris |

C. RECOMMENDED BOOKS:

| S.N. | Author | Title |
|---|---|---|
| 1 | Neville, Brad W | Oral & Maxillofacial Pathology |
| 2 | Rajendran, R | Shafer's text book of oral pathology |
| 3 | Cawson, R A & Odell, W | Essentials of oral pathology & oral medicine |
| 4 | Ghom, Anil Govindrao | Textbook of oral pathology |
| 5 | Regezi, Joseph a. (et. Al.) | Oral Pathology Clinical pathologic correlations |
| Reference books | | |
| 1 | Shear,Mervyn&Speightpaul | Cysts of Oral & Maxillofacial regions |
| 2 | Jose, Maji | Manual of oral histology & oral pathology: colour atlas & text |
| 3 | Soames, J.V. &Southam, J.C. | Oral Pathology |
| 4 | Wood &Goaz | Differential diagnosis of oral & maxillofacial lesions |
| 5 | Bancroft, John & Gamble, Marilyn | Theory & practice of histological techniques |
| 6 | Barnes, Leon | Surgical Pathology of the Head & Neck. Vol.1 |

D. SCHEME OF EXAMINATION

*INTERNAL EXAMINATION SCHEME –*

i. First internal (Theory/Practical): 20 Marks
ii. Second internal (Theory/Practical): 20 Marks
iii. Third Internal (Theory/Practical): 60 Marks

Theory as per the university rules

Practicals: (distribution of marks)

University Clinical Examination: 90 Marks

- Spotters (Specimen -identification & points in support-8x 5 Marks) 40 Marks
- Histopathology slides & one blood slide ( Diagram,Labelling and salient features) 8x 5 Marks) 40Marks
- Record book / Journal & Seminar 10 Marks

## PROSTHODONTICS AND CROWN & BRIDGE

### Course outcomes assessed:

Were the students able to: Describe prosthetic needs of patients according to the existing biomechanics of the edentulous state. Diagnose and treat patients who are partially and completely edentulous (including geriatric patients) with complete and partial dentures. Perform clinical steps in treating patients with prosthetic needs and fabricate prostheses for all conventional prosthodontic modes of treatment. Identify cases requiring specialist prosthodontic treatment needs and refer them for further follow up. Plan and communicate treatment plans with special mention on success and failure criteria, factors and motivate patients on the significance of preventive prosthodontic care. Motivate the patient for proper Prosthodontic treatment, maintenance of oral and prosthesis hygiene. Participate in the implementation of the community outreach activities. Exhibit a high standard of professional ethics and conduct and apply these in all aspects of professional life. Participate in CDE programme to update the knowledge and professional skill including evidence-based Prosthodontics from time to time.

A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| | |
|---|---|
| 1. Complete Denture: | |
| 1.1 Biologic considerations in jaw relation & jaw movements craniomandibular relations | MUST TO KNOW |
| 1.1.1 Mandibular movements | MUST TO KNOW |
| 1.1.2 Concept of occlusion – discussion in brief | MUST TO KNOW |
| 1.2 Relating the patient to the articulator | |
| 1.2.1 Face bow types and uses – discuss in brief | MUST TO KNOW |
| 1.2.2 Face bow transfer procedure - discuss in brief | DESIRABLE TO KNOW |
| 1.3 Recording the maxillo-mandibular relation | |
| 1.3.1 Vertical relation | MUST TO KNOW |
| 1.3.1.1 Freeway space concept | MUST TO KNOW |
| 1.3.1.2 Methods of recording Vertical relation | MUST TO KNOW |
| 1.3.1.3 Errors in recording Vertical relations | MUST TO KNOW |
| 1.3.2 Centric relation records | MUST TO KNOW |
| 1.3.2.1 Definitions | MUST TO KNOW |
| 1.3.2.2 Rationale of Centric relation | MUST TO KNOW |
| 1.3.2.3 Methods to record Centric relation | MUST TO KNOW |
| 1.3.2.4 Gothic arch tracings | MUST TO KNOW |
| 1.3.2.5 Errors in recording centric relation | MUST TO KNOW |
| 1.3.2.6 Long centric | DESIRABLE TO KNOW |

| | |
|---|---|
| 1.3.3 Eccentric relation records | GOOD TO KNOW |
| 1.3.3.1 Lateral relation records | GOOD TO KNOW |
| 1.3.3.2 Protrusive relation records | GOOD TO KNOW |
| 1.4 Teeth selection and arrangement: | |
| 1.4.1 Anterior teeth selection | |
| 1.4.1.1 Size of anterior teeth | MUST TO KNOW |
| 1.4.1.2 Shape of anterior teeth | MUST TO KNOW |
| 1.4.1.3 Shade of anterior teeth | MUST TO KNOW |
| 1.4.1.4 Dentogenic principles | MUST TO KNOW |
| 1.4.1.5 Dynesthetic concept | MUST TO KNOW |
| 1.4.2 Posterior teeth | |
| 1.4.2.1 Size of posterior teeth | MUST TO KNOW |
| 1.4.2.2 Form of posterior teeth | MUST TO KNOW |
| 1.4.2.3 Shade of posterior teeth | MUST TO KNOW |
| 1.4.3Esthetic and functional harmony | MUST TO KNOW |
| 1.5 Relating inclination of teeth to concept of occlusion | |
| 1.5.1 Anterior guidance | GOOD TO KNOW |
| 1.5.2 Condylar guidance | GOOD TO KNOW |
| 1.5.3Difference between natural dentition occlusion and complete denture occlusion | MUST TO KNOW |
| 1.5.4 Curve of Spee and Curve of Wilson | MUST TO KNOW |
| 1.5.5 Theories of Occlusion | MUST TO KNOW |
| 1.6 Trial dentures | MUST TO KNOW |
| 1.7 Laboratory procedures | |
| 1.7.1 Rationale of remount procedure | MUST TO KNOW |
| 1.7.2Plaster cast for clinical denture remount procedure | MUST TO KNOW |
| 1.8 Denture insertion | |
| 1.8.1 Insertion procedures | MUST TO KNOW |
| 1.8.2 Clinical errors | MUST TO KNOW |
| 1.8.3 Correcting occlusal disharmony | MUST TO KNOW |
| 1.8.4 Selective grinding procedures | MUST TO KNOW |
| 1.8.5 Instructions on denture use and maintenance | MUST TO KNOW |
| 1.9 Treating problems associated with denture use – in brief | MUST TO KNOW |
| 2. Removable Partial Denture: | |
| 2.1 Examination, diagnosis & treatment planning & evaluation of diagnostic data | MUST TO KNOW |
| 2.2 Components of RPD | |
| 2.2.1 Major connectors | MUST TO KNOW |
| 2.2.1.1 Definition | MUST TO KNOW |
| 2.2.1.2 Requirements | MUST TO KNOW |

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|---|---|
| 2.2.1.3Types of maxillary major connectors | MUST TO KNOW |
| 2.2.1.4Types of mandibular major connectors | MUST TO KNOW |
| 2.2.2 Minor connectors | MUST TO KNOW |
| 2.2.2.1 Definition | MUST TO KNOW |
| 2.2.2.2 Requirements | MUST TO KNOW |
| 2.2.2.3Types of minor connectors | MUST TO KNOW |
| 2.2.3 Rest and rest seats | MUST TO KNOW |
| 2.2.3.1 Definition | MUST TO KNOW |
| 2.2.3.2 Requirements and design | MUST TO KNOW |
| 2.2.3.3 Types of rests | MUST TO KNOW |
| 2.2.4 Direct retainers | MUST TO KNOW |
| 2.2.4.1 Definition | MUST TO KNOW |
| 2.2.4.2 Requirements and design | MUST TO KNOW |
| 2.2.4.3 Classification | MUST TO KNOW |
| 2.2.4.4 Circumferential clasps | MUST TO KNOW |
| 2.2.4.4.1 Design | MUST TO KNOW |
| 2.2.4.4.2 Simple circlet clasp | MUST TO KNOW |
| 2.2.4.4.3 Reverse circlet clasp | MUST TO KNOW |
| 2.2.4.4.4 Embrasure clasp | MUST TO KNOW |
| 2.2.4.4.5 Combination clasp | MUST TO KNOW |
| 2.2.4.4.6 ‘C’ clasp | MUST TO KNOW |
| 2.2.4.4.7 Multiple circlet clasp | MUST TO KNOW |
| 2.2.4.4.8 Ring clasp | MUST TO KNOW |
| 2.2.4.4.9 Back action clasp | MUST TO KNOW |
| 2.2.4.5 Bar clasps | MUST TO KNOW |
| 2.2.4.5.1 I Bar clasp | MUST TO KNOW |
| 2.2.4.5.2 Y Bar clasp | MUST TO KNOW |
| 2.2.4.5.3 T Bar clasp | MUST TO KNOW |
| 2.2.4.5.4 RPI system | MUST TO KNOW |
| 2.2.5 Indirect retainers | |
| 2.2.5.1 Definition | MUST TO KNOW |
| 2.2.5.2 Requirements and design | MUST TO KNOW |
| 2.2.5.3 Classification | MUST TO KNOW |
| 2.2.6 Tooth replacement | |
| 2.2.6.1 Definition | MUST TO KNOW |
| 2.2.6.2 Requirements | MUST TO KNOW |
| 2.2.6.3 Types | MUST TO KNOW |
| 2.2.7 Denture bases | |
| 2.2.7.1 Requirements | MUST TO KNOW |

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|---|---|
| 2.2.7.2 Types | MUST TO KNOW |
| 2.3 Principles of RPD design | |
| 2.3.1 Philosophies of RPD design | MUST TO KNOW |
| 2.3.2 Configurations in RPD designs | MUST TO KNOW |
| 2.4 Survey and design | |
| 2.4.1 Surveyors | MUST TO KNOW |
| 2.4.2 Surveying | MUST TO KNOW |
| 2.5 Mouth preparations and master cast | MUST TO KNOW |
| 2.6 Impression materials and functional impression procedures for RPD | MUST TO KNOW |
| 2.7 Preliminary jaw relation and esthetic try-in for some anterior replacement teeth | MUST TO KNOW |
| 2.8 Laboratory procedures for framework construction – in brief | DESIRABLE TO KNOW |
| 2.9 Fitting the framework – in brief | DESIRABLE TO KNOW |
| 2.10 Try-in of the RPD - in brief | DESIRABLE TO KNOW |
| 2.11 Completion of the RPD - in brief | DESIRABLE TO KNOW |
| 2.12 Inserting the RPD - in brief | DESIRABLE TO KNOW |
| 2.13 Post insertion observations | MUST TO KNOW |
| 2.14 Temporary acrylic partial dentures | MUST TO KNOW |
| 2.15 Immediate removable partial denture | GOOD TO KNOW |
| 2.16 Removable partial dentures opposing complete denture | GOOD TO KNOW |
| 3. Fixed Partial Denture: | |
| 3.1 Fundamentals of occlusion - in brief | MUST TO KNOW |
| 3.2 Articulators - in brief | MUST TO KNOW |
| 3.3 Treatment planning for single tooth restorations | MUST TO KNOW |
| 3.4 Treatment planning for replacement of missing teeth including selection and choice of abutment teeth | MUST TO KNOW |
| 3.5 Fixed partial denture configurations | MUST TO KNOW |
| 3.6 Principles of tooth preparations | MUST TO KNOW |
| 3.7 Preparation for full veneer crowns - in brief | MUST TO KNOW |
| 3.8 Preparation for partial veneer crowns - in brief | MUST TO KNOW |
| 3.9 Provisional restorations | MUST TO KNOW |

## A. Syllabus for Practical:

a. I term:

i. Verification of completion of all pre-clinical work in the journal.

ii. Written assignment, viva & demonstration of all clinical and laboratory procedures.
iii. Minimum1 Complete denture
iv. 2 FPD Tooth preparation (complete metal) and impression making
v. Peer teaching 02 per batch

b. II term:
i. Demonstration for all clinical and laboratory steps for Removable partial denture
ii. Minimum 1 complete denture
iii. 02 FPD tooth preparation (complete metal) and impression making
iv. Demonstration of generation of a PICO question, search strategy literature search and appraisal through checklists

## B. Recommended Books:

| Sr. No | Title | Author |
|---|---|---|
| 1. | Syllabus of complete denture | Charles M Heartwell& Arthur O Rahn |
| 2. | Prosthodontic treatment for edentulous patients | C O Boucher |
| 3. | Essentials of complete denture prosthodontics | Sheldon Winkler |
| 4. | Removable partial prosthodontics | McCracken |
| 5. | Clinical removable partial prosthodontics | Stewart Rudd Kuebker |
| 6. | Contemporary fixed prosthodontics | Rosensteil |
| 7. | Prosthodontic Treatment for Edentulous Patients | ZarbBolender |
| 8. | Removable partial prosthodontics | Ernest L Miller & Joseph E. Grasso |
| 9. | Fundamentals of fixed prosthodontics | Herbert Shillingburg |
| 10. | Theory & practice of fixed prosthodontics | Tylman |
| 11. | Dental lab Procedures: Complete dentures, removable partial prosthodontics, Fixed | Rudd and Morrow |

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|---|---|---|
| | Prosthodontics | |
| 12. | Maxillofacial Prosthetics | Taylor |
| 13. | Contemporary Implant dentistry | C E Misch |

## C. Examination Scheme

University Exams shall be conducted at the end of fourth BDS

## PERIODONTOLOGY

### 1. DEFINITION:

1.1. The science that deals with the structures and behavior of the periodontium in health and in disease is called Periodontology, and the branch of dentistry concerned with prevention and treatment of periodontal disease is termed Periodontics.

### 2. AIMS:

2.1. Provide the knowledge, skills and attitudes of the student fundamental to diagnosis and treatment of periodontics and related procedures to enable critical evaluation and problem solving for periodontal problems to allow independent practicebased on the highest level of available evidences.

2.2. Provide the knowledge, skills and attitudes Provide the knowledge relating to the contemporary practice of periodontics (including an appreciation of an interdisciplinary approach to comprehensive patient care), to allow communication with both specialist and non-specialist audiences

2.3. Produce students who are competent in the design and interpretation of original clinical research at the forefront of current dental research

### 3. OBJECTIVES:

3.1. The student shall acquire the skill to perform scaling, diagnostic tests of periodontal diseases; to use the instruments for periodontal therapy and maintenance of the same. The student shall develop attitude to impart the preventive measures namely, prevention of periodontal diseases and prevention of the progression of the disease. The student shall also develop an attitude to perform the treatment will full aseptic precautions, shall develop an attitude to prevent iatrogenic diseases; to conserve the tooth to the maximum possible time by maintaining periodontal health and to refer the patients who require specialist’s care.

### 4. SCOPE:

4.1. Our specialty has expanded considerably with a lot of emphasis on microbiology, immunology, tissue engineering and periodontal medicine. The surgical aspects have seen tremendous advances both in the techniques and eqipments and materials.

Course outcomes assessed:

Were the students able to: Describe the anatomy and physiology of the periodontium and correlate it with health and diseased states. Describe the types, etiopathogenesis diagnosis and treatment plan for periodontal pathologies. Diagnose periodontal pathologies Perform dental scaling, diagnostic tests of periodontal diseases; use the instruments for periodontal therapy and maintenance of the same. Impart the preventive measures namely, the prevention of periodontal diseases and prevention of the progress of the disease. Perform the treatment with full aseptic precautions. Prevent iatrogenic diseases; to conserve the tooth to the maximum possible time by maintaining periodontal health. Refer the patients who require specialist's care.

## A. COURSE CONTENT AND APPROACH TO THE SUBJECT:

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Historical Background | Desirable to Know |
| 2. Normal Periodontium | Must to Know |
| 2.1. Gingiva | |
| 2.1.1. Definition | Must to Know |
| 2.1.2. Clinical Features | Must to Know |
| 2.1.3. Microscopic Features | Must to Know |
| 2.1.4. Correlation of clinical and microscopic features | Must to Know |
| 2.2. Periodontal Ligament | Must to Know |
| 2.2.1. Definition | Must to Know |
| 2.2.2. Periodontal fibers | Must to Know |
| 2.2.3. Cellular elements | Must to Know |
| 2.2.4. Ground substance | Must to Know |
| 2.2.5. Functions of periodontal ligament | Must to Know |
| 2.3. Cementum | Must to Know |
| 2.3.1. Definition | Must to Know |
| 2.3.2. Cementoenamel junction and | Must to Know |

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|---|---|
| cementodentinal junction | |
| 2.3.3. Clinical features of Cementum | Must to Know |
| 2.3.4. Classification of Cementum | Must to Know |
| 2.4. Alveolar Bone | Must to Know |
| 2.4.1. Definition | Must to Know |
| 2.4.2. Cells and intercellular matrix | Must to Know |
| 2.4.3. Parts of alveolar bone | Must to Know |
| 2.4.4. Clinical and radiographic features | Must to Know |
| 2.4.5. Osseous topography | Must to Know |
| 2.5. Aging &the Periodontium | Good to Know |
| 2.5.1. Effects of aging on the periodontium | Good to Know |
| 2.5.2. Effects of aging on the progression of periodontal disease | Good to Know |
| 2.5.3. Aging and response to periodontal treatment | Good to Know |
| 3. Classification of Periodontal Diseases | Must to Know |
| 3.1. American academy of periodontology classification (1999) | Must to Know |
| 3.2. Other classification of periodontal diseases | Desirable to Know |
| 4. Epidemiology of Gingival & Periodontal Diseases | |
| 4.1. Definition of epidemiology | Must to Know |
| 4.2. Epidemiology of gingival diseases | Good to Know |
| 4.3. Epidemiology of periodontal diseases | Good to Know |
| 4.4. Periodontal indices | Good to know |
| 5. Etiology of Periodontal Diseases | |
| 5.1. Plaque | |
| 5.1.1. Definition of plaque | Must to Know |
| 5.1.2. Structure and composition of plaque | Must to Know |
| 5.1.3. Formation of plaque | Must to Know |

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|---|---|
| 5.1.4. Physiologic properties of plaque | Good to Know |
| 5.1.5. Micro-organisms associated with specific periodontal diseases | Must to Know |
| 5.1.6. Various Plaque hypothesis | Good to Know |
| 5.2. Calculus | |
| 5.2.1. Definition of calculus | Must to Know |
| 5.2.2. Classification and composition of calculus | Must to Know |
| 5.2.3. Mode of attachment of calculus to tooth | Must to Know |
| 5.2.4. Theories of calculus formation | Good to Know |
| 5.2.5. Etiologic significance | Must to Know |
| 5.3. Other Predisposing Factors with Periodontal Disease | |
| 5.3.1. Iatrogenic factors | Good to Know |
| 5.3.2. Malocclusion | Good to Know |
| 5.3.3. Periodontal complications associated with orthodontic therapy | Good to Know |
| 5.3.4. Extraction of impacted third molars | Desirable to Know |
| 5.3.5. Habits and self-inflicted injuries | Desirable to Know |
| 5.3.6. Tobacco use | Good to Know |
| 5.3.7. Radiation therapy | Desirable to Know |
| 5.3.8. Genetic Factors associated with Periodontal Disease | Desirable to Know |
| 6. Host Response-Basic Concepts | |
| 6.1. Microbial aspects | Good to Know |
| 6.2. Immunologic aspects | Good to Know |
| 6.3. Microbiology and immunology in gingival health | Good to know |
| 6.4. Microbiology and immunology in periodontal diseases | Good to know |
| 7. Smoking in Periodontal Diseases | |
| 7.1. Effect of smoking on periodontal diseases | Good to know |

| | |
|---|---|
| 7.2. Effect of smoking on response to periodontal treatment | Good to know |
| 8. Influence of Systemic Disorders & Stress on the Periodontium | |
| 8.1. Endocrine disorders and hormonal changes | |
| 8.1.1. Diabetes mellitus | Must to know |
| 8.1.2. Female sex hormones | Must to know |
| 8.1.3. Corticosteroid hormones | Desirable to know |
| 8.1.4. Hyperparathyroidism | Desirable to know |
| 8.2. Hematologic disorders and immune deficiencies | |
| 8.2.1. Leukemia | Good to Know |
| 8.2.2. Anemia | Good to Know |
| 8.2.3. Thrombocytopenia | Good to Know |
| 8.2.4. Neutrophil disorders | Good to Know |
| 8.2.5. Antibody deficiency disorders | Desirable to Know |
| 8.3. Stress and psychosomatic disorders | Desirable to Know |
| 8.4. Nutritional deficiencies | Desirable to Know |
| 8.5. Other systemic conditions | |
| 8.5.1. Hypophosphatasia | Desirable to Know |
| 8.5.2. Congenital heart disease | Desirable to Know |
| 8.5.3. Metal intoxications | Desirable to Know |
| 9. Periodontal medicine | |
| 9.1. Focal infection theory | Good to Know |
| 9.2. Subgingival environment as a reservoir of bacteria | Good to Know |
| 9.3. Periodontal diseases and coronary heart diseases/atherosclerosis | Good to Know |
| 9.4. Periodontal diseases and stroke | Good to Know |
| 9.5. Periodontal diseases and pregnancy outcomes | Must to Know |
| 9.6. Periodontal diseases and diabetes mellitus | Must to Know |

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|---|---|
| 9.7. Periodontal diseases and COPD | Desirable to Know |
| 10. Oral Malodor | |
| 10.1. Definition | Must to Know |
| 10.2. Classification | Must to Know |
| 10.3. Etiology | Must to Know |
| 10.4. Diagnosis | Must to Know |
| 10.5. Treatment | Must to Know |
| 11. Defense mechanism of the gingiva | |
| 11.1. Sulcular fluid | Good to know |
| 11.2. Leukocytes in dento-gingival area | Good to know |
| 11.3. Saliva | Good to know |
| 12. Gingival Inflammation | |
| 12.1. Stages of gingivitis | Must to Know |
| 13. Clinical features of gingivitis | |
| 13.1. Course and duration | Must to Know |
| 13.2. Clinical findings | Must to Know |
| 14. Gingival Enlargement | |
| 14.1. Inflammatory enlargement | Must to Know |
| 14.2. Drug-induced enlargement | Must to Know |
| 14.3. Idiopathic enlargement | Must to Know |
| 14.4. Enlargement associated with systemic diseases | Must to Know |
| 14.5. Neoplastic enlargement | Desirable to Know |
| 14.6. False enlargement | Desirable to Know |
| 15. Acute Gingival Infections | |
| 15.1. Necrotizing ulcerative gingivitis | Must to Know |
| 15.2. Primary herpetic gingivostomatitis | Must to Know |
| 15.3. Pericoronitis | Must to Know |
| 16. Desquamative Gingivitis | Good to Know |
| 17. AIDS & Periodontium | |

| | |
|---|---|
| 17.1. Pathogenesis | Good to Know |
| 17.2. Classification and staging | Desirable to Know |
| 17.3. Oral and periodontal manifestations of HIV infection | Must to Know |
| 17.4. Dental treatment complications | Must to Know |
| 17.5. Gingival and periodontal diseases in AIDS | Must to Know |
| 17.6. Periodontal treatment protocol | Must to Know |

## A. PRACTICALS:

### DEMONSTRATIONS-

1. History taking and clinical examination of the patients
2. Recording of different indices, Use of disclosing agents
3. Methods of using various scaling instruments and identification of periodontal surgical instruments (FLIPPED CLASSROOM)
4. Identifying a clinical problem, formulating a question and searching the relevant databases for the evidence (First 2 steps of Evidence Based Decision Making)

### Clinical Work Quota

1. 10 cases- Diagnosis, treatment planning and discussion and total periodontal treatment Cases with supporting evidence for it (related evidences searched, appraised and discussed along with the history)
2. 15 complete cases / equivalent-Dental scaling, oral hygiene instructions

## B. RECOMMENDED BOOKS:

Refer to page no. 242

## C. SCHEME OF EXAMINATION:

Final Exams shall be conducted at the end of fourth BDS

## ORAL AND MAXILLOFACIAL SURGERY

Oral and maxillofacial surgery is the specialty of dentistry that includes the diagnosis ad surgical and adjunctive treatment of diseases, injuries and defects including both the functional and esthetic aspects of the hard and soft tissues of the oral and maxillofacial region

### Aim:

To produce a graduate who is competent in performing extraction of teeth under both local and general anaesthesia, prevent and manage related complications, acquire a reasonable knowledge and understanding of the various diseases, injuries, infections occurring in the Oral & Maxillofacial region and offer evidence-based solutions to such of those common conditions and has an exposure in to the in-patient management of maxillofacial problems.

### Objectives:

a. Knowledge & Understanding:

At the end of the course and the clinical training the graduate is expected to –

1. Able to apply the knowledge gained in the related medical subjects like pathology, microbiology and general medicine in the management of patients with oral surgical problem.
2. Able to diagnose, manage and treat the patient on the basis of best available evidence. (Understand the principles of treatment of patients with oral surgical problems.
3. Knowledge of range of surgical treatments.
4. To promote evidence based decision making taking into consideration the requirement of a patient to have oral surgical specialist opinion or treatment.
5. Understand and apply the principles of evidence based dentistry in patient management.
6. Understanding of the protocols and complications associated with management of major oral surgical procedures and principles involved in patient management based on the best possible available evidence.
7. Should know ethical issues and communication ability.

### Course outcomes assessed:

Were the students able to: Apply the knowledge gained in the related medical subjects like pathology, microbiology and general medicine in the management of patients with oral surgical problem. Diagnose, manage and treat (understand the principles of treatment of) patients with oral surgical problems. Explain range of surgical treatments. Ability to decide the requirement of a patient to have oral surgical specialist opinion or treatment. Explain the principles of in-patient management. Explain the management of major oral surgical procedures and

principles involved in patient management. Explain ethical issues. Examine any patient with an oral surgical problem in an orderly manner. Prescribe various clinical and laboratory investigations and is capable of formulating differential diagnosis. Extract teeth under both local and general anaesthesia. Perform minor oral surgical procedures under L.A. like frenectomy, alveolar procedures & biopsy etc. Assess, prevent and manage various complications during and after surgery. Provide primary care and manage medical emergencies in the dental office. Describe management of major oral surgical problems and principals involved in in-patient management.

## A. COURSE CONTENT AND APPROACH TO THE SUBJECT:

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Trigeminal nerve, | |
| 1.1 Course and Distribution | Must Know |
| 2. Facial nerve, | |
| 2.1 Course and Distribution | Must Know |
| 3. Blood supply and lymphatic drainage of face and jaws, | |
| 3.1 Arterial Supply | Must Know |
| 3.2 Venous Drainage | Must Know |
| 3.3 Lymphatic Drainage | Must Know |
| 4. Applied anatomy of the mid face skeleton and mandible | |
| 4.1 Applied Anatomy of Maxilla | Good Know |
| 4.2 Applied Anatomy of Zygomatico Maxillary complex | Good Know |
| 4.3 Applied Anatomy of Orbital Cavity | Desirable Know |
| 4.4 Applied Anatomy of Nasal Cavity | Desirable Know |
| 4.5 Applied Anatomy of Mandible | Must Know |
| 5. Case history | |
| 5.1Past illness and present medical illness | Must Know |
| 5.2Types of pulse, respiration Effect of systemic factors over oral manifestations | Desirable Know |
| 5.3 Differential Diagnosis | Good Know |
| 6. Introduction, classification, mode of action, types, complication, use of vasoconstrictor and armamentarium of L.A. | |
| 6.1 Introduction of Local Anesthesia | Must Know |
| 6.2 Classification of Local Anesthesia | Must Know |
| 6.3 Mode of Action of Local Anesthesia | Must Know |
| 6.4 Types of Local Anesthesia | Must Know |
| 6.5 Complications of Local Anesthesia | Must Know |
| 6.6 Use of Vasoconstrictors with Local Anesthesia | Must Know |

| | |
|---|---|
| 6.7 Armamentariums used for Local Anesthesia | Must Know |
| 7. Exodontia- Definition, indication and contraindication, types of extractions-intra and trans-alveolar, mechanical principles, complication, patient and operator positioning, armamentarium | |
| 7.1 Principles of Exodontia | Must Know |
| 7.2 Method of Exodontia | |
| 7.2.1 Forceps or Intra –alveolar or closed method | Must Know |
| 7.2.2 Surgical or Trans-alveolar or open method | Must Know |
| 7.3 Types of Movements & Forces | Must Know |
| 7.4 Elevators used for Exodontia | Must Know |
| 7.5 Indications & Contraindications of Exodontia | Must Know |
| 7.6 Complication of Exodontia | Must Know |
| 7.7 Extractions in medically compromised patients | Desirable to Know |
| 8. Trismus | |
| 8.1 Types of Trismus | Must Know |
| 8.2 Causes of Trismus | Good to Know |
| 8.3 Management of Trismus | Desirable to Know |
| 9. Healing of Extraction Socket | |
| 9.1 Stages of Healing | Desirable to Know |
| 9.2 Factors Affecting Healing | Desirable to Know |
| 10. Management of medically compromised patient, | |
| 10.1 Hypertensive Patient | Must Know |
| 10.2 Cardiac conditions like angina, CCF, | Must Know |
| 10.3 Diabetic Patient | Must Know |
| 10.4 Thyroid Disorders | Must Know |
| 10.5 Bleeding Disorders | Must Know |
| 10.6 Patient on Steroid Therapy | Must Know |
| 10.7 Tuberculosis | Must Know |
| 10.8 HIV/ AIDS | Must Know |
| 11. Management of unconscious patient and pregnant/lactating women | |
| 11.1 Management of Unconscious Patient | Must Know |
| 11.2 Management of Pregnant Woman | Must Know |
| 11.3 Management of Lactating Woman | Desirable to Know |

## B. CLINICAL WORK:

a. Various local anaesthetic techniques including nerve blocks (as required for dental tooth extraction)
b. Extraction

Quota of Work to Be Completed

| | |
|---|---|
| 3rd year | Minimum of 05 patients extraction under local anesthesia |
| 4th year | Minimum of 10 patients extraction under local anesthesia with various nerve block techniques |
| Total | Minimum of 15 patients extraction |

## C. RECOMMENDED BOOKS:

Refer page no. 249

## D. SCHEME OF EXMINATION:

FINAL Exams shall be conducted at the end of fourth BDS

## CONSERVATIVE DENTISTRY AND

## ENDODONTICS

### Definitions

### Operative Dentistry

“Art and science of the diagnosis, treatment and prognosis of defects of teeth that do not require full coverage restorations for correction. Such treatment should result in the restoration of proper tooth form, function and esthetic while remaining the physiologic integrity of the teeth in harmonious relationship with the adjacent hard and soft tissues, all of which should enhance the general health and welfare of the patient.”

### Endodontics

“It is the branch of dentistry that is concerned with the morphology, physiology and pathology of the human dental pulp and peri-radicular tissues. Its study and practice encompass the basic clinical sciences including biology of the normal pulp; the etiology, diagnosis, prevention and treatment of disease and injures of the pulp; and associated peri-radicular conditions.

### Aims and objectives

A. Knowledge and understanding

B. Skills and

C. Attitudes

A. Knowledge and understanding:

The graduate should acquire the following knowledge during the period of training.

i. To take a detailed history, perform needed investigations, diagnose the disease conditions and manage the disease condition effectively.
ii. To gain knowledge about aesthetic restorative material and to translate the same to patient’s needs.
iii. To gain the knowledge about endodontic treatment on the basis of scientific foundations.
iv. To carry simple endodontic treatment.

### Skills:

He should attain skills necessary for practice of dentistry as said above.

### Attitudes:

i) Maintain a high standard of professional ethics and conduct and apply theses in all aspects of professional life.

ii) Expected to participate in CDE programme to update the knowledge and professional skill from time to time.
iii) To help and participate in the implementation of the national oral health policy.
iv) He should be able to motivate the patient for proper dental treatment at the same time proper maintenance of oral hygiene.

## Scope of the subject

### Operative dentistry

The scope of operative dentistry includes

- To know the condition of the affected tooth and other teeth.
- To examine not only the affected tooth but also the oral and systemic health of the patient.
- To diagnose the dental problem and the interaction of problem area with other tissue.
- Provide optimal treatment plan to restore the tooth to return to health and function and increase the overall well being of the patient.
- Thorough knowledge of dental material which can be used to restore the affected areas.
- To understand the biological basis and function of the various tooth tissue.
- To maintain the pulp vitality and occurrence of pulpal pathology.
- To have knowledge of dental anatomy and histology
- To understand the effect of the operative procedures on the treatment of other disciplines.
- An understanding and appreciation for infection control to safe guard both patient and the dentist against disease transmission.

### Endodontics

The scope of endodontics includes

- The differential diagnosis and the treatment of oral pain of pulpal or peri-radicular origin;
- Vital pulp therapy, such as pulp capping and pulpotomy;
- Non-surgical treatment of root canal system with or without peri-radicular pathosis of pulpal origin and the obturation of these root canal system;
- Selective surgical removal of pathological tissues resulting from pulpal pathosis;
- Repair procedures related to such surgical removal of pathological tissues;
- Intentional implantation and replantation of avulsed teeth;
- Surgical removal of tooth structure such as root-end resection and root end filing;
- Hemisection,bicuspidization and root resection;
- Endodontic implants;
- Bleaching of discoloured dentin and enamel;
- Retreatment of teeth previously treated endodontically.

- And treatment procedures related to coronal restorations by means of post and/or cores involving the root canal space.

## Course outcomes assessed:

Were the students able to**:** Diagnose diseases of the teeth -Perform simple restorative work for decayed teeth using medium and high speed hand pieces to carry out restorative work. Describe aesthetic restorative material and to translate the same to patients needs. Explain endodontic treatment on the basis of scientific foundation. Identify endodontic instruments and materials needed for carrying out simple endodontic treatment. Perform simple endodontic treatment and emergency endodontic treatment. Explain treatment of luxated teeth.Exhibit a high standard of professional ethics and conduct and apply these in all aspects of professional life. Participate in CDE programme to update the knowledge and professional skill from time to time. Participate in the implementation of the national oral health policy. Motivate the patient for proper dental treatment, maintenance of oral hygiene and maintenance of the restorative work to prevent future damage.

## A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Dentinal hypersensitivity | |
| 1.1 Definition, causes, theories of pain | Must to Know |
| 1.2 Clinical features, various anti-hypersensitive agents | Must to Know |
| 1.3 Bio-active materials | Desirable to Know |
| 2. Management of Deep Carious Lesions | |
| 2.1 Direct and indirect pulp capping | Must to Know |
| 2.2 Interim restoration | Must to Know |
| 2.3 Rationale | Must to Know |
| 2.4 interim restorative materials | Must to Know |
| 2.5 prefabricated crowns | Good to Know |
| 2.6 Indirect acrylic restoration | Good to Know |
| 3. Pain control | |
| 3.1 Local anesthesia, analgesia | Must to Know |
| 3.2 Inhalation, sedation and hypnosis | Good to Know |
| 4. Amalgam failure | |
| 4.1 Causes of failure | Must to Know |
| 4.2 Pain following restoration | Must to Know |
| 4.3 Secondary caries, marginal leakage | Must to Know |
| 4.4 Bulk fracture | Must to Know |
| 4.5 Tooth fracture, dimensional change | Must to Know |
| 4.6 Tarnish and corrosion | Must to Know |
| 4.7 Steps/methods to prevent amalgam failure | Must to Know |
| 5. Gingival Tissue Management | |

| | |
|---|---|
| 5.1 Moisture and soft tissues management, | Must to Know |
| 5.2 Biological width, | Must to Know |
| 5.3 Gingival retraction cord, | Must to Know |
| 5.4 Mechanical, chemical, surgical, electrosurgical means | Must to Know |
| 6. Principles and scope and endodontics | |
| 6.1 Application of rubber dam | Must to Know |
| 6.2 Sterilization of instruments | Must to Know |
| 6.3 Debridement, drainage | Must to Know |
| 6.4 Chemoprophylaxis, immobilization | Must to Know |
| 6.5 Avoidance of trauma, trephination | Must to Know |
| 6.6 Chemical irritation | Must to Know |
| 7. Rational of endodontic treatment | |
| 7.1 Reaction of pulp and peri-radicular tissue | Must to Know |
| 7.2 Endodontic implication | Must to Know |
| 7.3 Fish's theory and four zones of infection | Must to Know |
| 8. Anatomy of pulp cavity | |
| 8.1 Structure and function of dentin pulp complex | Must to Know |
| 8.2 Development, morphologic zones of pulp, cells of pulp | Must to Know |
| 8.3 Metabolism, connective tissue fibers, innervations | Must to Know |
| 8.4 Ground substance, vascularity, repair | Must to Know |
| 8.5 Check out for no. of canals, orifice, variation in no. of canals, c-shape canals etc. | Must to Know |
| 8.6 Pulp calcification and age changes | Must to Know |
| 9. Pulp protection | |
| 9.1 Causes of pulpal injuries | Must to Know |
| 9.2 Uses of varnish | Must to Know |
| 9.3 Liners and bases, | Must to Know |
| 9.4 Direct and indirect pulp capping, | Must to Know |
| 9.5 Pulpotomy | Must to Know |
| 9.6 Pulp capping agents | Must to Know |
| 9.7 Direct bonding of pulp exposure, | Good to Know |
| 9.8 MTA | Good to Know |
| 10. Diagnosis and treatment planning | |
| 10.1 Definition | Must Know |
| 10.2 History taking | Must Know |
| 10.3 Clinical examination | Must Know |
| 10.4 Pulp vitality test | Must Know |
| 10.5 Radiograph | Must Know |
| 10.6 Diagnosis of acute and chronic lesions | Must Know |
| 10.7 Emergency management, diagnosis of crack tooth and root fractures | Must Know |
| 10.8 General considerations | Must Know |
| 10.9 Treatment planning sequence | Must Know |
| 10.10 Interdisciplinary consideration | Good to Know |
| 10.11 Indication for endodontic treatment. | Must Know |

| | |
|---|---|
| 11. Pulpal diseases | |
| 11.1 Introduction, | Must Know |
| 11.2 Classification, | Must Know |
| 11.3 Diagnosis and their management | Must Know |
| 12. Periapical diseases | |
| 12.1 Introduction, | Must Know |
| 12.2 Classification, | Must Know |
| 12.3 Diagnosis and their management | Must Know |

## B. PRACTICAL –

Clinical exercises

| Term | | Type of exercise | Number |
|---|---|---|---|
| First term | Extracted teeth | Simple Class I preparation for silver amalgam | 5 |
| | | Class I preparation for silver amalgam with modifications(buccal and palatal extensions) | 5 |
| | | Class V preparation for silver amalgam | 5 |
| | Patient work | Simple Class I preparation and restoration | 5 |
| | | Class V GIC restoration | 3 |
| Second term | Extracted teeth | Simple Class I preparation for Silver amalgam | 05 |
| | | Class I preparation with modifications(Palatal / lingual/buccal extensions) base and band application followed by restoration with silver amalgam | 05 |
| | | Class V preparation for silver amalgam | 2 |
| | | Class V preparation for composite | 2 |
| | Patient work | Simple Class I preparation and restoration | 5 |
| | | Class V GIC restoration | 3 |

*Demonstration of class I and Class V composite restoration to be completed in first term of posting.
*Management of deep carious lesion
* Before second term viva for composite is mandatory.
Students should use the PICO format to search the relevant articles categorized according to the level of evidence to help them in formulating strategies for clinical application of restorative materials.

## C. RECOMMENDED BOOKS:

Refer page no. 131

## D. SCHEME OF EXAMINATION:

FINAL Exams shall be conducted at the end of fourth BDS

# ORTHODONTICS AND DENTOFACIAL ORTHOPEDICS

## 1. DEFINITION:

American Association of Orthodontics- The area of Dentistry concerned with the supervision , guidance, and correction of the growing and matured dentofacial structures, including those conditions that require movement of teeth or correction of malrelationships and malformations of related structures by the adjustment of relationship between and among teeth and facial bones by the application of forces and/or the stimulation and redirection of the functional forces within the craniofacial complex.

British Society of Orthodontics- Orthodontics includes the study of growth and development of jaws and face particularly, and the body generally as influencing the position of the teeth; the study of action and reaction of internal and external influences on the development and the prevention and correction of arrested and perverted development.

## AIM:

The dental graduate student should acquire adequate knowledge, necessary skills and reasonable attitudes which are required for carrying out the prescribed activities in the subject of Orthodontics and Dentofacial Orthopaedics.

## OBJECTIVE:

Undergraduate program in orthodontics is designed to enable the qualifying dental surgeon to diagnose, analyse and treat common orthodontic problems by preventive, interceptive and corrective orthodontic procedures. The following basic instructional procedures will be adapted to achieve the above objectives.

## SCOPE OF THE SUBJECT:

The Dental graduate will be able to diagnose the type of malocclusion and treat simple malocclusions with removable Orthodontic appliances based on highest level of evidence.

## COURSE OUTCOMES ASSESSED:

Were the students able to: -Diagnose, analyse and treat common orthodontic problems by preventive, interceptive and corrective orthodontic procedures. Analyse and Interpret Radiographs for orthodontic diagnosis. Explain principles and fabrication of intra-oral and extra-oral appliances. Fabricate and deliver simple orthodontic appliances

## B. COURSE CONTENTS AND APPROACH TO THE SUBJECT:

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction to Orthodontics | |
| • 1.1 Definition of Orthodontics | Must to Know |
| • 1.2 Division of orthodontic | Must to Know |
| • 1.3 Goals of orthodontic treatment | Must to Know |
| • 1.4 Need for orthodontic treatment | Must to Know |
| • 1.5 Unfavorable sequelae of malocclusion | Must to Know |
| • 1.6 Scope of orthodontic treatment | Must to Know |
| • 1.7 History of orthodontics | Desirable to Know |
| • 1.8 Orthodontic indices | Good to Know |
| 2. Growth and Development | |
| • 2.1 Introduction to Growth and Development | Must to Know |
| • 2.2 Growth spurts and differential growth | Must to Know |
| • 2.3 Methods of measuring growth | Must to Know |
| • 2.4 Growth theories – Genetic, Sicher's, Scott's, Moss's, Petrovics, Multifactorial | Must to Know |
| • 2.5 Genetic and epigenetic factors in gorwth | Must to Know |
| • 2.5 Scammons Growth curve | Must to Know |
| • 2.6 Cephalocaudal gradiant of growth | Must to Know |
| • 2.7 Osteogenesis | Desirable to Know |
| • 2.8 Methods of studying gowth | Good to Know |
| • 2.9 Factors affecting growth and development | Good to Know |
| 3. Morphologic Development of craniofacial structures | |
| • 3.1 Methods of bone growth | Must to Know |
| • 3.2 Prenantal growth of craniofacial structures | Must to Know |
| • 3.3 Post natal growth of cranial base, maxilla, mandible dental arches and occlusion. | Must to Know |
| 4. Development of occlusion | |
| • 3.1 Introduction | Must to Know |
| • 3.2 Development of tooth | Must to Know |
| • 3.3 Sequence of eruption | Must to Know |
| • 3.4 Pre deciduous dentition | Must to Know |
| • 3.5 Deciduous dentition | Must to Know |
| • 3.6 Permanent dentition | Must to Know |
| • 3.7 Establishment of occlusion | Must to Know |
| • 3.8 Self correcting malocclusions at different stages of dentition | Must to Know |

| | |
|---|---|
| • 3.9 Dental age | Good to Know |
| • Wolff's law of transformation of bone | Desirable to Know |
| • Trajectories of force | Desirable to Know |
| 5. Normal Occlusion | |
| • Definition | Must to Know |
| • Terminology used | Must to Know |
| • Compensatory curves | Must to Know |
| • Andrew's six keys to occusion | Must to Know |
| • Ideal vs normal occlusion | Must to Know |
| • Dynamics of occlusion | Desirable to Know |
| • Canine guidance | Desirable to Know |
| • Anterior guidance | Desirable to Know |
| • Posterior guidance | Desirable to Know |
| • Mutually protected occlusion | Desirable to Know |
| • Gnathology | Good to Know |
| • Centric relation | Good to Know |
| • Centric occlusion | Good to Know |
| • Role of TMJ in occlusion age changes in occlusion | Good to Know |
| • Natural vs artificial occlusion | Good to Know |

## C. CLINICAL SYLLABUS:

- Making upper Alginate impression
- Making lower Alginate impression
- Study model preparation
- Model Analysis
  - Pont's analysis
  - Ashley Howe's Analysis
  - Carey's Analysis
  - Bolton's Analysis
  - Moyer's Mixed Dentition Analysis
- 

## D. RECOMMENDED BOOKS:

| TITLE | AUTHOR |
|---|---|
| William R. Profit – Contemporary | Orthodontics |
| Orthodontics For Dental Students | White And Gardiner |
| Handbook Of Orthodontics | Moyers R.E |
| Orthodontics - Principles And Practice | Graber T.M. |
| Design, Construction And Use Of Removable Appliances | Adams C.P |
| Clinical Orthodontics: Vol 1 & 2 | Salzmann |

Reference Books

| TITLE | AUTHOR |
|---|---|
| Introduction to Orthodontic | Laura Mitchell |
| Rakosi Orthodontic Diagnostic Atlas | Rakosi |
| Removable Orthodontic Appliances | Issacson |

## E. EXAM SCHEME:

- University Exams shall be conducted at the end of IV BDS

## PEDODONTICS & PREVENTIVE DENTISTRY

- Definition:- “An age-defined specialty providing primary and comprehensive, preventive and therapeutic oral health care for infants and children through adolescence, including those with special health care needs (American Academy of Pediatric dentistry)”
- Aim:-
    - During training in Paediatric dentistry, students should acquire knowledge regarding preventive measures, diagnosis of oral pathologies in oral cavity of children, necessary skills and reasonable attitude for preventive and clinical management with emphasis on treatment needs for children with disabilities with best and relevant evidence.
- Objectives:-

The Objectives are dealt under three headings, Knowledge and Understanding, Skills, and Attitudes

- Knowledge and Understanding: the graduate student should acquire the following during the period of training.
    - Adequate knowledge of the scientific foundations on which paediatric dentistry is based and good understanding of various relevant scientific methods, principles of biological functions and ability to evaluate and analyse scientifically various established facts and data.
    - Adequate knowledge of the development, structure and function of teeth ,mouth and jaws and associated tissues both in health and disease in children and their relationship and effect on general state of child’s health with psychological and social well-being of the patient.
    - To understand the behaviour of the child in health and sickness as well as influence of the natural and social environment on the state of oral health.

- Skills: Graduate should be able to demonstrate the following skills necessary for practice in paediatric dentistry.
    - Promote oral health and help to prevent oral diseases in children.
    - Control pain and anxiety amongst the child patient during dental treatment with best available evidence.
    - Diagnose and manage various common dental problems encountered in children keeping in mind the expectations and the right of the child to receive the best possible treatment available based on best evidence.
    - Prevent and manage complications if encountered while carrying out various surgical and other procedures in children with best evidence.

- Attitude: Should develop during the training period
    - Willingness to apply the current knowledge of dentistry in the best interest of the patient and community.
    - Maintain a high standard of professional ethics and conduct and apply this in all aspects of professional life.
    - Seek to improve awareness and provide possible solutions for oral health problems and needs for special children.
    - Willingness to participate in the Evidence based CDE programs to update knowledge and professional skills from time to time.
    - Help and participate in the implementation of the National Oral Health Policy.

- Scope of the subject:-

    - Pediatric dentistry encompasses all aspects f oral health care of children and adolescents. It is based on basic knowledge of various specialties of dentistry like cariology, dental radiology, oral medicine, preventive and restorative dentistry, oral surgery and rehabilitation, child psychology, endodontics, periodontics, preventive and interceptive orthodontics, special care dentistry, immunology, neonatology and allied health sciences.
    - Pediatric dentistry also includes treatment and early diagnosis of oral diseases and conditions found in child and adolescent besides preventive approach.
    - Present trends in the scope of paediatric dentistry
        - Preventive and public health dentistry.
        - Child psychology and management
        - Advanced restorative dentistry
        - Preventive and interceptive orthodontics
        - Special care dentistry
        - Child abuse and neglect (Forensic Pedodontics)
        - Genetics in pediatric dentistry

**Course outcomes assessed: Were the students able to:**

CO1-Perform a proper clinical history, methodologically examine the child patient, and perform essential diagnostic procedures, interpret them, and arrive at a reasonable diagnosis to treat appropriately. CO2-Treat dental diseases which occurring child patient.

CO3-Repair and restore the lost / tooth structure to maintain harmony between both hard and soft tissues of the oral cavity.

CO4-Manage the disabled children effectively and efficiently, tailored to the needs of individual requirement and conditions.

CO5-Manage efficiently life-threatening conditions with emphasis on basic life support measure.

A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction, definition, scope & importance of Pedodontics | |
| 1.1 Definition, Aim, scope, Objectives and Importance of Pedodontics | Must to Know |
| 1.2 Adequate Knowledge of scientific foundations on which paediatric dentistry is based & good understanding of various relevant scientific methods & Principles | Must to Know |
| 2. Setting up of Paediatric dental clinic | |
| 2.1 Modifications for handicapped child | Good to Know |
| 2.2 To know the setting & functioning of a paediatric dental clinic | Good to Know |
| 3. Case History Recording | |
| 3.1 Outline of principles of examination, diagnosis, and treatment planning | Must to Know |
| 3.2 Able to record a case history from pedodontics point of view | Must to Know |
| 4. Growth & Development of dentition | |
| 4.1 Development of teeth and associated structures | Must to Know |
| 4.2 Eruption and shedding of teeth | Must to Know |
| 4.3 Teething disorders and their management | Must to Know |
| 4.4 Chronology of eruption of teeth | Desirable to Know |
| 4.5 Adequate knowledge of the development of dentition from birth through adolescence | Must to Know |
| 5. Development of Occlusion from birth through adolescence | |
| 5.1 Pre-deciduous Stage | Must to Know |
| 5.2 Mixed dentition | Must to Know |
| 5.3 Deciduous dentition stage | Must to Know |
| 5.4 Permanent dentition stage | Must to Know |
| 5.5 Understanding the sequence & Eruption of each tooth & its role in the development of occlusion | Good to Know |
| 6. Infant oral health care | |
| 6.1 Pre birth parent counseling | Desirable to Know |
| 6.2 Guiding parents in different techniques of oral hygiene maintenance | Good to Know |
| 6.3 Learn the Harmful effects of non-maintenance of proper oral hygiene | Good to Know |
| 7. Pit & Fissure sealants & preventive resin restoration | |
| 7.1 History, classification, indications, contraindications, method of application | Must to Know |
| 7.2 Learn indication, types & application of pit & fissure sealants – Flipped classroom | Good to Know |
| 8. Applied Morphology & Histology of deciduous & permanent teeth | |

| | |
|---|---|
| 8.1 Morphology & histological differences in crown, root, enamel, dentin, cementum& pulp between primary & permanent teeth | Must to Know |
| 8.2 Learn morphological features of each deciduous tooth in detail – Flipped classroom | Must to Know |
| 9. Importance of first permanent molar | |
| 9.1 Learn eruption pathway & importance of first permanent molar in establishing occlusion | Good to Know |
| 10. Dental caries | |
| 10.1 Historical background | Good to Know |
| 10.2 Definition, etiology & pathogenesis | Must to Know |
| 10.3 Caries pattern in Primary, young permanent and permanent teeth in children | Good to Know |
| 11. Rampant caries and early childhood caries | |
| 11.1 Definition, aetiology, pathogenesis, Clinical features, Complications & Management. | Good to Know |
| 11.2 Role of diet and nutrition in dental caries | Desirable to Know |
| 11.3 Dietary modifications & diet counseling | Desirable to Know |
| 11.4 Caries activity, tests, caries prediction, caries susceptibility & their clinical application | Desirable to Know |
| 11.5 Clinically able to classify a carious lesion | Must to Know |
| 12. Oral surgical procedures in children | |
| 12.1 Indications and contraindications of extractions of primary and permanent teeth in children | Good to Know |
| 12.2 Knowledge of local and general anesthesia | Must to Know |
| 12.3 Minor surgical procedures in children | Desirable to Know |
| 12.4 Learn about the basic surgical procedures & Local Anesthesia techniques in pediatric dentistry | Good to Know |

B. CLINICAL WORK:

1. Diagrams – Cavity preparation
2. Case history recording and chair side discussions
3. Cases
4. Seminar

Quota for third year

1. Restorations: -
   1.1. Class1 and Class 2 - 10
2. Preventive: -
   2.1. Oral Prophylaxis - 10

2.2. Fluoride application - 08

3. Extractions - 10
4. Clinical History taking - 03
5. Education and Motivation

C. RECOMMENDED BOOKS: Refer to page no.276

D. SCHEME OF EXAMINATION:

CLINICAL / PRACTICAL POSTING AND EXAMINATION -

FINAL Exams shall be conducted at the end of fourth BDS

## PUBLIC HEALTH DENTISTRY

DEFINITION OF THE SUBJECT:

Public Health Dentistry is a specialty of dentistry concerned with the oral health of a population rather than individuals. It has been defined as the science and art of preventing oral diseases, promoting oral health and improving the quality of life through the organised efforts of the community.

3.AIM AND OBJECTIVES AND SCOPE OF THE SUBJECT:

I. AIM:

To prevent and control oral diseases and promote oral health through organized community efforts

II. OBJECTIVES:

A. Knowledge:

At the conclusion of the course the student shall have knowledge of the basis of public health, preventive dentistry, public health problems in India, Nutrition, Environment and their role in health, basics of dental statistics, epidemiological methods, National oral health policy with emphasis on oral health policy.

B. Skill and Attitude Development:

At the conclusion of the course, the students shall have required at the skill of identifying health problems affecting the society, conducting health surveys, conducting health education classes and deciding health strategies by critical appraisal of evidence. Students should develop a positive attitude towards the problems of the society and must take responsibilities in providing health.

C. Effective Communication:

At the conclusions of the course, the students should be able to communicate the needs of the community efficiently, inform the society of all the recent methodologies in preventing oral disease with substantial scientific evidence

III. SCOPE OF THE SUBJECT:

The subject has wide scope as described by the following key areas of dental public health practice.

1. Oral health surveillance
2. Assessing the evidence on oral health and dental interventions, programmes and services
3. Policy and strategy development and implementation
4. Strategic leadership and collaborative working for health

5. Oral health improvement
6. Health and public protection
7. Developing and monitoring quality dental services
8. Dental Public Health intelligence
9. Academic Dental Public Health
10. Appropriate and evidence- based decision-making and judgement
11. Appropriate attitudes, ethical understanding and legal responsibilities
12. Role within the Health Service
13. Personnel Development

**Course outcomes assessed: Were the students able to:**

CO1-Describe the basis of public health, preventive dentistry, public health problems in India, Nutrition, Environment and their role in health, basics of dental statistics, epidemiological methods, National oral health policy with emphasis on oral health policy.
CO2-Identify health problems affecting the society, conducting health surveys, conducting health education classes and decide health strategies.
CO3-Exhibhit a positive attitude towards the problems of the society and must take responsibilities in providing health.
CO4-Communicate the needs of the community efficiently, inform the society of all the recent methodologies in preventing oral disease

A. COURSE CONTENT AND APPROACH TO THE SUBJECT

APPROACH TO THE SUBJECT

| TOPIC | APPROACH |
|---|---|
| 1. INTRODUCTION TO PUBLIC HEALTH DENTISTRY | |
| 1.1 Definition of dentistry | Must know |
| 1.2 Pioneers of dentistry | Desirable to know |
| 1.3 History of dentistry | Must know |
| 1.3.1 Milestones in the field of dentistry | Good to know |
| 1.3.2 Historical dates | Good to know |
| 1.3.3 Dentistry in ancient times | Good to know |
| 1.4.Aim, scope and objectives of dentistry | Must know |
| 1.4.1 Dentistry in future | Good to know |
| 2. PUBLIC HEALTH DENTISTRY | |
| 2.1Health and disease | Must know |
| 2.1.1 Concepts, philosophy, definition and characteristics | Must know |

| | |
|---|---|
| 2.2 Public health | Must know |
| 2.2.1Definition, concepts and history of public health | Must know |
| 2.3 General epidemiology | Must know |
| 2.3.1 Definition, objectives, methods, uses and screening for disease | Must know |
| 2.3.2 Investigation of an epidemic | Desirable to know |
| 2.3.3 Quarantine procedures | Good to know |
| 2.4. Public health administration | Must know |
| 2.4.1 Priority, establishment, manpower, health management | Must know |
| 2.4.2 infectious disease epidemiology | Desirable to know |
| 2.4.3 Control of epidemics | Good to know |
| 2.5 Health care delivery system | Must know |
| 2.5.1 Centre and state, oral health policy, primary health care, national health programmes, health organizations and agencies | Must know |
| 2.5.2 Health care delivery systems of other countries | Desirable to know |
| 2.6 Behavioral science | Must know |
| 2.6.1 Definition of sociology, anthropology and psychology and their role in health and oral health of community | Must know |
| 2.7 Health economics | Desirable to know |
| 3. DENTAL PUBLIC HEALTH | |
| 3.1 Introduction to dental public health | Must know |
| 3.1.1 Definition and difference between community and clinical health | Must know |
| 3.2 Epidemiology of dental diseases dental caries, periodontal diseases, malocclusion, dental fluorosis and oral cancer. | Must know |
| 3.2.1 Epidemiological studies related to oral diseases, etiology and risk factors for oral diseases | Must know |
| 3.3 Survey procedures | Must know |
| 3.3.1 Planning, implementation and evaluation, WHO oral health survey methods 1997, indices for dental diseases. | Must know |
| 3.4 Delivery of dental care | Must know |
| 3.4.1 Dental auxiliaries( operating and non- operating), incremental and | Must know |
| 3.5 Comprehensive health care,School dental health | Must know |
| 3.6 Payments of dental care | Must know |
| 3.6.1 Methods of payments, dental insurance, Government plans | Must know |
| 3.7 Preventive dentistry | Must know |
| 3.7.1 Definition, levels, role of individual,community and profession | Must know |

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|---|---|
| 3.7.2 Fluorides in dentistry, plaque control programmes | Must know |
| 4. Dentist Act 1948 with amendment | |
| 4.1.1 Objectives, functions, composition, registration and membership of IDA (FLIPPED CLASSROOM) | Must know |
| 4.2 Dental Council of India and State Dental Councils , Composition and responsibilities | Must know |
| 4.2.1 Objectives, functions and composition of centre and state DCI (FLIPPED CLASSROOM) | Must know |
| 4.3 Indian Dental Association , Head Office, State, Local and branches (FLIPPED CLASSROOM) | Must know |

B. PRACTICAL

Preparation of oral health education material
Assuming Leadership role in organizing and solving Community Health Problems
Discussion and Demonstration of Dental Indices

C. RECOMMENDED BOOK:

Refer to Page no. 272

D. SCHEME OF EXAMINATION:

FINAL Exams shall be conduct
end of fourth BDS

## ORAL MEDICINE AND RADIOLOGY

### ORAL MEDICINE:

Oral Medicine is the specialty of dentistry that is concerned with the oral health care of medically compromised patients and with the diagnosis and nonsurgical management of medically related disorders or conditions affecting the oral and maxillofacial region. The practice of oral medicine will provide optimal health to all people through the diagnosis and management of oral diseases.

### ORAL DIAGNOSIS:

Oral Diagnosis is art of using scientific knowledge of identifying oral disease process and distinguishing one disease from other.

### ORAL RADIOLOGY:

Radiology is a science dealing with x-rays and their uses in diagnosis and treatment of diseases in relation to oro-facial diseases.

## 1. AIM:

- To train the student to diagnose the common disorders of Oro-facial region by clinical examination and with the help of such investigations as may be required and medical management of Oro-facial disorders with drugs and physical agents.
- To train the student about the importance, role, use and techniques of Radiographs and other imaging methods in Diagnosis.
- To train the student about the Principles of the Clinical and Radiographic aspects of Forensic Odontology.
- To train the student to ensure higher competence in both general & special areas of Oral Medicine & Radiology.
- To prepare the student for teaching, research and clinical abilities including prevention of various oral & maxillofacial lesions.
- To train the student to apply evidence-based knowledge for the diagnosis and treatment of oral diseases.

## 2. OBJECTIVES:

At the end of curriculum, the student should be able to acquire -

- Knowledge: Theoretical, Clinical and practical knowledge of all orofacial lesions, diagnostic procedures pertaining to them and latest information of imaging modules and recent advances in treatment modalities.
- Skills : Three important skills need to be imparted -

- Diagnostic skill in recognition of oral lesions and their management.
- Research skills in handling scientific problems pertaining to oral treatment.
- Clinical and Didactic skills in encouraging younger doctors to attain learning objectives.
- Evidence Searching Skills using various databases for treatment protocol of various oral diseases.
- Evidence based diagnostic skills in using the latest gold-standard investigative procedures.
- Critical Appraisal of available evidence for diagnosis and Implementation of best clinical evidence in the management of individual patients.
- Evaluation of the evidence implemented to the patients.

- **ATTITUDE:**
  - The positive mental attitude and the persistence of continued learning need to be inculcated.
  - Inculcating positive approach towards newer learning methodologies and treatment modalities based on clinical evidence

## COURSE OUTCOMES ASSESSED:

Were the students able to Describe the disorders of Orofacial region. Diagnose the common disorders of Orofacial region by clinical examination and with the help of such investigations as may be required and medical management of oro-facial disorders with drugs and physical agents. Describe the role, use and techniques of radiographs/digital radiograph and other imaging methods in diagnosis. Take radiographs for intra-oral conditions and interpret them to arrive at radiographic diagnosis. Explain the principles of the clinical and radiographic aspects of Forensic Odontology.

## A. COURSE CONTENT AND APPROACH TO SUBJECT:

### 1. APPROACH TO THE SUBJECT OF ORAL MEDICINE

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction to Oral Medicine | |
| 1.1. Definition and Scope | Must to Know |
| 1.2. Clinical Applications | Must to Know |
| 2. Principles of Oral Diagnosis | |
| 2.1. Definition. | Must to Know |
| 2.2. Importance and Various types of diagnosis | Must to Know |
| 3. Behavioral Sciences | |
| 3.1. Introduction | Good to Know |
| 3.2. Social Sciences | Good to Know |
| 3.3. Health behavior and lifestyle | Good to Know |

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| 3.4. Theories of behavior change | Good to Know |
| 3.5. Life style and oral health | Good to Know |
| 3.6. Social stratification and oral health | Good to Know |
| 3.7. Risk behavior | Good to Know |
| 3.8. Utilization of dental services | Good to Know |
| 3.9. Conclusion | Good to Know |
| 4. Jurisprudence and Ethics in Medicine and Dentistry | |
| 4.1. Introduction | Good to Know |
| 4.2. History | Good to Know |
| 4.3. Ethical Principles | Good to Know |
| 4.4. Ethical rules for dentist | Good to Know |
| 4.5. Declaration of Geneva | Good to Know |
| 4.6. World medical association international code of medical ethics | Good to Know |
| 4.7. Ethics in dental research | Good to Know |
| 4.8. The Nuremberg code | Good to Know |
| 4.9. Declaration of Helsinki | Good to Know |
| 4.10. Ethical guidelines for biomedical research on human participants – By the Indian Council of Medical Research (ICMR) | Good to Know |
| 4.11. Conclusion | Good to Know |
| 5. Clinical Case history and components | |
| 5.1. Importance of Clinical Case History | Must to Know |
| 5.2. Vital Statistics | Must to Know |
| 5.3. Chef Complaint | Must to Know |
| 5.4. History of Present Illness | Must to Know |
| 5.5. Past & Present Medical History | Must to Know |
| 5.6. Past and Present Dental History | Must to Know |
| 5.7. Personal History | Must to Know |
| 5.8. General Examination<br>5.8.1. Extraoral Examination<br>5.8.2. Intraoral Examination | Must to Know |
| 5.9. Examination of Area of Chief Complaint | Must to Know |
| 5.10. Provisional / Clinical Diagnosis | Must to Know |
| 5.11. Differential Diagnosis | Must to Know |
| 5.12. Laboratory Investigations | Must to Know |
| 5.13. Final Diagnosis | Must to Know |
| 5.14. Treatment Plan<br>5.14.1. Emergency Treatment<br>5.14.2. Planned Treatment | Must to Know |
| 6. Referral for Opinions | |
| 6.1. What is Referral | Good to Know |
| 6.2. Need for referring patients | Good to Know |

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| 6.3. Methods for referring patients<br>6.3.1. Conventional referrals<br>6.3.2. Information and Communication Technology referrals | Good to Know |
| 6.4. Dental Reference | Good to Know |
| 6.5. Medical Reference | Good to Know |
| 7. Regressive changes and teeth staining | |
| 7.1. Attrition | Desirable to Know |
| 7.2. Abrasion | Desirable to Know |
| 7.3. Erosion | Desirable to Know |
| 7.4. Abfraction | Desirable to Know |
| 7.5. Intrinsic stains | Desirable to Know |
| 7.6. Extrinsic stains | Desirable to Know |
| 8. Developmental Anomalies of Jaw and Teeth | |
| 8.1. Developmental Anomalies involving size of jaw | Must to know |
| 8.2. Developmental Anomalies involving shape of jaw | Must to know |
| 8.3. Developmental Anomalies involving size of tooth | Must to know |
| 8.4. Developmental Anomalies involving shape of tooth | Must to know |
| 8.5. Developmental Anomalies involving number of tooth | Must to know |
| 8.6. Developmental Anomalies involving structure of tooth | Must to know |
| 8.7. Developmental Anomalies involving eruption of tooth | Must to know |
| 8.8. Names of associated syndromes | Good to know |
| 9. Spread of Infection: | |
| 9.1. Inflammation and infection | Must to know |
| 9.2. Focus of infection | Must to know |
| 9.3. Focal infection | Must to know |
| 9.4. Facial space infections | Must to know |
| 9.5. Oral sepsis and its effect on general system | Must to know |
| 10. Pharmaco-therapeutics: | |
| 10.1 General therapeutic measures- drugs commonly used in Oral Medicine | Good to know |
| 10.1.1. Antibiotics | Good to know |
| 10.1.2. Chemotherapeutic agents | Good to know |
| 10.1.3. Anti-inflammatory and analgesic drugs | Good to know |
| 10.1.4. Corticosteroids | Good to know |
| 10.1.5. Antiviral drugs | Good to know |
| 10.1.6. Antifungal drugs | Good to know |
| 10.1.7. Anti-tubercular drugs | Good to know |
| 10.1.8. Antihistamines | Good to know |
| 10.1.9. Immunomodulators | Good to know |
| 10.1.10. Immunosuppressive drugs | Good to know |
| 10.1.11. Sialogogues and antisialogogues | Good to know |
| 11. Geriatric Dentistry | |
| 11.1. Concept of Aging | Good to know |

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| 11.2. Geriatric Patient Assessment | Good to know |
| 11.3. Age related Systemic Changes | Good to know |
| 11.4. Age related Oral Changes | Good to know |
| 11.5. Institutionalized Older Adults | Good to know |
| 11.6. Summary | Good to know |
| 12. Pediatric Dentistry | |
| 12.1. Evaluation of Pediatric Patient | Good to know |
| 12.2. Medical and Dental Issues Associated with Craniofacial Abnormalities | Good to know |
| 12.3. Developmental Variations of Normal Structures | Good to know |
| 12.4. Diseases of Tongue | Good to know |
| 12.5. Diseases of Gingiva and Periodontium | Good to know |
| 12.6. Salivary Gland Pathology | Good to know |
| 12.7. Diseases with altered Immune System | Good to know |
| 12.8. Infections | Good to know |
| 13. Pigmented Lesions of the Oral Mucosa - | |
| 13.1 Hemangioma | Must to Know |
| 13.2 Varix | Must to Know |
| 13.3 Angiosarcoma | Desirable to Know |
| 13.4 Kaposi's Sarcoma | Desirable to Know |
| 13.5 Hereditary Hemorrhagic Telangiectasia | Desirable to Know |
| 13.6 Café au Lait Pigmentation | Desirable to Know |
| 13.7 Smoker's Melanosis | Must to Know |
| 13.8 Ecchymosis | Must to Know |
| 13.9 Petechia | Must to Know |
| 13.10 Graphite Tattoo | Desirable to Know |

## 2. APPROACH TO THE SUBJECT OF ORAL RADIOLOGY

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Introduction to Oral Radiology | |
| 1.1. History | Good to know |
| 1.2. Origin | Good to know |
| 1.3. Definitions | Good to know |
| 1.4. Scope | Good to know |
| 1.5. Limitations | Good to know |
| 2. Radiation physics | |
| 2.1 Atomic structure & ionization of radiation | Must to Know |
| 2.2 Different types of radiation | Must to Know |
| 2.3 Details of parts of x- ray machine | Must to Know |
| 2.4 Electromagnetic spectrum | Must to Know |
| 2.5 Bremstrauhlung radiation | Must to Know |
| 2.6 Characteristic radiation | Must to Know |

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| 2.7 Exposure time, current, voltage | Must to Know |
| 2.8 Filtration | Must to Know |
| 2.9 Collimation | Must to Know |
| 2.10 Inverse-square law | Must to Know |
| 2.11 Different dosimeters | Must to Know |
| 2.12 Wave theory & quantum theory | Desirable to Know |
| 2.13 Details about power supply | Desirable to Know |
| 2.14 Photoelectric, Compton and coherent scattering | Desirable to Know |
| 2.15 Half wave rectification | Good to Know |
| 2.16 Different units of radiation | Good to Know |
| 3. Radiation biology | |
| 3.1 Radiolysis of water, direct & indirect effects | Must to Know |
| 3.2 Stochastic & deterministic effects | Must to Know |
| 3.3 Late somatic effects | Must to Know |
| 3.4 Radiation effect at cellular level | Desirable to Know |
| 3.5 Radiation effect at tissue and organ level | Desirable to Know |
| 3.6 Modifying factors | Desirable to Know |
| 3.7 Effect of whole body irradiation | Good to Know |
| 4. Radiation safety and protection | |
| 4.1 Sources of radiation | Must to Know |
| 4.2 Dose limits | Must to Know |
| 4.3 Estimates of risks | Must to Know |
| 4.4 Methods of dose reduction | Must to Know |
| 4.5 Various equipments to reduce the exposure and dose | Must to Know |
| 4.6 Methods of protection of environment | Desirable to Know |
| 4.7 Radiology department design | Desirable to Know |
| 4.8 NCRP & ICRP guidelines of radiation protection | Good to Know |
| 5. Quality assurance and infection control | |
| 5.1 Importance of Radiographic quality assurance | Must to Know |
| 5.2 Schedule of Radiographic quality assurance procedure | Must to Know |
| 5.3 Key steps in radiographic Infection control | Must to Know |
| 5.4 Universal precautions | Desirable to Know |
| 5.5 Coin test | Good to Know |
| 6. Radiographic Techniques | |
| 6.1 All intraoral radiographic technique procedures (FLIPPED CLASSROOM) | Must to Know |
| 6.2 Principles, indications, advantages, disadvantages, contraindications | Must to Know |
| 6.3 All film holding instruments (FLIPPED CLASSROOM) | Desirable to Know |
| 6.4 Radiographic examination of children | Good to Know |
| 6.5 Special considerations Radiographic techniques for endodontics | Good to Know |
| 6.6 Radiographic techniques in pregnancy | Good to Know |
| 6.7 Radiographic techniques for edentulous patients | Good to Know |
| 6.8 Different extraoral views, their indications, advantages, | Must to Know |

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| disadvantages, uses, principles | |
| 6.9 Technique & Evaluation of image | Desirable to Know |
| 6.10 Interpretation | Good to Know |
| 6.11 Panoramic Radiography | |
| 6.11.1 Indications, advantages, disadvantages, principle | Must to Know |
| 6.11.2 The image layer | Must to Know |
| 6.11.3 Panoramic machines | Must to Know |
| 6.11.4 Patient positioning and head alignment (FLIPPED CLASSROOM) | Must to Know |
| 6.11.5 Errors | Desirable to Know |
| 6.11.6 Ghost image | Desirable to Know |
| 6.11.7 Different image receptors | Desirable to Know |
| 6.11.8 Interpretation of opg | Good to Know |
| 7. Factors Affecting Ideal Radiographs: | |
| 7.1. K.V.P. and mA of X-ray machine | Must to Know |
| 7.2. Filters | Must to Know |
| 7.3. Collimation | Must to Know |
| 7.4. Intensifying screens | Must to Know |
| 7.5. Grids | Must to Know |
| 7.6. X-ray films | Must to Know |
| 7.7. Exposure time | Must to Know |
| 7.8. Techniques | Must to Know |
| 7.9. Dark room | Must to Know |
| 7.10. Safe light | Must to Know |
| 7.11. Developer and Fixer solutions | Must to Know |
| 7.12. Film Processing (FLIPPED CLASSROOM) | Must to Know |
| 7.13. Storage of Films | Good to Know |
| 7.14. Image Characteristics | Good to Know |
| 8. Normal radiographic anatomy | |
| 8.1 Radiographic appearance of Teeth Supporting structures, Maxilla, Mandible | Must to Know |
| 8.2 Cervical burn out | Desirable to Know |
| 8.3 Y line of Ennis | Desirable to Know |
| 8.4 Differentiating points between normal anatomy & jaw pathologies. | Desirable to Know |
| 8.5 Radiographic appearance of different Restorative materials | Good to Know |
| 9. Faulty Radiographs and Artifacts in Radiographs | |
| 9.1 Common Problems in Film Exposure and Development | Must to Know |
| 9.1.1 Light Radiographs | Must to Know |
| 9.1.2 Dark Radiographs | Must to Know |
| 9.1.2 Insufficient Contrast | Must to Know |
| 9.1.3 Film Fog | Must to Know |

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| 9.1.4 Dark Spots or Lines | Must to Know |
| 9.1.5 Light Spots | Must to Know |
| 9.1.6 Yellow or Brown Stains | Must to Know |
| 9.1.7 Blurring | Must to Know |
| 9.1.8 Partial Images | Must to Know |
| 9.1.9 Emulsion Peel | Must to Know |
| 10. Principles of radiographic interpretation | |
| 10.1 Role in radiographs in disease detection and monitoring | Must to Know |
| 10.2 Guidelines for ordering radiographs | Must to Know |
| 10.3 Common dental radiographic examinations | Desirable to Know |
| 10.4 Special considerations | Good to Know |
| 10.5 Ideal viewing conditions | Must to Know |
| 10.6 Systematic radiographic analysis of intraoral radiographs | Must to Know |
| 10.6 Analysis of intraosseous lesion: Aunt Minnie and step-by- step method | Desirable to Know |
| 10.7 Systematic radiographic analysis of intraoral radiographs | Good to Know |
| 10.8 Lamina dura in health & disease | Good to Know |
| 11. Dental caries | |
| 11.1 Radiographic appearance of all types of caries | Must to Know |
| 11.2 Radiographic classification | Must to Know |
| 11.3 Use of bitewing radiograph | Must to Know |
| 11.4 Radiographic interpretation of caries | Must to Know |
| 11.5 Alternative diagnostic tools to detect caries | Desirable to Know |
| 11.6 Differentiation of secondary caries from caries | Good to Know |
| 12. Periodontal diseases | |
| 12.1 Indications of radiographs in periodontal diseases | Must to Know |
| 12.2 Limitations of radiographs in periodontal diseases | Must to Know |
| 12.3 General radiographic features of periodontal disease | Must to Know |
| 12.4 Radiographic classification of periodontal disease | Must to Know |
| 12.5 Dental considerations with periodontal diseases | Desirable to Know |
| 12.6 Effect of systemic diseases on periodontium | Must to Know |
| 12.7 Digital subtraction radiography | Must to Know |
| 13. Inflammatory lesions of the jaws | |
| 13.1 Clinical and radiographic features of Periapical & pericoronal infection | Must to Know |
| 13.2 D/D of different inflammatory lesions of jaw | Must to Know |
| 13.3 Clinical and radiographic features of osteomyelitis | Desirable to Know |
| 13.4 Clinical and radiographic features of osteoradionecrosis | Good to Know |
| 14. Developmental disturbances of the face, jaws and teeth | |
| 14.1 Classification, general & radiographic features of Developmental disturbances of the face, jaws and teeth | Must to Know |
| 14.2 Genetics | Desirable to Know |

## B. PRACTICAL / CLINICAL SCHEME FOR III BDS

Under practical / clinical scheme for III BDS, a. Examination of Trigeminal and Facial Nerves as writing assignment – in III BDS first term b. Discussion on Pulp, periapical & periodontal diseases and Prescribing Intraoral Radiographs - in III
BDS second term c. Demonstration of Clinical examination of pathology (Swelling, PMDs, Malignancy, Ulcer etc.) - in III
BDS second term d. Peer teaching on topics General physical examination and Extraoral examination - in III BDS second term

### III year 1st term

1. Demonstration on Patient shall be given to every Clinical Posting batch during the Clinical posting:
   1.1. OPD
      1.1.1 . Introduction
      1.1.2 . Importance of case history
      1.1.3 . Patient Positioning on dental chair
      1.1.4 . Dental and Oral Examination
      1.1.5 . Recording of OPD Case Paper
   1.2. Radiology
      1.2.1. Introduction
      1.2.2. Importance of Dental Radiographs
      1.2.3. Patient Positioning on dental chair
      1.2.4. Dental Radiograph taking procedure and techniques
      1.2.5. Processing of Radiograph
      1.2.6. Interpretation of Radiograph
      1.2.7. Faults / Artifacts on Radiographs
      1.2.8. Prescribing Intra-oral radiograph

2. Each student shall be given a writing assignment during the Clinical Posting: 2.1. Case History – Description and Importance
   2.2. Head and Neck Lymph nodes

2.3. Salivary Glands
2.4. Muscles of Mastication
2.5. Temporomandibular Joint
2.6. X-ray films
2.7. Processing solutions and techniques
2.8. IOPAR Technique
2.9. Dark room

3. Each student shall perform clinical examination and shall take Intraoral Periapical Radiographs during the clinical posting. The record for the same shall be maintained in the Record / Log book.

## III BDS Second Term:

a. Demonstration shall be given to every Clinical Posting batch during the Clinical posting of III BDS Second Term on:
   1.1. Medicine Prescription writing
   1.2. Prescribing Intraoral &Extraoral Radiographs and Advanced Imaging Modalities

b. Each student shall be given a Writing Assignment during the Clinical posting:
   2.1. Swelling
   2.2. Oral Ulcer
   2.3. Classification and Five trade names of NSAIDs
   2.4. Classification and Five trade names of Antibiotics
   2.5. Classification and Five trade names of Antioxidants
   2.6. Classification, Contraindications and Five trade names of Corticosteroids
   2.7. Five trade names of Gum Paints, Mouthwash, Topical Anesthetic & Antiseptic gel / cream and Dental Antihypersensitivity toothpaste
   2.8. Schematic diagrams of radiographic anatomical landmarks of maxilla and mandible

3. The Student shall be trained to arrive at Proper Diagnosis by following a Scientific and Systematic procedure of History taking and Examination of the Oro-facial region.

## C. RECOMMENDED BOOKS:

Refer page no. 216

## D. SCHEME OF EXAMINATION:

FINAL Exams shall be conducted at the end of fourth BDS

**FOURTH BDS**
**ORAL MEDICINE AND RADIOLOGY**

## A. COURSE CONTENT AND APPROACH TO THE SUBJECT:

### 1. APPROACH TO THE SUBJECT OF ORAL MEDICINE

The change in IV BDS Oral Medicine & Radiology theory syllabus shall be as following:

1. Introduction of Biomedical waste management chapter under the section of Environmental Science

These will enable students to handle the material waste with caution.

## COURSE OUTCOMES ASSESSED:

Were the students able to-Describe the disorders of Orofacial region. Diagnose the common disorders of Orofacial region by clinical examination and with the help of such investigations as may be required and medical management of oro-facial disorders with drugs and physical agents. Describe the role, use and techniques of radiographs/digital radiograph and other imaging methods in diagnosis. Take radiographs for intra-oral conditions and interpret them to arrive at radiographic diagnosis. Explain the principles of the clinical and radiographic aspects of Forensic Odontology.

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Infectious Diseases | |
| 1.1 C/F,O/M investigations, D/D & treatment - TB, syphilis, hepatitis, AIDS | Must to Know |
| 1.2 C/F,O/M investigations, D/D & treatment of actinomycosis, other STDs | Desirable to Know |
| 1.3 C/F,O/M investigations, D/D & treatment of protozoal infection | Good to Know |
| 2. Red and White Lesions of Oral Mucosa - Definitions and Burket,s classification, C/F, investigations, D/D & treatment | |
| 2.1 Leukoedema | Must to Know |
| 2.2 White Sponge Nevus | Desirable to Know |

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| 2.3 Linea Alba (White Line) | Must to Know |
| 2.4 Frictional (Traumatic) Keratosis | Must to Know |
| 2.5 Cheek Chewing | Must to Know |
| 2.6 Chemical Injuries of the Oral Mucosa | Desirable to Know |
| 2.7 Actinic Keratosis (Cheilitis) | Good to Know |
| 2.8 Smokeless Tobacco–Induced Keratosis | Must to Know |
| 2.9 Oral Hairy Leukoplakia | Desirable to Know |
| 2.10 Candidiasis | Must to Know |
| 2.11 Mucous Patches | Good to Know |
| 2.12 Leukoplakia | Must to Know |
| 2.13 Erythroplakia | Must to Know |
| 2.14 Oral lichen planus | Must to Know |
| 2.15 Lupus Erythomatosus | Good to Know |
| 3. Ulcerative, vesicular, and Bullous lesions - Definitions of all surface lesions. C/F, investigations, D/D & treatment | |
| 3.1 Primary Herpes Simplex Virus Infections | Must to Know |
| 3.2 Coxsackievirus Infections | Desirable to Know |
| 3.3 Varicella-Zoster Virus Infection | Must to Know |
| 3.4 Erythema Multiforme | Must to Know |
| 3.5 Contact Allergic Stomatitis | Must to Know |
| 3.6 Oral Ulcers Secondary to Cancer Chemotherapy | Desirable to Know |
| 3.7 Acute Necrotizing Ulcerative Gingivitis | Desirable to Know |
| 3.8 Recurrent Aphthous Stomatitis | Must to Know |
| 3.9 Behçet's Syndrome | Desirable to Know |
| 3.10 Pemphigus | Must to Know |
| 3.11 Subepithelial Bullous Dermatoses | Good to Know |
| 3.12 Histoplasmosis | Good to Know |
| 4. Oral Cancer | |
| 4.1 Epidemiology, etiology & risk factors | Must to Know |
| 4.2 Precancerous lesions & conditions | Must to Know |
| 4.3 C/F and D/D of all Head & Neck cancers | Must to Know |
| 4.4 Imaging and all treatment modalities | Must to Know |
| 4.5 Tumor biology | Desirable to Know |
| 4.6 Nutrition: risk and prophylaxis | Desirable to Know |
| 4.7 Viruses in oral cancer | Good to Know |
| 4.8 Regimens of radiotherapy and chemotherapy | Good to Know |
| 4.9 Complications of treatment and their management | Good to Know |
| 5. Diseases of Tongue: | |
| 5.1. Developmental | Must to know |
| 5.2. Inflammatory | Must to know |
| 5.3. Nutritional and Metabolic | Must to know |
| 5.4. Neoplastic | Must to know |
| 5.5. Miscellaneous | Must to know |
| 6. Salivary Gland Diseases | |
| 6.1 Anatomy & physiology, functions of saliva | Must to Know |

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| 6.2 classification of salivary gland disorders | Must to Know |
| 6.3 C/F of salivary gland disorders | Must to Know |
| 6.4 Diagnostic approaches to the patient with salivary gland disease | Must to Know |
| 6.5 Basic imaging methods | Must to Know |
| 6.6 C/F | Must to Know |
| 6.7 Investigations | Must to Know |
| 6.8 D/D | Must to Know |
| 6.9 Treatment of Specific diseases and disorders of the Salivary glands | Must to Know |
| 6.10 Xerostomia | Must to Know |
| 6.11 Salivary gland tumors | Must to Know |
| 6.12 Medicinal treatment of sialorrhoea and xerostomia | Desirable to Know |
| 6.13 Methods of saliva collection | Good to Know |
| 6.14 advanced imaging modalities like sialography | Good to Know |
| 6.15 Scintigraphy | Good to Know |
| 6.16 CT | Good to Know |
| 6.17 MRI | Good to Know |
| 7. Temporo-Mandibular Joint Disorders | |
| 7.1. Functional Anatomy | Must to know |
| 7.2. Etiology, Epidemiology & Classification | Must to know |
| 7.3. Assessment | Must to know |
| 7.4. General Clinical Characteristics | Must to know |
| 7.5. Specific Disorders and their Management | Must to know |
| 7.6. Arthritis of the Temporo-mandibular Joint | Must to know |
| 7.7. Developmental Defects & Trauma | Must to know |
| 8. Maxillary sinus disorders: | |
| 8.1. Developmental Disorders | Must to know |
| 8.2. Inflammatory Disorders | Must to know |
| 8.3. Cystic Disorders | Must to know |
| 8.4. Neoplasm | Must to know |
| 8.5. Trauma | Must to know |
| 8.6. Miscellaneous | Must to know |
| 9. Oral Manifestations of: | |
| 9.1. Metabolic Disorders | Good to know |
| 9.2. Endocrine disorders | Good to know |
| 9.3. Nutritional deficiency | Good to know |
| 10. Oro-Facial Pain: | |
| 10.1. Pain arising from diseases of oro-facial tissues | Must to know |
| 10.2. Pain arising due to CNS diseases | Must to know |
| 10.3. Referred Pain | Must to know |
| 11. Hematologic Diseases | |
| 11.1 Physiology of blood | Must to Know |
| 11.2 Clinical & lab findings | Must to Know |
| 11.3 Classification of hematologic disorders | Must to Know |

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|---|---|
| 11.4 General and oral manifestation | Must to Know |
| 11.5 Investigations & treatment of RBC & WBC disorders | Must to Know |
| 11.6 Leukemias | Must to Know |
| 11.7 General and oral manifestation of Lymphomas | Desirable to Know |
| 11.8 Multiple myeloma | Desirable to Know |
| 11.9 Different chemotherapeutic regimens for leukemia and their complications | Good to Know |
| 12. Bleeding and clotting disorders - Vessel Wall Disorders, Platelet Disorders, Coagulation Disorders | |
| 12.1 Physiology of blood coagulation | Must to Know |
| 12.2 clinical & lab findings | Must to Know |
| 12.3 classification of bleeding & clotting disorders | Must to Know |
| 12.4 Clinical Features | Must to Know |
| 12.5 Oral manifestations | Must to Know |
| 12.5 Investigations | Must to Know |
| 12.6 D/D | Must to Know |
| 12.7 Treatment | Must to Know |
| 12.8 C/F, investigations, D/D & treatment of Fibrinolytic Disorders | Desirable to Know |
| 12.9 PT, INR,dented management of patients with bleeding & clotting disorders | Good to Know |
| 13. Cervicofacial Lymphadenopathy | Must to Know |
| 14. Management of Dental Problems In Medically Compromised patients: | |
| 14.1. Physiological changes: Puberty, Pregnancy and Menopause | Desirable to know |
| 14.2. Patients suffering with Cardiac, Respiratory, Liver, Kidney, Bleeding Disorders, Hypertension, Diabetes , AIDS and Post-irradiated Patients. | Desirable to know |
| 15. Allergy: | |
| 15.1. Local allergic reactions | Must to Know |
| 15.2. Anaphylaxis | Must to Know |
| 15.3. Serum sickness | Must to Know |
| 15.3.1. Local allergic manifestations to food drugs & chemicals. | Must to Know |
| 15.3.2. Systemic allergic manifestations to food drugs & chemicals | Must to Know |
| 16. Neuromuscular Diseases | |
| 16.1 Types, causes, C/F, investigations and management of Facial palsy, Epilepsy along with recent updates | Must to Know |
| 16.2 Dental considerations in patients with epilepsy | Desirable to Know |
| 16.3 Muscular atrophy | Good to Know |
| 17. Forensic Odontology: | |
| 17.1. Medico legal aspects of Oro-facial injuries | Good to know |
| 17.2. Identification of Bite marks | Good to know |
| 17.3. Determination of Age and Sex | Good to know |

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|---|---|
| 17.4. Identification of cadavers by Dental Appliances, Restorations and Tissue remnants | Good to know |
| 17.5. Role of Dentist in Forensic Science | Good to know |
| 18. Benign Tumors of the Oral Cavity - Definition of tumor, hamartomas, choriostoma and terratoma with examples. Classification of odontogenic and non-odontogenic benign tumors, C/F, investigations, D/D & treatment | |
| 18.1 Pyogenic Granuloma | Must to Know |
| 18.2 Hemangioma and Angiomatous Syndromes | Must to Know |
| 18.3 Lymphangioma | Desirable to Know |
| 18.4 Giant Cell Granuloma (Peripheral and Central) | Must to Know |
| 18.5 Fibrous Dysplasia of Bone | Good to Know |
| 18.6 Albright's Syndrome | Good to Know |
| 19. Environmental Science including Biomedical Waste Management | |
| 19.1. Introduction | Good to Know |
| 19.2. What is Bio- Medical Waste | Good to Know |
| 19.3. Risk from Bio- Medical Waste | Good to Know |
| 19.4. Environmental Hazard | Good to Know |
| 19.5. Occupational Hazard | Good to Know |
| 19.6. Public Health Hazard | Good to Know |
| 19.7. Legal Provision | Good to Know |
| 19.8. Treatment and Disposal Methodology | Good to Know |

## 2. APPROACH TO THE SUBJECT OF DIFFERENTIAL DIAGNOSIS

| TOPIC | DISTRIBUTION |
|---|---|
| Soft tissue lesions | |
| 1.1. White lesions of oral mucosa | Must to Know |
| 1.2. Solitary oral ulcers and fissures | Must to Know |
| 1.3. Peripheral oral exophytic lesions | Good to Know |
| 1.4. Pits, fistulas and draining lesions | Good to Know |
| 1.5. Intraoral brownish, bluish or black conditions | Good to Know |
| 1.6. Solitary red lesions | Good to Know |
| 1.7. Generalized red conditions and multiple ulcerations | Good to Know |
| 1.8. Red conditions of the tongue | Good to Know |
| 1.9. Yellow conditions of the oral mucosa | Good to Know |
| Bony lesions | |
| 2.1. Radiolucencies of Jaws | |
| 2.1.1. Anatomic radiolucencies | Must to Know |
| 2.1.2. Periapical radiolucencies | Must to Know |

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|---|---|
| 2.1.3. Pericoronalradiolucencies | Must to Know |
| 2.1.4. Solitary cystlike radiolucency not necessarily containing teeth | Good to Know |
| 2.1.5. Multiple separate well defined radiolucency | Good to Know |
| 2.1.6. Generalized rarefactions of jawbones | Good to Know |
| 2.2. Mixed radiolucent-radiopaque lesions | Good to Know |
| 2.2.1. Mixed radiolucent-radiopaque lesions associated with teeth | Good to Know |
| 2.2.2. Mixed radiolucent-radiopaque lesions not necessarily containing teeth | Good to Know |
| 2.3. Radiopacities of the jawbones | Good to Know |
| 2.3.1. Anatomic radiopacities | Good to Know |
| 2.3.2. Periapical radiopacities | Good to Know |
| 2.3.3. Solitary radiopacities not necessarily containing tooth | Good to Know |
| 2.3.4. Multiple separate radiopacities | Good to Know |
| 2.3.5. Generalized radiopacities | Good to Know |

## 3. APPROACH TO THE SUBJECT OF ORAL RADIOLOGY

The change in IV BDS Oral Medicine & Radiology theory syllabus shall be as following:

1. Introduction of Radiological waste management chapter under the section of Environmental Science

These will enable students to handle the material waste with caution.

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Radiographic Techniques: | |
| 1. Extra oral radiographic examination | |
| 1.1 Different extraoral views, their indications, advantages, disadvantages, uses, principles | Must to Know |
| 1.2Technique & Evaluation of image | Desirable to Know |
| 1.3Interpretation | Good to Know |
| 1.2. Trauma Radiography | |

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|---|---|
| 1.2.1. Traumatic injuries of the teeth | Good to Know |
| 1.2.2. Traumatic injuries to facial bones | Good to Know |
| 1.2.2.1. Mandibular fractures | Good to Know |
| 1.2.2.2. Midfacial fractures including maxillary fractures | Good to Know |
| 1.2.3. Monitoring the healing of fractures | Good to Know |
| 1.3 Digital imaging | |
| 1.3.1 Principles, advantages & disadvantages over conventional radiography | Must to Know |
| 1.3.2 Digital detectors | Must to Know |
| 1.3.3 Digital image display | Must to Know |
| 1.3.4 Characteristics of digital detectors | Desirable to Know |
| 1.3.5 Characteristics of image, storage | Good to Know |
| 1.3.6 Teleradiology | Good to Know |
| 1.4 Specialized radiographic techniques | |
| 1.4.1Principles,advantages & disadvantages over conventional radiography | Must to Know |
| 1.4.2 Indications &contraindications | Must to Know |
| 1.4.3 Parts of machines | Must to Know |
| 1.4.4 Different dyes used in Specialized radiographic technique | Desirable to Know |
| 1.4.5 Radioisotopes | Good to Know |
| 1.4.6 Contrast imaging | Good to Know |
| 1.4.7 USG transducers | Good to Know |
| 2. Principles and Complications of Radiotherapy in oro-facial malignancies. | Good to Know |
| 3. Contrast Radiography & Basic Knowledge of Radio-Active Isotopes. | Good to Know |
| 4. Orofacial implants | |
| 4.1 Importance of imaging, commonly used R/GIC techniques, indications, prescribing proper radiographs. | Must to Know |
| 4.2 Preoperative planning Intra operative and post operative assessment | Desirable to Know |
| 4.3 Radiographs signs of failure of implants | Good to Know |
| 4.4 Imaging stents | Good to Know |
| 4.5 Basic knowledge about CBCT | Good to Know |
| 5. Radiography in Forensic Odontology [Based on EBES] | |
| 5.1. Radiographic Age Estimation | Good to Know |
| 5.2. Post-Mortem Radiographic Methods | Good to Know |
| 6. Guidelines for prescribing radiographs | |
| 6.1 Role in radiographs in disease detection and monitoring | Must to Know |
| 6.2 Guidelines for ordering radiographs | Must to Know |
| 6.3 Common dental radiographic examinations | Desirable to Know |
| 6.5 Special considerations | Good to Know |
| 7. Principles of radiographic interpretation | |

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| 7.1 Ideal viewing conditions | Must to Know |
| 7.2 Systematic radiographic analysis of intraoral radiographs | Must to Know |
| 7.3 Analysis of intraosseous lesion: Aunt Minnie and step-by-step method | Desirable to Know |
| 7.4 Systematic radiographic analysis of intraoral radiographs | Good to Know |
| 7.5 Lamina dura in health & disease | Good to Know |
| 8. Dental caries | |
| 8.1 Radiographic appearance of all types of caries | Must to Know |
| 8.2 Radiographic classification | Must to Know |
| 8.3 Use of bitewing radiograph | Must to Know |
| 8.4 Radiographic interpretation of caries | Must to Know |
| 8.5 Alternative diagnostic tools to detect caries | Desirable to Know |
| 8.6 Differentiation of secondary caries from caries | Good to Know |
| 9. Periodontal diseases | |
| 9.1 Indications of radiographs in periodontal diseases | Must to Know |
| 9.2 Limitations of radiographs in periodontal diseases | Must to Know |
| 9.3 General radiographic features of periodontal disease | Must to Know |
| 9.4 Radiographic classification of periodontal disease | Must to Know |
| 9.5 Dental considerations with periodontal diseases | Desirable to Know |
| 9.6 Effect of systemic diseases on periodontium | Must to Know |
| 9.7 Digital subtraction radiography | Must to Know |
| 10. Dental anomalies | |
| 10.1 Developmental abnormalities number of teeth, Size of teeth, number of teeth, Shape of teeth | Must to Know |
| 10.2 Syndromes associated with these abnormalities | Desirable to Know |
| 10.3 Genetic factors associated with these anamolies | Good to Know |
| 11. Inflammatory lesions of the jaws | |
| 11.1 Clinical and radiographic features of periapical&pericoronal infection | Must to Know |
| 11.2 D/D of different inflammatory lesions of jaw | Must to Know |
| 11.3 Clinical and radiographic features of osteomyelitis | Desirable to Know |
| 11.4 Clinical and radiographic features of osteoradionecrosis | Good to Know |
| 12. Cysts of the jaws | |
| 12.1 Definition, classification, theories of cyst enlargement | Must to Know |
| 12.2 Radiographic features of Odontogenic cyst & Non odontogenic cyst | Must to Know |
| 12.3 Syndromes associated with cysts | Desirable to Know |
| 12.4 Malignant potential of differed cysts, | Good to Know |
| 12.5 Complications of cyst | Good to Know |
| 13. Benign tumours of the jaws | |
| 13.1 Definition, classification, radiographic features of benign tumors, odontogenictumours, Non odontogenictumours | Must to Know |
| 13.2 Hyperplasias | Desirable to Know |
| 13.3 Indications of different radiographs | Good to Know |

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|---|---|
| 13.4 Malignant potential | Good to Know |
| 14. Malignant diseases of the jaws | |
| 14.1 General features and radiographic features of malignancies of jaws | Must to Know |
| 14.2 Radiographic D/D of malignancies | Desirable to Know |
| 14.3 Metastatic tumors, Malignancy of the hematopoetic system | Good to Know |
| 15. Diseases of bone manifested in the jaws | |
| 15.1 General and radiographic features of bone dysplasias | Must to Know |
| 15.2 Syndromes associate with bone dysplasias | Desirable to Know |
| 15.3 Genetic factors with bone dysplasias | Good to Know |
| 16. Systemic diseases manifested in the jaws | |
| 16.1 General features of systemic diseases, radiographic changes in jaws. | Must to Know |
| 16.2 Differentiation form other jaw lesions | Desirable to Know |
| 16.3 Pathophysiology for changes in jaws | Good to Know |
| 17. Radiographic Waste Disposal | |
| 17.1. Introduction | Good to Know |
| 17.2. What is Radiographic Waste | Good to Know |
| 17.3. Risk from Radiographic Waste | Good to Know |
| 17.4. Disposal of Lead waste | Good to Know |
| 17.5. Disposal of X-ray system cleaners | Good to Know |
| 17.6. Disposal of Processing solutions | Good to Know |
| 17.7. Disposal of Dental films | Good to Know |

## B. PRACTICAL / CLINICAL:

Under practical / clinical scheme for IV BDS, a. Discussion on Ideal and Faulty radiographs - in IV BDS first term b. Peer teaching on topics Radiation physics, biology & protection; Intraoral Radiography techniques
and Anatomical Landmarks in IOPA - in IV BDS first term c. Discussion on Scope and recent advances in Oral Medicine and Radiology - in IV BDS second term

## IV BDS First Term

1. The students, during the clinical posting, shall be given demonstration on:
   1.1. Clinical examination of Normal Structure and Pathology (Swelling, OPMDs, Oral Malignancy, Oral Ulcer etc.)
   1.2. Evidence based Literature Search for developing Search Skills
2. Each student shall be given a writing assignment during the clinical posting:
   2.1. Treatment of Oral Submucous Fibrosis
   2.2. Treatment of Oral Leukoplakia
   2.3. Treatment of Oral Lichen Planus
   2.4. Treatment of Recurrent Apthous Stomatitis
   2.5. Treatment of Oral Candidiasis
3. The students after identifying the clinical problem will formulate questions and will search the relevant databases for the evidence.
4. The Critical appraisal for different types of research papers as per the Hierarchy of Evidence will be undertaken by each student.
5. Role-modeling shall be practiced under the supervision of Department Teaching Faculty, especially during the clinical case discussions.
6. Each student shall perform clinical examination and shall take Intraoral Periapical Radiographs during the clinical postings of III and IV BDS. The record for the same shall be maintained in the record / log book.

## IV BDS Second Term

1. The students, during the clinical posting, shall be given demonstration on:
   1.1. Electric Pulp Testing
   1.2. Toluidine blue solution test for OPMD's and Oral Malignancy
   1.3. Digital OPG procedure
2. Each student shall be given a writing assignment during the clinical posting on: 2.1. Tooth vitality
   2.2. Vital staining and other Oral Cancer Screening Aids
   2.3. Indications for Intra-oral and Extra-oral Radiographs

## C. RECOMMENDED BOOKS:

| Sr. No. | Title | Author | Publisher |
|---|---|---|---|
| 1. | Burkit's Oral Medicine, Diagnosis and Treatment | Greenberg Glick | J.B. Lippincott |
| 2. | Oral Radiology | White &Pharoah | Mosby Elsevier |

| | | | |
|---|---|---|---|
| 3. | Differential Diagnosis of Oral & Maxillofacial Lesions | Norman K.Goaz Paul Wood | Mosby Elsevier |

Books for References:

I. Oral Medicine

| Sr. No. | Title | Author | Publisher |
|---|---|---|---|
| 1. | Principles of Oral Diagnosis | Coleman | Mosby Year Book |
| 2. | Oral Manifestations of Systemic Diseases | Jones | W.B. Saunders company |
| 3. | Clinical Methods | Hutchinson | --- |
| 4, | Oral Pathology | Shafers | --- |
| 5. | Tobacco related Oral Mucosal Lesions and Conditions | Fali Mehta | --- |
| 6. | Synopsis of Oral Pathology | S.N.Bhaskar | --- |
| 7. | Principles and Practice of Radiographic Interpretation | H.M.Worth | --- |
| 8. | Radiographic Interpretation for the Dentist | S.N.Bhaskar | --- |
| 9. | Park | | |
| 10. | Soben Peter | | |

II. Oral And Maxillofacial Radiology

| Sr. No. | Title | Author | Publisher |
|---|---|---|---|
| 1. | Oral Radiology | White &Goaz | Mosby year Book |
| 2. | Dental Radiology | Wuehrmann | C.V. Mosby Company |
| 3. | Oral Roentgenographic Diagnosis | Stafne | W.B.Saunders Co |
| 4. | A Guide to Dental Radiography | Rita Mason | ----- |

## D. SCHEME OF EXAMINATION:

*INTERNAL EXAMINATION SCHEME –*

i. First internal (Theory/Practical): 20 Marks
ii. Second internal (Theory/Practical): 20 Marks
iii. Third Internal(Theory/Practical): 60 Marks

## University Practical/Clinical Examination

Long Case history Chair
Side Examination
Radiology – IOPA Spotter

These will enable students to develop analytical thinking.

| S. No | Particulars | Marks |
|---|---|---|
| 1 | Long Case history | 40 |
| 2 | Chair-side Examination | 10 |
| 3 | Radiology – Intraoral Periapical Radiograph | 20 |
| | 1. Technique - Film Placement & X-ray tube head angulation (07 mks.) | |
| | 2. Processing of Film (06 mks.) | |
| | 3. Interpretation of Radiograph (07 mks.) | |
| 4 | Spotters (Five Spotters) | 20 |
| Total | | 90 |
| 5 | Viva voce | 20 |

## PROSTHODONTICS AND CROWN & BRIDGE

1. Geriatric Oral Health Related quality of life
2. Forensic Prosthodontics

The change in IV BDS Prosthodontics theory exams shall be as following:

1. To introduce – Implant Prosthodontic as treatment option

These will enable students to keep up-to-date with the current practices in prosthodontics.

The change in IV BDS Prosthodontics theory shall be as following:

1. Prosthodontic Management of TMJ disorder

These will enable students to keep up-to-date with the current practices in prosthodontics

### COURSE OUTCOMES ASSESSED:

Were the students able to: Describe prosthetic needs of patients according to the existing biomechanics of the edentulous state.Diagnose and treat patients who are partially and completely edentulous (including geriatric patients) with complete and partial dentures Perform clinical steps in treating patients with prosthetic needs and fabricate prostheses for all conventional prosthodontic modes of treatment Identify cases requiring specialist prosthodontic treatment needs and refer them for further follow upPlan and communicate treatment plans with special mention on success and failure criteria, factors and motivate patients on the significance of preventive prosthodontic care.-Motivate the patient for proper Prosthodontic treatment, maintenance of oral and prosthesis hygiene Participate in the implementation of the community outreach activities. Exhibit a high standard of professional ethics and conduct and apply these in all aspects of professional life. Participate in CDE programme to update the knowledge and professional skill including evidence based Prosthodontics from time to time.

A. COURSE CONTENT AND APPROACH TO THE SUBJECT:

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Complete Denture | |
| 1.1 Biological consideration in jaw relation & jaw movements – craniomandibular relations | |
| 1.1.1 Mandibular movements | Desirable to Know |
| 1.1.2 Concept of occlusion – Discussion in brief | Desirable to Know |
| 1.2 Relating the patient to the articulator | |
| 1.2.1 Face bow types and uses – discuss in brief | Desirable to Know |
| 1.2.2 Face bow transfer procedure - discuss in brief | Good to Know |
| 1.3 Recording the maxillo-mandibular relation | |
| 1.3.1 Vertical relation | Must to Know |
| 1.3.2 Centric relation records | Must to Know |
| 1.3.3 Eccentric relation records | Good to Know |
| 1.3.4 Lateral relation records | Good to Know |
| 1.4 Teeth selection and arrangement | |
| 1.4.1 Anterior teeth | Must to Know |
| 1.4.2 Posterior teeth | Must to Know |
| 1.4.3 Esthetic and functional harmony | Desirable to Know |
| 1.5 Relating inclination of teeth to concept of occlusion – in brief | |
| 1.5.1 Neutrocentric concept | Desirable to Know |
| 1.5.2 Balanced occlusion concept | Must to Know |
| 1.5.3 Lingualized Occlusion concept | |
| 1.6 Trial Dentures | Must to Know |
| 1.7 Laboratory procedures | |
| 1.7.1 Wax contouring | Must to Know |
| 1.7.2 Investing of dentures | Must to Know |
| 1.7.3 Preparing of mould | Must to Know |
| 1.7.4 Preparing and packing of acrylic resin | Must to Know |
| 1.7.5 Processing of dentures | Must to Know |
| 1.7.6 Recovery of dentures - Lab remount procedures | Must to Know |
| 1.7.7 Recovering the complete denture from the cast | Must to Know |
| 1.7.8 Finishing and polishing the complete denture | Must to Know |

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|---|---|
| 1.7.9 Plaster cast for clinical denture remount procedure | Desirable to Know |
| 1.8 Denture insertion | |
| 1.8.1 Insertion procedures | Must to Know |
| 1.8.2 Clinical errors | Must to Know |
| 1.8.3 Correcting occlusal disharmony | Must to Know |
| 1.8.4 Selective grinding procedures | Must to Know |
| 1.9 Problems with associated denture use – in brief | Must to Know |
| 2. Removable Partial Dentures | |
| 2.1 Examination, diagnosis & treatment planning & evaluation of diagnostic Data | Must to Know |
| 2.2 Components of RPD | |
| 2.2.1 Major connectors | Must to Know |
| 2.2.2 Minor connectors | Must to Know |
| 2.2.3 Rest and rest seats | Must to Know |
| 2.2.4 Direct retainers | Must to Know |
| 2.2.5 Indirect retainers | Must to Know |
| 2.2.6 Tooth replacement | Must to Know |
| 2.3 Principles of RPD design | Must to Know |
| 2.4 Survey and design – in brief | |
| 2.4.1 Surveyors | Must to Know |
| 2.4.2 Surveying | Must to Know |
| 2.4.3 Designing | Must to Know |
| 2.5 Mouth preparation and master cast | Must to Know |
| 2.6 Impression materials and procedures for RPD | Must to Know |
| 2.7 Preliminary jaw relation and esthetic try-in for some anterior replacement teeth | Must to Know |
| 2.8 Laboratory procedures for framework construction – In brief | Desirable to Know |
| 2.9 Fitting the framework – in brief | Desirable to Know |
| 2.10 Try-in of the RPD - in brief | Must to Know |
| 2.11 Completion of the RPD - in brief | Desirable to Know |
| 2.12 Inserting the RPD - in brief | Must to Know |
| 2.13 Post insertion observations | Desirable to Know |
| 2.14 Temporary acrylic partial dentures | Must to Know |
| 2.15 Immediate removable partial denture | Desirable to Know |
| 2.16 Removable partial dentures opposing complete denture | Desirable to Know |
| 3. Fixed Partial Denture | |
| 3.1 Fundamentals of occlusion - in brief | Must to Know |
| 3.2 Articulators - in brief | Must to Know |
| 3.3 Treatment planning for single tooth restorations | Must to Know |
| 3.4 Treatment planning for replacement of missing teeth including selection and choice of abutment teeth | Must to Know |
| 3.5 Fixed partial denture configuirations | Must to Know |

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| 3.6 Principles of tooth preparations | Must to Know |
| 3.7 Preparation for full veneer crowns - in brief | Desirable to Know |
| 3.8 Preparation for partial veneer crowns - in brief | Desirable to Know |
| 3.9 Provisional restorations | Must to Know |
| 3.10 Fluid control and soft tissue management(Gingival Retraction Procedure – FLIPPED CLASSROOM) | Must to Know |
| 3.11 Impressions | Must to Know |
| 3.12 Working casts and dies | Desirable to Know |
| 3.13 Wax patterns | Desirable to Know |
| 3.14 Pontics and edentulous ridges | Must to Know |
| 3.15 Esthetic considerations | Desirable to Know |
| 3.16 Finishing and cementation | Desirable to Know |
| 4. Topics to be covered in brief | |
| 4.1 Solder joints and other connectors | Desirable to Know |
| 4.2 All – ceramic restorations | Good to Know |
| 4.3 Metal ceramic restorations | Desirable to Know |
| 4.4 Preparations of intra-coronal restorations | Good to Know |
| 4.5 Preparations for extensively damaged teeth | Good to Know |
| 4.6 Preparations for periodontally weakened teeth | Good to Know |
| 4.7 The functionally generated path technique | Good to Know |
| 4.8 Investing and casting | Must to Know |
| 4.9 Resin – bonded FPD | Desirable to Know |
| 4.10 Occlusion in complete dentures | Must to Know |
| 4.11 Treating abused tissues | Must to Know |
| 4.12 Relining and rebasing of dentures | Must to Know |
| 4.13 Immediate complete dentures | Must to Know |
| 4.14 The single complete denture | Desirable to Know |
| 4.15 Overdentures | Must to Know |
| 4.16 Dental implants in complete denture | Must to Know |
| 4.17 Maxillofacial prosthetics | Desirable to Know |
| 4.18 Geriatric oral health related quality of life | Desirable to Know |
| 4.19 Computer aided designing and computer aided milling | Desirable to Know |
| 4.20 Forensic Prosthodontics | Desirable to Know |
| 4.21 Herbal Prosthodontics | Desirable to Know |
| 4.22 Prosthodontic Management of TMJ disorder | Desirable to Know |
| 4.23 Implant prosthodontic | Desirable to Know |

## B. SYLLABUS FOR PRACTICALS:

Quota of Work To Be Completed

| | |
|---|---|
| 4th year 1st term | • Minimum1 Complete denture.<br>• 1 Removable Partial Denture<br>• 02 FPD Tooth preparation (Metal Ceramic Maxillary)<br>• End posting assessment as a Clinical step and viva (25 marks)<br>• Generation of a PICO question, search strategy literature search and appraisal through checklists |
| 4th year 2st term | • Minimum1 Complete denture.<br>• 1 Removable Partial Denture<br>• 02 FPD Tooth preparation (Metal Ceramic Mandibular) and impression making<br>• End posting assessment as a Clinical step and viva (25 marks)<br>• 1 Seminar presentation with PICO and evidence based evaluation of articles concerned to the seminar topic |
| Total | • 04 Complete dentures<br>• 02 Removable Partial dentures<br>• 08 FPD Tooth preparations<br>• 1 Seminar presentation with PICO and evidence based evaluation of articles concerned to the seminar topic |

## C. RECOMMENDED BOOKS FOR READING:

| Sr. No | Title | Author |
|---|---|---|
| 1. | Syllabus of complete denture | CharlesM Heartwell& Arthur O Rahn |
| 2. | Prosthodontic treatment for edentulous patients | C O Boucher |
| 3. | Essentials of complete denture prosthodontics | Sheldon Winkler |
| 4. | Removable partial prosthodontics | McCracken |
| 5. | Clinical removable partial prosthodontics | Stewart Rudd Kuebker |
| 6. | Contemporary fixed prosthodontics | Rosensteil |

| | | |
|---|---|---|
| 7. | Prosthodontic Treatment for Edentulous Patients | ZarbBolender |
| 8. | Removable partial prosthodontics | Ernest L Miller & Joseph E. Grasso |
| 9. | Fundamentals of fixed prosthodontics | Herbert Shillingburg |
| 10. | Theory & practice of fixed prosthodontics | Tylman |
| 11. | Dental lab Procedures: Complete dentures, removable partial prosthodontics, Fixed Prosthodontics | Rudd and Morrow |
| 12. | Maxillofacial Prosthetics | Taylor |
| 13. | Contemporary Implant dentistry | C E Misch |

## D. EXAM SCHEME:

a. INTERNAL EXAM

- First internal (Theory/Practical): 20 Marks
- Second internal (Theory/Practical): 20 Marks
- Third Internal (Theory/Practical): 60 Marks

b. UNIVERSITY EXAM

Practical Examination will be of Total 90 marks and will consist of:

Clinical / Practical:

1. To restructure clinical prosthodontics evaluation pattern by incorporating OSCE/OSPE in place of spotters
2. Upper and lower arch complete primary impression
3. FPD tooth preparation on typhodonts

These will enable students develop analytical thinking.

| SR. NO | PARTICULARS | MARKS |
|---|---|---|
| 1 | Spotters /OSPE- 10 X 2 | 20 |
| 2 | Case History | 05 |
| 3 | Exercise No 1: Complete denture Prosthodontics:<br>Upper and lower arch complete denture Primary impression | 20+20=40 |
| 4 | Exercise No. 2: Fixed Prosthodontics<br>FPD tooth preparation on typhodont | 25 |
| | TOTAL | 90 |

## PERIODONTOLOGY

### COURSE OUTCOMES ASSESSED:

Were the students able to describe the anatomy and physiology of the periodontium and correlate it with health and diseased states. Describe the types, etiopathogenesis diagnosis and treatment plan for periodontal pathologies. Diagnose periodontal pathologies perform dental scaling, diagnostic tests of periodontal diseases; use the instruments for periodontal therapy and maintenance of the same. Impart the preventive measures namely, the prevention of periodontal diseases and prevention of the progress of the disease. Perform the treatment with full aseptic precautions. Prevent iatrogenic diseases; to conserve the tooth to the maximum possible time by maintaining periodontal health. Refer the patients who require specialist's care.

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT:

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Periodontal Pocket | |
| 1.1. Definition | Must to Know |
| 1.2. Classification | Must to Know |
| 1.3. Clinical features | Must to Know |
| 1.4. Pathogenesis | Must to Know |
| 1.5. Histopathology | Must to Know |
| 1.6. Relationship of attachment loss and bone loss to pocket depth | Must to Know |
| 1.7. Differences between suprabony and infrabony pockets | Must to Know |
| 1.8. Periodontal abscess | Must to Know |
| 1.9. Periodontal cyst | Desirable to Know |
| 2. Patterns of Bone Loss | |
| 2.1. Normal bone morphology | Must to Know |
| 2.2. Classification of bone defects | Must to Know |
| 3. Trauma From Occlusion | |
| 3.1. Definition | Must to Know |

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|---|---|
| 3.2. Classification | Must to Know |
| 3.3. Stages of tissue response | Must to Know |
| 3.4. Effect of TFO on periodontal disease progression | Must to Know |
| 3.5. Pathologic tooth migration | Must to Know |
| 4. Chronic Periodontitis | |
| 4.1. Clinical features | Must to Know |
| 4.2. Risk factors | Good to Know |
| 5. Necrotizing Ulcerative Periodontitis | |
| 5.1. Clinical features | Must to Know |
| 5.2. Etiology | Must to Know |
| 6. Aggressive Periodontitis | |
| 6.1. Definition | Must to Know |
| 6.2. Classification | Must to Know |
| 6.3. Localized aggressive periodontitis | |
| 6.3.1. Clinical characteristics | Must to Know |
| 6.3.2. Radiographic findings | Must to Know |
| 6.3.3.Prevalence and distribution by age and gender | Desirable to Know |
| 6.4. Generalized aggressive periodontitis | |
| 6.4.1. Clinical characteristics | Must to Know |
| 6.4.2. Radiographic findings | Must to Know |
| 6.4.3.Prevalence and distribution by age and gender | Desirable to Know |
| 6.5. Risk factors for aggressive periodontitis | |
| 6.5.1. Microbiologic factors | Good to Know |
| 6.5.2. Immunologic factors | Desirable to Know |
| 6.5.3. Genetic factors | Desirable to Know |
| 6.5.4. Environmental factors | Desirable to Know |
| 7. Diagnosis | |

| | |
|---|---|
| 7.1. Clinical diagnosis | Must to Know |
| 7.2. Advanced Diagnostic Techniques | Must to Know |
| 8. Radiographic Aids in Diagnosis of Periodontal Diseases | Must to Know |
| 9. Prognosis | |
| 9.1. Definition | Must to Know |
| 9.2. Types of prognosis | |
| 9.2.1. Overall versus individual prognosis | Must to Know |
| 9.3. Factors affecting prognosis | |
| 9.3.1. Overall clinical factors | Good to Know |
| 9.3.2. Systemic and environmental factors | Good to Know |
| 9.3.3. Local factors | Good to Know |
| 9.3.4. Prosthetic and restorative factors | Good to Know |
| 10. Treatment Plan | |
| 10.1. Phases of treatment plan | Must to Know |
| 11. Rationale For Periodontal Treatment | Must to Know |
| 12. Periodontal therapy in female patients | |
| 12.1. Puberty | Good to Know |
| 12.2. Menses | Good to Know |
| 12.3. Periodontal manifestations of pregnancy and its management | Must to Know |
| 12.4. Oral contraceptives | Good to Know |
| 12.5. Menopause | Good to Know |
| 13. Periodontal Treatment of Medically Compromised Patients | |
| 13.1. Cardiovascular diseases | |
| 13.1.1. Hypertension | Must to Know |
| 13.1.2. Ischemic heart diseases | Must to Know |
| 13.1.3. Congestive heart failure | Must to Know |
| 13.1.4. Cardiac pacemakers and defibrillators | Good to Know |

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|---|---|
| 13.1.5. Infective endocarditis | Good to Know |
| 13.1.6. Cerebrovascular accidents | Good to Know |
| 13.2. Endocrine disorders | |
| 13.2.1. Diabetes mellitus | Must to Know |
| 13.2.2. Thyroid and parathyroid disorders | Desirable to Know |
| 13.2.3. Adrenal insufficiency | Desirable to Know |
| 13.3. Renal diseases | Desirable to Know |
| 13.4. Liver diseases | Desirable to Know |
| 13.5. Pulmonary diseases | Desirable to Know |
| 13.6. Immunosuppression and chemotherapy | Desirable to Know |
| 13.7. Radiation therapy | Desirable to Know |
| 13.8. Hematological disorders | |
| 13.8.1. Coagulation disorders | Good to Know |
| 13.8.2. Thrombocytopenic purpuras | Good to Know |
| 13.8.3. Non-thrombocytopenic purpuras | Good to Know |
| 13.8.4. Leukemia | Good to Know |
| 13.8.5. Agranulocytosis | Desirable to Know |
| 13.9. Infectious diseases | |
| 13.9.1. Hepatitis | Good to Know |
| 13.9.2. HIV and AIDS | Good to Know |
| 13.9.3. Tuberculosis | Good to know |
| 14. Treatment of aggressive and atypical forms of periodontitis | |
| 14.1. Management of Aggressive periodontitis | Must to Know |
| 14.2. Periodontitis refractory to treatment | Good to Know |
| 14.3. Necrotizing ulcerative periodontitis | Must to Know |
| 15. Treatment of acute gingival diseases | |
| 15.1. Acute necrotizing ulcerative gingivitis | Must to Know |
| 15.2. Acute pericoronitis | Must to Know |
| 15.3. Acute herpetic gingivostomatitis | Must to Know |

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|---|---|
| 15.4. Gingival and periodontal abscess | Must to Know |
| 16. Plaque control | |
| 16.1. Mechanical plaque control | Must to Know |
| 16.2. Chemical plaque control | Must to Know |
| 17. Periodontal instruments | |
| 17.1. Classification and description | Must to Know |
| 18. General Principles of periodontal instrumentation | |
| 18.1. Accessibility | Must to Know |
| 18.2. Visibility, illumination and retraction | Must to Know |
| 18.3. Condition and sharpness of instrument | Must to Know |
| 18.4. Maintaining a clean field | Must to Know |
| 18.5. Instrument stabilization | Must to Know |
| 18.6. Instrument activation | Must to Know |
| 19. Chemotherapeutic agents | |
| 19.1. Definitions | Must to Know |
| 19.2. Systemic administration of antibiotics | Must to Know |
| 19.3. Serial and combination therapy | Must to Know |
| 19.4. Local drug delivery | Must to Know |
| 20. Host modulation therapy | |
| 20.1. Definition and rationale | Good to Know |
| 20.2. Systemically administered agents | Desirable to Know |
| 20.3. Locally administered agents | Desirable to Know |
| 20.4. Sub-antimicrobial dose doxycycline | Desirable to Know |
| 20.5. Emerging host modulation therapies | Desirable to Know |
| 21. Sonic and ultrasonic instrumentation | |
| 21.1. Mechanism of action | Must to Know |
| 21.2. Types of power instruments | Must to Know |
| 21.3. Efficacy and clinical outcomes | Must to Know |

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| 21.4. Efficiency | Must to Know |
| 21.5. Special considerations | |
| 21.5.1. Aerosol production | Must to Know |
| 21.5.2. Cardiac pacemakers | Must to Know |
| 22. Supragingival and subgingival irrigation | Good to Know |
| 23. Occlusal evaluation and therapy | Good to Know |
| 24. Perio-endodontic continuum | |
| 24.1. Pathogenesis | Good to Know |
| 24.2. Classification | Good to Know |
| 24.3. Management | Good to Know |
| 25. General principles of periodontal surgery | |
| 25.1. Surgical instruments | Good to Know |
| 25.2. Patient preparation | Good to Know |
| 25.3. Sterilization, disinfection and asepsis | Good to Know |
| 25.4. Management of emergency | Good to Know |
| 25.5. Periodontal dressings | Good to Know |
| 25.6. Management of post-operative pain and bleeding | Good to Know |
| 26. Gingival surgical techniques | |
| 26.1. Gingival curettage | Good to Know |
| 26.2. Gingivectomy | Good to Know |
| 26.3. Treatment of gingival enlargement | Good to Know |
| 27. Periodontal flaps | |
| 27.1. Definition and classification of flap | Must to Know |
| 27.2. Designs of flap | Must to Know |
| 27.3. Incisions | |
| 27.3.1. Horizontal incisions | Must to know |
| 27.3.2. Vertical incisions | Must to know |
| 27.3.3. Interdental incisions | Must to know |
| 27.4. Suturing techniques | Good to Know |

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|---|---|
| 27.5. Flap Techniques for Pocket Therapy | |
| 27.5.1. Techniques for access and pocket depth reduction/elimination | Must to know |
| 27.5.1.1. Modified Widman flap | Must to know |
| 27.5.1.2. Undisplaced Flap | Must to know |
| 27.5.1.3. Apically Displaced Flap | Must to know |
| 27.5.2. Flap For Reconstructive Surgery | |
| 27.5.2.1. Papilla Preservation Flap | Good to Know |
| 27.5.2.2. Conventional Flap | Good to Know |
| 27.5.3. Distal Molar Surgery | Desirable to Know |
| 28. Resective osseous surgery | |
| 28.1. Rationale | Good to Know |
| 28.2. Terminology | Good to Know |
| 28.3. Osseous resection technique | |
| 28.3.1. Instrumentation | Good to Know |
| 28.3.2. Vertical grooving | Good to Know |
| 28.3.3. Radicular blending | Good to Know |
| 28.3.4. Flattening interproximal bone | Good to Know |
| 28.3.5. Gradualizing marginal bone | Good to Know |
| 29. Reconstructive periodontal surgery | |
| 29.1. Non-graft associated procedures | Desirable to Know |
| 29.2. Graft materials and procedures | Good to Know |
| 29.3. Combined techniques | Desirable to Know |
| 30. Furcation involvement and its treatment | |
| 30.1. Definition | Must to know |
| 30.2. Etiologic factors | Must to know |
| 30.3. Diagnosis and Classification | Must to know |
| 30.4. Local anatomic factors | Must to know |
| 30.5. Treatment | Must to know |
| 31. Periodontal plastic and esthetic surgeries | |

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|---|---|
| 31.1. Terminologies | Good to Know |
| 31.2. Objectives | Good to Know |
| 31.2.1. Problems associated with attached gingival | Good to Know |
| 31.2.2. Problems associated with shallow vestibule | Good to Know |
| 31.2.3. Problems associated with aberrant frenum | Good to Know |
| 31.3. Etiology of marginal tissue recession | Good to Know |
| 31.4. Factors affecting surgical outcome | Desirable to Know |
| 31.5. Techniques to increase attached gingiva | Must to know |
| 31.6. Techniques to deepen vestibule | Good to Know |
| 31.7. Techniques to remove frenum | Good to Know |
| 32. Perio-restorative interrelationship | |
| 32.1. Biologic width | Good to Know |
| 33. Dental implants | |
| 33.1. Basic concepts | Good to know |
| 33.2. Periodontal perspective | Good to know |
| 34. Recent advances in surgical technology | |
| 34.1. Lasers | Good to know |
| 34.2. Microsurgery | Good to know |

## B. PRACTICAL SYLLABUS:

1. Polishing of teeth
2. Demonstration to patients about different oral hygiene aids
3. Surgical procedures- Gingivectomy, Gingivoplasty and Periodontal flap treatments.
4. Problem based learning
5. Critical Appraisal of different types of research papers as per the Hierarchy of Evidence. (Third Step of Evidence Based Decision Making).

6. Application of the Evidence in local population. (Fourth Step of Evidence Based Decision Making)

Clinical Work Quota

3. 15 cases- Diagnosis, treatment planning and discussion and total periodontal treatment Cases with supporting evidence for it (related evidences searched, appraised and discussed along with the history)
4. 25 complete cases / equivalent-Dental scaling, oral hygiene instructions – 10 cases- Cases treated with implementing principals of EBDM starting from question formation to appraisal and application of evidence for the particular patient.
5. 5 cases - Assistance in periodontal surgery.

1. Consideration of one case in II term posting for end-term after intimation to the students. Case history – 10 marks, clinical exercise – 10 marks and viva voce – 5 marks (total – 25 marks)

A work record should be maintained by all the students and should be submitted at the time of examination after due certification from the Head of Department. Students should have to complete the work prescribed by the concerned department from time to time and should submit a certified record for evaluation.

## C. RECOMMENDED BOOKS:

| TITLE | AUTHOR | PUBLISHER |
|---|---|---|
| Carranza's Clinical Periodontology | Newman | - |

## REFERENCE BOOKS:

| TITLE | AUTHOR | PUBLISHER |
|---|---|---|

| | | |
|---|---|---|
| Clinical Periodontology | Jan Lindhe | - |
| Periodontics | Eley& Manson | - |
| Periodontics | Rose &Mealey | - |
| Decision making in periodontics | Hall | - |
| Periodontal Medicine | Genco | - |
| Implant Dentistry | Misch | - |

## D. SCHEME OF EXAMINATION

INTERNAL PRACTICAL EXAMINATION SCHEME

The internal Practical examinations in the subject of Periodontology, shall be conducted as under:

i. First internal (Theory/Practical): 20 Marks
ii. Second internal (Theory/Practical): 20 Marks
iii. Third Internal (Theory/Practical): 60 Marks

UNIVERSITY EXAM:

Theory: As per the university rules

Clinical: As per the university rule. Details of marking pattern will be as below:

1. Change in marking scheme for university practical examination shall be as given below:

Total marks: 90

1. Spotters: 20 marks (10*2)
2. Case history, Diagnosis and treatment planning: 30 marks
   2.1. Case history: 15 marks
   2.2. Diagnosis : 5 marks
   2.3. Treatment planning: 10 marks
3. Segmental scaling: 30 marks
   3.1. Sterilization & Asepsis: 5
   3.2. Armamentarium: 5 marks
   3.3. Principles of Instrumentation: 10 marks
   3.4. Completeness of scaling: 10
4. Journal: 10 marks

## ORAL & MAXILLOFACIAL SURGERY

### COURSE OUTCOMES ASSESSED:

Were the students able to Apply the knowledge gained in the related medical subjects like pathology, microbiology and general medicine in the management of patients with oral surgical problem. Diagnose, manage and treat (understand the principles of treatment of) patients with oral surgical problems. Explain range of surgical treatments. Ability to decide the requirement of a patient to have oral surgical specialist opinion or treatment. Explain the principles of in-patient management. Explain the management of major oral surgical procedures and principals involved in patient management. Explain ethical issues Examine any patient with an oral surgical problem in an orderly manner. Prescribe various clinical and laboratory investigations and is capable of formulating differential diagnosis. Extract teeth under both local and general anaesthesia. Perform minor oral surgical procedures under L.A. like frenectomy, alveolar procedures & biopsy etc. Assess, prevent and manage various complications during and after surgery. Provide primary care and manage medical emergencies in the dental office. Describe management of major oral surgical problems and principals involved in in-patient management.

### A. THEORY SYLLABUS TOPICS WITH DISTRIBUTION:

| TOPIC | DISTRIBUTION |
|---|---|
| 1. Principles of Surgery and Incisions | |
| 1.1 Asepsis | Must Know |
| 1.1.1 Definition, measures to prevent infection during surgery | Must Know |
| 1.1.2 Preparation of patient | Must Know |
| 1.2 Pre anesthetic considerations, | Must Know |
| 1.3 Pre medication : Purpose & Drugs Used | Must Know |
| 1.4 Anaesthetic considerations | Must Know |
| 1.4.1 Anaesthetic Considerations - Local | Must Know |
| 1.4.2 Anaesthetic Considerations - Local with Sedation | Must Know |
| 2. Flap Designing | |
| 2.1 Triangular Flap | Desirable to Know |
| 2.2 Trapezoidal Flap | Good to Know |
| 2.3 Semilunar Flap | Good to Know |
| 3. Infection Control | |
| 3.1 Sterilization | Must Know |

| | |
|---|---|
| 3.2 Disinfection | Must Know |
| 3.3 Hospital Acquired Infection | Must Know |
| 4. Control of Haemorrhage | |
| 4.1 Aetiological Factors | Must Know |
| 4.2 Factors Affecting | Must Know |
| 4.3 Methods of Control | Must know |
| 5. Blood Transfusion | |
| 5.1 Types of Blood Group | Must Know |
| 5.2 Antigenicity | Must Know |
| 5.3 Indications of Blood Transfusion | Must know |
| 5.4 Complications of Blood Transfusion | Must Know |
| 6. Wound management and principles of suturing | |
| 6.1 Primary Healing | Must Know |
| 6.2 Secondary Healing | Must Know |
| 6.3 Types of Suture Materials | Must know |
| 6.4 Principles and Types of Suturing | Must Know |
| 6.5 Types of Wounds | Must Know |
| 7. Local anesthesia-various nerve blocks | |
| 7.1 Inferior Alveolar Nerve Block | Must Know |
| 7.2 Posterior Superior Alveolar Nerve Block | Must Know |
| 7.3 Inferior Orbital Nerve Block | Must know |
| 7.4 Mental Nerve Block | Must Know |
| 8. Laboratory investigation | |
| 8.1 Biopsy | Must know |
| 8.2 FNAC | Must know |
| 8.3 Haematological Investigations | Must know |
| 8.4 Organ Specific Investigations | Must know |
| 9. Infections of the maxillofacial region | |
| 9.1 Ludwig's Angina | Must know |
| 9.2 Osteomyelitis | Must know |
| 9.3 Space Infection | Must know |
| 9.4 Osteoradionecrosis | Must know |
| 9.5 Management with HBO | Must know |
| 9.6 Principals of Antibiotics | Must know |
| 10. Third molar and canine impaction | |
| 10.1 Diagnosis and Treatment Planning | Must know |
| 10.2 Classification | Must know |
| 10.3 Incision Designs | Must know |
| 10.4 Surgical Techniques for Removal | Must know |
| 11 Emergency drugs | |
| 11.1 Adrenaline | Must know |
| 11.2 Atropine | Must know |
| 11.3 Salbutamol | Desirable to Know |
| 11.4 Diazepam | Must know |
| 11.5 Mefentamine | Must know |

| | |
|---|---|
| 11.6 Hydrocortisone | Must know |
| 11.7 Dexona | Must know |
| 11.8 Avil | Desirable to Know |
| 12 Maxillofacial trauma | |
| 12.1 Mandibular Fracture | Must know |
| 12.2 Mid Face Fracture | Must know |
| 12.3 Condylar Fracture | Must know |
| 12.4 Zygomatic Complex Fracture | Must know |
| 12.5 Nasoethmoid Complex Fracture | Must know |
| 13 Cysts of maxillofacial region | |
| 13.1 Etiology and Classification of Cyst | Must know |
| 13.2 Enucleation | Must know |
| 13.3 Marsupialisation | Must know |
| 14 Maxillary sinus and its clinical implications | |
| 14.1 Surgical anatomy of sinus | Must know |
| 14.2 Sinusitis | Must know |
| 14.3 Caldwell luc procedure, | Must know |
| 14.4 Removal of foreign body | Must know |
| 14.5 Nasal Antrostomy | Must know |
| 14.6 Closure of OAF | Must know |
| 15 TMJ disorders | |
| 15.1 Anatomy | Must know |
| 15.2 Incision Design | Must know |
| 15.3 MPDS | Must know |
| 15.4 TMJ Ankylosis | Must know |
| 15.5 Tumors of TMJ | Must know |
| 16Salivary gland disorders | |
| 16.1 Anatomic Considerations | Must know |
| 16.2 Mucocele | Must know |
| 16.3 Ranula | Must know |
| 17 Preprosthetic surgery | |
| 17.1 Corrective Procedures | Must know |
| 17.2 Alveoloplasty | Must know |
| 17.3 Reduction of Maxillary Tuberosity, | Must know |
| 17.4 Frenectomy | Must know |
| 17.5 Removal of Tori | Must know |
| 17.6 Ridge extension procedures: indications and various surgical procedures | Must know |
| 18 Dentofacial deformities and their correction | |

| | |
|---|---|
| 18.1 classification and clinical features | Must know |
| 18.2 maxillary procedures | Good to know |
| 18.3 Mandibular procedures | Good to know |
| 19 cleft lip and palate | |
| 19.1 aetiology and classification | Must know |
| 19.2 cleft lip repair | Good to know |
| 19.3 palatoplasty | Good to know |
| 20 Neurological disorders | |
| 20.1 Trigeminal neuralgia | Must know |
| 20.2 Facial nerve paralysis | Must know |
| 20.3 Nerve injuries | Good to know |
| 21 Tumours of oral cavity | |
| 21.1 Benign odontogenic and non-odontogenic tumours | Must know |
| 21.2 Biopsy | Must know |
| 21.3 oral cancer | Must know |
| 22. Oral implantology | Must know |
| 23.Medical jurisprudence and medicolegal considerations | Good to know |

Formal and structured evidence-based education is integrated in theory which incorporates at least one or two evidences related to the lecture being taken.

B. PRACTICAL/ CLINICAL :

i. VARIOUS THEORY TOPICS WILL BE DISCUSSED

ii. CLINICALS: During the clinical postings the students are required to appear for daily discussions on various pre-decided topics for which they are asked to systematically search and find best available evidences and produce during discussions either in electronic form or print form

| | |
|---|---|
| 3rd year | Minimum of 05patients extraction under local anaesthesia |
| 4th year | Minimum of 10 patients extraction under local anaesthesia with various nerve block techniques |

| | |
|---|---|
| Total | Minimum of 15 patients extraction<br>Preclinical suturing exercise<br>Preclinical wiring exercise |

C. RECOMMENDED BOOKS:

| TITLE | AUTHOR |
|---|---|
| Impacted teeth | Alling John F |
| Principles of oral and maxillofacial surgery ; Vol.1,2 & 3 | Peterson LJ |
| Text book of oral and maxillofacial surgery | Srinivasan B. |
| Handbook of medical emergencies in the dental office | Malamed SF. |
| Killeys Fractures of the mandible | Banks P. |
| Killeys fractures of the middle 3rd of the facial skeleton | Banks P. |
| The maxillary sinus and its dental implications | McGovanda |
| Killey and kays outline of oral surgery - part -1 | Seward GR |

| | |
|---|---|
| Essentials of safe dentistry for the medically compromised patients | Mc Carthy FM |
| Oral & maxillofacial surgery, Vol 2 | Laskin DM |
| Extraction of teeth | Howe, GL |
| Minor Oral Surgery | Howe, GL |
| Contemporary oral and maxillofacial surgery | Peterson I.J. &EA |
| Oral and maxillofacial infections | Topazian RG & Goldberg MH |

## D. SCHEME OF EXAMINATION:

I. First internal (Theory/Practical)- 20 Marks
II. Second Internal (Theory/Practical) – 20 Marks
III. Third Internal (Theory/Practical) – 60 Marks

University Examination:

Theory: As per the university examination scheme

Practical & / Clinical: 90 Marks
- Extraction 35
- Local anaesthesia 15
- Chair side viva 20
- Spotters 20

## CONSERVATIVE & ENDODONTICS

1. Management anatomic complexities in Endodontics – as desirable to know

These will enable students to keep up-to-date with the current practices in endodontics.

### COURSE OUTCOMES ASSESSED:

Were the students able to: Diagnose diseases of the teeth Perform simple restorative work for decayed teeth using medium and high speed hand pieces to carry out restorative work. Describe aesthetic restorative material and to translate the same to patients needs. Explain endodontic treatment on the basis of scientific foundation. Identify endodontic instruments and materials needed for carrying out simple endodontic treatment. Perform simple endodontic treatment and emergency endodontic treatment. Explain treatment of luxated teeth Exhibit a high standard of professional ethics and conduct and apply these in all aspects of professional life. Participate in CDE programme to update the knowledge and professional skill from time to time. Participate in the implementation of the national oral health policy. Motivate the patient for proper dental treatment, maintenance of oral hygiene and maintenance of the restorative work to prevent future damage.

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| S.no. | Topics | Sub-topics | Distribution |
|---|---|---|---|
| | | Operative | |
| 1 | Adhesion | Need for bonding, | Must know |
| | | types of bonding, | Must know |
| | | clinical factors affecting bonding | Must know |
| | | advantage & disadvantages of bonding | Must know |
| | | acid etch techniques | Must know |
| | | Enamel bonding &dentin bonding agents. | Must know |
| | | | |
| | | Formation and thickness of smear layer | Good to know |

| | | | |
|---|---|---|---|
| 2 | Smear layer | removal of smear layer | Good to know |
| | | acid etching, | Good to know |
| | | conditioning, | Good to know |
| | | bonding, | Good to know |
| | | primers, | Good to know |
| | | Smear plugs and smear units. | Good to know |
| | | | |
| 3 | Cavity preparation for composite | Difference between tooth preparation for amalgam and composites | Must know |
| | | types of composite restoration, | Must know |
| | | conventional, beveled conventional, modified, facial/ lingual slot, | Must know |
| | | Pulp protection. | Must know |
| | | | Must know |
| 4 | Anterior Restorations | Resin composites | Must know |
| | | GIC | Must know |
| | | maintenance of contacts, | Must know |
| | | Finishing | Must know |
| | | gingival health. | Must know |
| | | | |
| 5 | Dental ceramics | Definition, classifications, composition and properties, condensation types | Must know |
| | | Cavity preparation, castable glass ceramics | Good to know |
| | | Porcelain laminates and veneers | Good to know |
| 6 | Smile design | Artistic elements | Good to know |
| | | Alteration of embrasures | Good to know |
| | | Correction of diastema | Good to know |
| | | Treatment of discolored tooth | Good to know |
| | | Pontics | Good to know |
| | | | |
| 7 | Cast restorations | Material qualities | Must know |
| | | Indications and contraindications | Must know |
| | | Advantages and disadvantages | Must know |
| | | Initial procedures | Must know |
| | | Tooth preparation for inlays and onlays | Must know |
| | | Restorative technique | Must know |

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| | | | |
| 8 | Difference between amalgam and inlay preparation | Principles of cavity preparation | Must know |
| | | Basic concepts of cavity design | Must know |
| | | Path of insertion, taper, bevels, flares | Must know |
| | | Secondary retention features | Must know |
| | | Indications and contraindications | Must know |
| | | Advantages and disadvantages | Must know |
| | | Factors affecting retention of cast restoration | Must know |
| | | | |
| 9 | Temporization or inter restoration | Rationale, requisites | Must know |
| | | Various interim restorative materials | Must know |
| | | Indirect acrylic resin | Must know |
| | | | |
| 10 | Direct filling gold | Classification | Must know |
| | | Properties, principles of manipulation | Must know |
| | | Types, annealing, degassing | Must know |
| | | Condensation and compaction | Must know |
| | | Biological properties | Must know |
| | | Indication and contraindication | Must know |
| | | Cavity preparation | Must know |
| | | | |
| 11 | Pin amalgam restorations | Rationale for uses of pins | Must know |
| | | Indications, advantages, disadvantages | Must know |
| | | Classification, principles of pin placement | Must know |
| | | Pin hole preparation, pin binding | Must know |
| | | Trimming and removal, pin amalgam foundation | Must know |
| | | Pin restoration in various cavities | Must know |
| | | Pin supported tooth restorations | Must know |
| | | Failures | Must know |
| | | | |
| 12 | Non carious lesions | Attrition, abrasion, erosion, fractures | Must know |
| | | Discoloration, enamel/dentin Hypoplasia | Must know |
| | | Hypo calcification and fluorosis | Must know |
| | | Causes, clinical features, differential diagnosis, treatment | Must know |
| | | | |
| | | Endodontics | |
| | | | |
| | | Theory of focal infection | Must know |
| | | Organism responsible for in pulpal and | Must know |

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|---|---|---|---|
| 13 | Microbiology | periapical infection, | |
| | | Methods to identify oral micro flora, histopathology | Must know |
| | | Bio film. | Good to know |
| | | | |
| 14 | Endodontic instruments | Classification-hand instruments,rotary instruments | Must know |
| | | Instruments for pulp space preparation, obturation | Must know |
| | | Instrument design | Must know |
| | | Sonic and ultrasonic instruments | Must know |
| | | Effectiveness and wear of instruments | Must know |
| | | | |
| 15 | Access preparation | Principles, instruments used, laws | Must know |
| | | Canal orifice identification | Must know |
| | | Access opening of individual tooth | Must know |
| | | Challenges faced | Must know |
| | | | |
| 16 | Biomechanical preparations | Definitions, needs | Must know |
| | | Objectives | Must know |
| | | Anatomy of root apex | Must know |
| | | Determination of working length | Must know |
| | | Methods of determination of working length | Must know |
| | | Apex locators | Must know |
| | | Hand and engine driven instruments | Must know |
| | | Irrigants and irrigation techniques | Must know |
| | | Disinfectants | Must know |
| | | Dentin surface modifiers | Must know |
| | | Lubricants | Must know |
| | | Concepts and strategies, techniques for canal preparation & cleaning instrument in size sequence, adequate enlargement of root canals mishaps & its management. | Must know |
| | | | |
| 17 | Irrigation solution in endodontics | Activity of irrigants, ideal properties | Must know |
| | | Passive dentistry | Must know |
| | | Smear layer interference technique | Must know |
| | | Irrigation and disinfection materials and their actions | Must know |
| | | | |
| | | Endodontic sealers | Must know |
| | | Zinc oxide eugenol cements | Must know |
| | | Chloropercha | Must know |
| | | Polymers | Must know |

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|---|---|---|---|
| 18 | Root canal sealers | Calcium hydroxide | Must know |
| | | GIC | Must know |
| | | Silicon based sealer | Must know |
| | | Sealer with formaldehyde | Must know |
| | | Properties | Must know |
| | | Recent advances | Must know |
| | | | |
| 19 | Intracanal medicaments. | various intracanal medicaments used in root canal treatment | Must know |
| | | mechanism of action | Must know |
| | | duration of application | Must know |
| | | complications and its management | Must know |
| | | Precautions | Must know |
| | | | |
| 20 | Obturation of root canal system | Requirement of an ideal root canal filling material | Must know |
| | | When to obdurate | Must know |
| | | Composition of gutta-percha | Must know |
| | | Classification of G P cones | Must know |
| | | Obturation methods using guttapercha( Thermoplasticized G P,Thermofill,MCspaden) | Must know |
| | | Recent advances in obturating methods | Good to know |
| | | Obturating methods for open apex(Reverse cone,rollcone,Apexification,revascularization ,Apical Plug etc) | Must know |
| | | | |
| 21 | Endo perio relation | Intercommunication between pulpal and periodontal tissues | Must know |
| | | Influence of pulpal pathology and vice versa | Must know |
| | | Theoretic pathways of osseous lesion formation | Must know |
| | | Differential diagnosis | Must know |
| | | Radiology alternatives | Must know |
| | | | |
| | | Causes of discoloration | Must know |
| | | Indication | Must know |
| | | Case selection | Must know |
| | | Vital and non vital bleaching methods | Must know |
| | | Bleaching agents | Must know |

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| 22 | Management of discolored tooth | Microbrasion | Must know |
| | | Recent advances | Good to know |
| | | Oral prophylaxis | Must know |
| | | Oral hygiene instructions | Must know |
| | | Complications | Must know |
| | | | |
| 23 | Traumatic injuries | Classification of fractured teeth | Must know |
| | | Causes of injury | Must know |
| | | Symptoms, diagnosis | Must know |
| | | Sequelae of each type of fracture | Must know |
| | | Avulsion | Must know |
| | | Role of storage media | Must know |
| | | Types of storage media | Must know |
| | | Splinting, instructions | Must know |
| | | Endodontic emergency | Must know |
| | | Management of soft tissue | Must know |
| | | Adjunctive therapy | Must know |
| | | Endodontic therapy | Must know |
| | | | |
| 24 | Endodontic mishaps | Ledges | Must know |
| | | Perforation | Must know |
| | | Instrument aspiration, | Must know |
| | | Breakage of instruments | Must know |
| | | Missed canals | Must know |
| | | Over extended filling | Must know |
| | | Vertical root fracture | Must know |
| | | Crown fracture management | Must know |
| | | Tissue emphysema | Must know |
| | | Masserians kit | Good to know |
| | | | |
| 25 | Root resorption | Definition | Must know |
| | | Types (internal resorption and external resorption, intrusion, subluxation, concussion) | Must know |
| | | Theories | Must know |
| | | Physiologic and pathologic resorption | Must know |
| | | Causes and clinical features | Must know |
| | | Radiological features, histological features | Must know |
| | | Management | Must know |
| | | | |
| | | Objectives | Must know |
| | | Indications | Must know |
| | | Contraindications | Must know |
| | | Local and general considerations | Must know |
| | | Preoperative consultation | Must know |

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|---|---|---|---|
| 26 | Endodontic surgeries | Premedication | Must know |
| | | Surgical instruments | Must know |
| | | Sterilization | Must know |
| | | Consent | Must know |
| | | Technique | Must know |
| | | LA | Must know |
| | | Post operative care | Must know |
| | | Flap design and preparation | Must know |
| | | Heamostasis procedure | Must know |
| | | Asepsis | Must know |
| | | GTR | Good to know |
| | | Repair | Must know |
| | | Techniques of apicectomy | Must know |
| | | Retrograde filling | Must know |
| | | Hemisection | Must know |
| | | Radisection | Must know |
| | | Techniques for root implantations | Good to know |
| | | Complication | Must know |
| | | | |
| 27 | Newer advances | Microscope and endodontic laser | Good to know |
| | | Laser Doppler flowmetry. | Good to know |
| | | | Must know |
| 28 | Lasers in conservative and endodontics | Introduction only | Must know |
| | | Types – PAP etc | Must know |
| | | Uses | Must know |
| | | | |
| 29 | Magnification | Physics of magnification | Desirable to know |
| | | Dental loops | Must know |
| | | Microscopes(introduction only) | Good to know |
| | | | |
| 30 | Professional association dentist act 1948 And its amendment 1993 | | Desirable to know |
| | | | |
| 31 | Duties towards government like payments of professional tax, income tax | | Desirable to know |
| | | | |
| 32 | Ethics | | Must know |
| 33 | Biomedical waste management | | Desirable to know |

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|---|---|---|---|
| | including radiographic waste management | | |
| 34 | Forensic odontology in relation to conservative dentistry &endodontics | | Desirable to know |
| 35 | Regenrative Endodontics | | Desirable to know |
| 36 | Management of anatomical varioations/complexities of root canal | | Desirable to know |

A. Clinical exercises to be completed in final B.D.S course

| Term | Exercise break up | Work quota |
|---|---|---|
| First term/ posting | Works on extracted teeth<br>1. Class II Mo/Do amalgam<br>2. Root canal treatment on anterior/ single rooted teeth (viva compulsory)<br>Works on patients<br>1. Class II amalgam<br>2. Class I amalgam/class I compound<br>3. Class V GIC<br>4. Case history<br>5. Vital pulp therapy in any 1 of the above restorations | <br>10<br><br>1 (anterior)<br><br>06<br>05<br>03<br>05<br>05 |
| Second term/posting | Work on extracted teeth<br>1. Class IComposite/GICRestorations<br>2. Class V composite restorations<br>3. Root canal treatment | <br>02<br><br>02<br>01 |
| | Work on patients<br>1. Class II amalgam<br>2. Class I GIC/composite<br>3. Root canal treatment on anteriors/single rooted teeth | <br>06+any quota reamaining in first term<br>03*<br><br>05 |
| | Peer to peer teaching and small group discussion | 1 each |

*Composite restorations will be allocated only if student has finished with silver amalgam quota

P.S:
1. All students are required to complete the said quota of clinical/preclinical work
2. All students will have to compulsorily appear for a viva before taking any new case/ exercise taught during the posting on a patient
3. All students are also expected to complete the said model work with respect to new exercises introduced in each term
4. Demonstrations will be given on the exercises that are new to the mentioned term and year
5. For getting demonstration for root canal treatment all other exercises must be complete
6. Composite patients will only be allotted if amalgam exercises are complete.
7. Students have to necessarily learn to evaluate the veracity based on critical appraisal checklist categorized according to the best available level of evidence.

## B. Recommended Books

| Sr. no. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Arts and Science of Operative Dentistry | Sturdevant's | Mosby |
| 2 | Textbook of Operative Dentistry | Marzouk | IshiyakuEuroAmerica, Inc Publishers |
| 3 | Fundamentals of operative dentistry | James summit | Quintessence |
| 4 | Endodontic Practice | Grossman | Wolter Kluwer |
| 5 | Pathway of Pulp | Cohen Stephen | Elsevier Mosby |
| 6 | Endodontic Therapy | FranklinWeine | Quintessence |

Reference books

| Sr. no. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Textbook of Dental Material Science | Phillip | Elsevier |
| 2 | Textbook of Operative Dentistry | Vimal Sikri | Cbs |
| 3 | Clinical Operative Dentistry Principles & practice | Ramya Raghu | Emmess |
| 4 | Textbook of Endodontics | Vimal Sikri | Elsevier |
| 5 | Textbook of Endodontics | Nisha Garg | Elsevier |

## C. SCHEME OF EXAMINATION

INTERNAL EXAMINATION SCHEME

I. First internal (Theory/Practical)- 20 Marks
II. Second Internal (Theory/Practical)– 20 Marks
III. Third Internal (Theory/Practical)– 60 Marks

UNIVERSITY EXAMINATION SCHEME:

Theory As per the university rules

Practical Examination pattern

Management of any patient attending the department with carious vital posterior or anterior
tooth for any of the following procedures:
Operative procedure,

1) Class I Compound (Buccal or palatal extension in molar teeth)
2) Class II

Marks distribution

| | |
|---|---|
| Cavity Preparation | 40 |
| Base,matrix band & Retainer application | 30 |
| Restoration | 30 |
| Total | 90 |

Endodontic procedure,

3) Non-vital anterior tooth; Root Canal Treatment

| | |
|---|---|
| Case history | 10 |
| Access cavity Preparation | 40 |
| Rubber dam application | 15 |
| Working length determination | 25 |
| Total | 90 |

## ORTHODONTICS & DENTOFACIAL ORTHOPAEDICS

1. Forensic Orthodontics– as desirable to know

These will enable students to keep up-to-date with the current practices in Orthodontics.

### COURSE OUTCOMES ASSESSED:

Were the students able to: Diagnose, analyse and treat common orthodontic problems by preventive, interceptive and corrective orthodontic procedures. Analyse and Interpret Radiographs for orthodontic diagnosis. Explain principles and fabrication of intra-oral and extra-oral appliances. Fabricate and deliver simple orthodontic appliances

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT

| S.no. | Topics | Subtopics | Distribution |
|---|---|---|---|
| 1 | Functional development stomatognathic system | Definition<br>Muscle of mastication<br>Trajectorial theory of bone formation<br>Swallowing pattern | Must Know |
| | | Buccinators mechanism<br>Various movements and positions of mandible | Desirable to Know |
| | | Speech and malocclusion clinical implications | Good to Know |
| 2 | Malocclusion | Definition<br>Classification<br>Description of dental, skeletal and functional<br>Angle's<br>Simon's<br>Lischer's<br>Deway's<br>Ackerman proffit | Must Know |
| | | WHO classification | Desirable to Know |

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|---|---|---|---|
| | | British standard classification<br>Ballaard's classification | |
| | | Orthodontic indices | Good to Know |
| 3 | Stomatognathic system | Normal functions<br>Abnormal functions<br>Clinical application | Must Know |
| 4 | Etiology of malocclusion | Classification<br>Factors – local and general<br>Graber's<br>Proffit's<br>Moyer's<br>Etiology of diaatema, crowding, spacing, open and deep bite, class II and III malocclusion and anterior/posterior cross-bite. | Must Know |
| | | Role of genetics in malocclusion | Desirable to Know |
| | | Butler's field theory<br>Equilibrium theory | Good to Know |
| 5 | Child psychology | Definition<br>Theories<br>Erickson's theory<br>Sigmondfrued's<br>Pavlov's theory<br>Behavorial management | Must Know |
| | | Frankel's rating types of conditioning | Desirable to Know |
| | | Motivation of child | Good to Know |
| 6 | Orthodontic diagnosis | Diagnostic aids<br>Classification<br>Clinical examination of the patient<br>Role of intraoral radiographs<br>Hand wrist radiographs<br>Facial photographs | Must Know |
| | | Importance of case history<br>Smile analysis<br>Diagnosis and treatment planning of patients | Desirable to Know |
| | | Panaromic radiographs<br>Occlusograms<br>EMG<br>C.T. scan<br>Photocephalograms | Good to Know |
| 7 | Anchorage | Definition<br>Classification | Must Know |

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| | | Types of anchorage | |
| | | TAD'S | Good to Know |
| 8 | Orthodontic appliances | Classification of removable and functional appliances<br>Methods of space application<br>Orthodontic materials<br>Principles of soldering and welding | Must Know |
| 9 | Preventive Orthodontics | Definition<br>Procedures undertaken<br>Advantages and disadvantages | Must Know |
| 10 | Interceptive Orthodontics | Definition<br>Various procedure<br>Serial extractions<br>Role of muscle | Must Know |
| 11 | Methods of space gaining | The various methods of gaining space<br>Indications of ectraction of various teethExtractions | Must Know |
| 12 | Model analysis | Classification<br>Bolton's ratio<br>Ashlweyhowe's index<br>Linder harth's index<br>Carey's index | Must Know |
| | | Korkhous analysis<br>Mixed dentition analysis | Desirable to Know |
| | | Occlusograms<br>Peck and peck index<br>Kesling set up | Good to Know |
| 13 | Cephalometrics | Definition<br>Development of cephalograms<br>Landmark plane identification<br>Cephalometric tracing<br>Down's analysis<br>Steiner's analysis<br>Tweed's analysis<br>Role of cephalogram in diagnosis and treatment plan | Must Know |
| | | Technique of taking cephalograms<br>Rickett's analysis<br>Mcnamara's analysis<br>Witt's analysis<br>VTO | Desirable to Know |
| | | Holdaway's soft tissue analysis<br>Computerised cephalometric system | Good to Know |
| 14 | Biology of tooth movement | Theories of tooth movement<br>Stages of tooth movement | Must Know |

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| | | Biological reaction to mild force<br>Biological reaction to heavy force<br>Deleterious effects of heavy orthodontic force<br>Types of orthodontic forces | |
| | | Biochemical chain of reactions after application of orthodontic forces | Desirable to Know |
| | | Clinical implications<br>Root resorption<br>Orthopedic forces | Good to Know |
| 15 | Removable orthodontic appliances | Components<br>Types of clasps and use<br>Types of bows and use<br>Types of springs and use | Must Know |
| | | Expansion appliances<br>Principles<br>Indications of arch expansion<br>Types of devices<br>RME and SME | Good to Know |
| 16 | Fixes orthodontic appliances | Definition<br>Indications and contraindications<br>Components of fixed orthodontic appliances<br>Edgewise, begg's and straight wire appliance | Must Know |
| 17 | Extraoral orthopedic applinaces | Headgear<br>Facemask<br>Chin cup | Must Know |
| 18 | Myofunctional appliances | Definition and principles<br>Muscle exercices<br>Activator<br>Bionator<br>Frankel appliance<br>Twin block<br>Fixed functional appliances | Must Know |
| 19 | Management of cleft lip and palate | Embryology<br>Classification<br>Role of orthodontist | Good to Know |
| 20 | Surgical orthodontics | Classification<br>Correction of –<br>Mandibular prognathism and | Must Know |

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|---|---|---|---|
| | | retrognathism<br>Maxillary prognathism amd retrognathism<br>Anterior open bite and deep bite<br>Cross bite | |
| 21 | Treatment planning | Deep bite<br>Open bite<br>Cross bite<br>Class II malocclusion<br>Class III malocclusion | Must Know |
| 22 | Retention and relapse | Need for retention<br>Causes for relapse<br>Types of retention devices<br>Theories of retention | Must Know |
| 23 | Forensic orthodontics | Use of orthodontic records for human identification, Identifying individuals by rugae area, intercanine width, and lower canines as aid in the identification process | Good to Know |

B.

## I. CLINICAL SYLLABUS

- **Case History taking**
- **Case discussion**
- **Discussion on the given topic**
- **Cephalometric tracings**
  - **Down's Analysis**
  - **Steiner's Analysis**
  - **Tweed's Analysis**

**II. PRACTICAL SYLLABUS**

- **Adam's clasp an anterior teeth – Gauge 0.7mm**
- **Modified Adams clasp on upper arch – Gauge 0.7mm**
- **High labial bow with Apron Spring on upper arch**
  - **(Gauge of labial bow – 0.9mm, Apron spring – 0.3mm)**
- **Coffin spring on upper arch Gauge 1mm**
- **Appliance construction –**
  - **Upper and lower Hawley's appliance**
  - **Anterior bite plane**
  - **Habit breaking appliance**

- **Posterior bite plane with Z-spring**
- **Activator**
  - **Catlans appliance**
  - **Upper expansion plate**

C. RECOMMENDED BOOKS:

| TITLE | AUTHOR |
|---|---|
| William R. Profit – Contemporary | Orthodontics |
| Orthodontics For Dental Students | White And Gardiner |
| Handbook Of Orthodontics | Moyers R.E |
| Orthodontics - Principles And Practice | Graber T.M. |
| Design, Construction And Use Of Removable Appliances | Adams C.P |
| Clinical Orthodontics: Vol 1 & 2 | Salzmann |

Reference Books

| TITLE | AUTHOR |
|---|---|
| Introduction to Orthodontic | Laura Mitchell |
| Rakosi Orthodontic Diagnostic Atlas | Rakosi |
| Removable Orthodontic Appliances | Issacson |

## D. SCHEME OF EXAMINATION

INTERNAL EXAMINATION SCHEME

I. First internal (Theory/Practical)- 20 Marks
II. Second Internal (Theory/Practical)– 20 Marks
III. Third Internal(Theory/Practical) – 60 Marks

Theory As per the university rules

Practical's / Clinical: (distribution of marks)

Total Marks: 90 Marks

Subdivision:

| | | |
|---|---|---|
| i. | Spotters | 10 x 2 marks = 20 marks |
| ii. | Wire bending | 45 marks |
| iii. | Model Analysis | 25 marks |

## PEDODONTICS & PREVENTIVE DENTISTRY

### COURSE OUTCOMES ASSESSED:

Were the students able to Perform a proper clinical history, methodologically examine the child patient, and perform essential diagnostic procedures, interpret them, and arrive at a reasonable diagnosis to treat appropriately. Treat dental diseases which occurring child patient. Repair and restore the lost / tooth structure to maintain harmony between both hard and soft tissues of the oral cavity. Manage the disabled children effectively and efficiently, tailored to the needs of individual requirement and conditions. Manage efficiently life-threatening conditions with emphasis on basic life support measure.

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT

1. Forensic Paediatric Dentistry – as desirable to know

These will enable students to stay up-to-date with advances in paediatric practice.

| Topics | Distribution |
|---|---|
| 1. Child Abuse & Neglect | Must know |
| 1.1. Classification, Etiology, Identification, Management. | Must know |
| 1.2. Learn about the different types of child abuse & its implications in pediatric dentistry. | Good to know |
| 2. Child psychology | Good to know |
| 2.1.1. Definition | Good to know |

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|---|---|
| 2.1.2. Theories of child psychology. | Good to know |
| 2.1.3. Psychological development of children with age. | Good to know |
| 2.1.4. Principles of psychological growth & development while managing child patient. | Good to know |
| 3. Dental fear and its management. | Must know |
| 3.1. Factors affecting child's reaction to dental treatment. | Must know |
| 3.2. Know different theories of child psychology | Good to know |
| 4. Behaviour management | Must know |
| 4.1. Definitions. | Must know |
| 4.2. Types of behaviour encountered in the dental clinic. | Good to know |
| 4.3. Non-Pharmacological & pharmacological methods of Behaviour Management. | Good to know |
| 4.4. Able to classify the children based on their behavioural patterns. | Good to know |
| 5. Restorative dentistry | Must know |
| 5.1. Principles of Pediatric Operative Dentistry. | Must know |
| 5.2. Modifications required for cavity preparation in primary and young permanent teeth. – Flipped classroom | Good to know |
| 5.3. Various Isolation techniques. | Must know |
| 5.4. Restorations of decayed primary, young permanent and permanent teeth in children using various restorative materials like Glass Ionomer, Composites & Silver Amalgam. Stainless steel, Polycarbonate & Resin Crowns. | Good to know |
| 6. Classification, modification & types of cavity preparation in children. | Must know |
| 7. Pediatric Endodontics | Good to know |
| 7.1. Principles & Diagnosis. | Good to know |
| 7.2. Classification of Pulpal Pathology in primary, young permanent & permanent teeth. | Good to know |
| 7.3. Management of Pulpally involved primary, young permanent & permanent teeth. | Good to know |
| 7.4. Pulp capping-direct & indirect. | Good to know |

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| 7.5. Pulpotomy | Good to know |
| 7.6. Pulpectomy – Flipped Classroom | Good to know |
| 7.7. Apexogenesis | Good to know |
| 7.8. Apexification | Good to know |
| | |
| 7.9. Obturation techniques and material used for primary, young permanent and Permanent teeth in children. | Good to know |
| 7.10. Knowledge about different procedures & Materials used in Pediatric Endodontics | Good to know |
| 8. Space Maintainers | Must know |
| 8.1. Definitions. | Must know |
| 8.2. Problems encountered during primary and mixed dentition phases and their Management. | Must know |
| 9. Serial extractions | Must know |
| 9.1. Decision making & Indications of various space maintainers / Regainers. | Must know |
| 10. Traumatic Injuries to the teeth & Supporting structures & their management | Good to know |
| 10.1. Classifications & Importance Squelae& reaction teeth to trauma. | Good to know |
| 10.2. Management of Traumatized teeth. | Good to know |
| 10.3. Classification & Management of different Traumatic Injuries in children. | Good to know |
| 11. Interceptive Orthodontics | Must know |
| 11.1. Identify the cause & Formulate the respective Treatment plan for various Dental malocclusions. | Must know |
| 12. Handicapped children & their management | Good to know |
| 12.1. Definition, | Good to know |
| 12.2. Etiology, Classification, Behavioural and Clinical features | Good to know |
| 12.3. Physically handicapping conditions. | Good to know |
| 12.4. Mentally compromising conditions. | Good to know |
| 12.5. Medically compromising conditions. | Good to know |
| 12.6. Genetic disorders | Desirable to know |
| 12.7. Know in brief about different handicapping conditions &their dental implications. | Desirable to know |
| 13. Oral habits & their management | Must know |
| 13.1. Definition, Etiology & Classification. | Must know |
| 13.2. Clinical features of digit sucking, tongue thrusting, mouth breathing and various other secondary habits. | Must know |
| 13.3. Management of oral habits in children. | Good to know |
| 13.4. Learn the different oral Habits & their effects on Oro- | Good to know |

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|---|---|
| facial structures. | |
| 14. Gingival & periodontal diseases in children | Must know |
| 14.1. Normal gingival &periodontium in children. | Must know |
| 14.2. Definition, etiology & Pathogenesis. | Must know |
| 14.3. Prevention & Management of gingival & Periodontal diseases. | Good to know |
| 14.4. Knowledge about normal gingival & periodontal Structures & their pathologic conditions | Good to know |
| 15. Pediatric Dental Radiology | Must know |
| 15.1. Different types of films & Projections. | Must know |
| 15.2. Modification for pediatric patients & Handicapped children. | Good to know |
| 15.3. Knowledgeaboutdifferentx-rayprojections, Modifications & Advances in Radiology, in accordance with pediatric dentistry. | Good to know |
| 16. Congenital abnormalities in children | Good to know |
| 16.1. Definition, classification, clinicalfeaturesand management. | Good to know |
| 16.2. To know about the common congenital abnormalities found in children that affect Orofacial Structures. | Good to know |
| 17. Dental emergencies in children and management. | Must know |
| 17.1. Special consideration in Aspirated &Ingested Dental materials & instrument | Good to know |
| 17.2. Know about the different emergencies that can arise in a dental situation. | Good to know |
| 18. Dental materials used in pediatric dentistry | Must know |
| 18.1. Tooth colored Filling materials. | Must know |
| 18.2. Amalgam | Must know |
| 18.3. Recent advances | |
| 18.4. Overall knowledge of composition, manipulation, | Must know |
| 18.5. Applicability of various materials used in pediatric Dentistry. | Must know |
| 19. Dental Health education and school dental health programs. | Good to know |
| 19.1. Outline of school dental health program. | Good to know |
| 19.2. Different school dental health programs. | Good to know |
| 19.3. Different school dental Health programs & planning for a school dental health program. | Good to know |
| 20. Fluorides | Must know |
| 20.1. Historical Background. | Must know |
| 20.2. Systemic and Topical fluorides. | Must know |
| 20.3. Mechanism of Action. | Must know |
| 20.4. Toxicity and Management. | Must know |
| 20.5. Knowledge about systemic & topical fluorides. | Must know |
| ***21.*** Forensic Pediatric Dentistry | Good to know |

21.1. Introduction
21.2. Importance of Primary teeth in forensic dentistry

## b) CLINICAL WORK:

1. Diagrams –
   1.1. Habit breaking appliance
   1.2. Fixed space maintainer
   1.3. Myofunctional appliances
   1.4. Orthopaedic appliances
   1.5. Interceptive orthodontics
2. Discussion of clinical topics
3. Case history records and chair side discussion
4. Cases
5. Seminar

Quota for Final year

1. Class1 and Class 2 restoration 35
2. Oral Prophylaxis 05
3. Fluoride application 02
4. Pit & Fissure Sealant application 05
5. Extractions 15
6. Clinical History taking 07
7. Education and Motivation

## c) RECOMMENDED BOOKS:

| Sr. No. | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1. | Dentistry for the child and adolescent | Mc Donald | Mosby | 10th | 2015 |
| 2. | Clinical Paedodontics | Finn | W B Saunders Company | 4th | 2001 |
| 3. | Text book of Paedodontics | SobhaTandon | Jaypee | 3rd | 2018 |

| | | | | | |
|---|---|---|---|---|---|
| 4. | Text book of Paediatric Dentistry | Nikhil Marwah | Jaypee | 4th | 2018 |
| 5. | Paediatric Dentistry – Principles and Practice | Muthu S | Elsevier | 2nd | 2011 |
| 6. | Text book of Paediatric dentistry | Damle S G | Arya | 5th | 2017 |

RECOMMENDED BOOKS FOR REFERENCE

| Sr. No. | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1. | Paediatric Dentistry (Infancy through adolescences) | Paul Casamassimo, Henry Fields ,DennisMcTigue, Arthur Nowak | Elsevier | 5th | 2016 |
| 2. | Kennedy's Paediatric operative dentistry | Kennedy & Curzon | Wright | 4th | 2002 |
| 3. | Primary Preventive Dentistry | Norman O. Harris | Pearson Prentice Hall | 6th | 2004 |
| 4. | Behaviour Management | Wright | Mosby | 1st | 1983 |
| 5. | Paediatric Dentistry | Mathewson | Quintenence book | 3rd | 1995 |
| 6. | Endodontics | Ingle | B.C Decker Inc. | 6th | 2002 |
| 7. | Pathways of Pulp | Cohen | Elsevier | 9th | 2007 |

| | | | | | |
|---|---|---|---|---|---|
| 8. | Principle and practice of Paedodontics | Arathi Rao | Jaypee | 3rd | 2012 |

## d) SCHEME OF EXAMINATION:

INTERNAL EXAMINATION SCHEME

I. First internal (Theory/Practical)- 20 Marks
II. Second Internal (Theory/Practical) – 20 Marks
III. Third Internal (Theory/Practical) – 60 Marks

Theory As per the university rule

| University Practicals / Clinicals: (distribution of marks) | | | 90 Marks |
|---|---|---|---|
| 1. | Spotters 10 * 2 marks | | 20 marks |
| 2. | Case History, Diagnosis & Treatment Planning | | 50 marks |
| 3. | Clinical procedure | | 10 marks |
| 4. | Journal | | 10 marks |

## PUBLIC HEALTH DENTISTRY

### COURSE OUTCOMES ASSESSED:

Were the students able to:Describe the basis of public health, preventive dentistry, public health problems in India, Nutrition, Environment and their role in health, basics of dental statistics, epidemiological methods, National oral health policy with emphasis on oral health policy.Identify health problems affecting the society, conducting health surveys, conducting health education classes and decide health strategies. Exhibhit a positive attitude towards the problems of the society and must take responsibilities in providing health. Communicate the needs of the community efficiently, inform the society of all the recent methodologies in preventing oral disease

### A. COURSE CONTENT AND APPROACH TO THE SUBJECT:

APPROACH TO THE SUBJECT

| TOPIC | APPROACH |
|---|---|
| 1. INTRODUCTION TO PUBLIC HEALTH DENTISTRY | |
| 1.1 Definitionof dentistry | Must know |
| 1.2 Pioneers of dentistry | Desirable to know |
| 1.3 History of dentistry | Must know |
| 1.3.1 Milestones in the field of dentistry | Good to know |
| 1.3.2 Historical dates | Good to know |
| 1.3.3 Dentistry in ancient times | Good to know |
| 1.4.Aim, scope and objectives of dentistry | Must know |
| 1.4.1 Dentistry in future | Good to know |
| 2. PUBLIC HEALTH DENTISTRY | |
| 2.1Health and disease | Must know |
| 2.1.1 Concepts, philosophy, definition and characteristics | Must know |
| 2.2 Public health | Must know |
| 2.2.1Definition, concepts and history of public health | Must know |
| 2.3 General epidemiology | Must know |
| 2.3.1 Definition, objectives, methods,uses and screening for disease | Must know |
| 2.3.2 Investigation of an epidemic | Desirable to know |
| 2.3.3 Quarantine procedures | Good to know |
| 2.4. Public health administration | Must know |

| | |
|---|---|
| 2.4.1 Priority, establishment, manpower, health management | Must know |
| 2.4.2 infectious disease epidemiology | Desirable to know |
| 2.4.3 Control of epidemics | Good to know |
| 2.5 Health care delivery system | Must know |
| 2.5.1 Centre and state, oral health policy, primary health care,national health programmes, health organizations and agencies | Must know |
| 2.5.2 Health care delivery systems of other countries | Desirable to know |
| 2.6 Behavioral science | Must know |
| 2.6.1 Definition of sociology, anthropology and psychology and their role in health and oral health of community | Must know |
| 2.7 Health economics | Desirable to know |
| 3. ENVIRONMENTAL HEALTH | |
| 3.1 Concepts and principles | Must know |
| 3.2 Role of environment in health, Domains of environment | Must know |
| 3.3 Physical environment | Must know |
| 3.3.1 Role of air, water, radiation ,noise in health and disease; air pollution, water pollution, | Must know |
| 3.3.2 Water purification methods | Desirable to know |
| 3.4 Biological environment | Must know |
| 3.4.1 Arthropods in health and disease | Must know |
| 3.4.2 Vector control | Desirable to know |
| 3.5 Social environment | Must know |
| 3.5.1 Definition and role of social environment in health and disease | Must know |
| 3.6 Waste disposal | Must know |
| 3.6.1 Hospital waste management | Must know |
| 3.6.2 Methods of solid waste disposal | Desirable to know |
| 3.6.3 Excreta disposal,sullage, sewage system | Good to know |
| 3.7 Mass disaster and environmental health | Must know |
| 4.HEALTH EDUCATION | |
| 4.1 Introduction to health education | Must know |
| 4.1.1 Definition | Must know |
| 4.2 Concepts and principles | Must know |
| 4.2.1 Theories and models of health education | Desirable to know |
| 4.3 Planning and evaluation of health education programme | Good to know |
| 4.3.1 Health education methods | Must know |
| 4.3.1 Levels of health education | Must know |
| 4.3.2 Health education aids | Must know |
| 4.3.3 Methods of communication | Must know |

| | |
|---|---|
| 4.3.4 Effective use of audio visual aids | Must know |
| 4.4.3 Barriers to communication | Must know |
| 5. ETHICS AND JURISPRUDENCE | |
| 5.1 Professional liabilities | Must know |
| 5.2 Basis for medical ethics | Must know |
| 5.2.1 Hypocratic oath | Desirable to know |
| 5.2.2 Negligence | Must know |
| 5.2.3 Malpractice | Must know |
| 5.4 Principles of ethics(FLIPPED CLASSROOM) | Must know |
| 5.4.1 Ethical rules for dentists prescribed by DCI | Must know |
| 5.4.2 Consents | Must know |
| 5.5 COPRA | Must know |
| 5.5.1 Evidence | Must know |
| 5.6 Contracts | Must know |
| 5.7 Methods of identification in forensic dentistry | Must know |
| 5.7.1 Age, sex identification using forensics | Desirable to know |
| 6. DENTAL PUBLIC HEALTH | |
| 6.1 Introduction to dental public health | Must know |
| 6.1.1 Definition and difference between community and clinical health | Must know |
| 6.2 Epidemiology of dental diseases dental caries, periodontal diseases,malocclusion, dental fluorosis and oral cancer. | Must know |
| 6.2.1 Epidemiological studies related to oral diseases, etiology and risk factors for oral diseases | Must know |
| 6.3 Survey procedures | Must know |
| 6.3.1 Planning, implementation and evaluation, WHO oral health survey methods 1997, indices for dental diseases. | Must know |
| 6.4 Delivery of dental care | Must know |
| 6.4.1 Dental auxiliaries( operating and non- operating), incremental and | Must know |
| 6.5 Comprehensive health care,School dental health | Must know |
| 6.6 Payments of dental care | Must know |
| 6.6.1 Methods of payments, dental insurance, Government plans | Must know |
| 6.7 Preventive dentistry | Must know |
| 6.7.1 Definition, levels, role of individual,community and profession | Must know |
| 6.7.2 Fluorides in dentistry, plaque control programmes | Must know |

7 RESEARCH METHODOLOGY

| | |
|---|---|
| 7.1 Introduction | Must know |
| 7.1.1 Definition and applications of research methodology | Must know |
| 7.2 Types of research | Must know |
| 7.2.1 Classification, differences, merits and demerits of research types | Must know |
| 7.3 Designing a research protocol | Must know |
| 7.3.1 Steps and considerations in a research protocol | Must know |
| 7.4 Health information | Must know |
| 7.4.1 Basic knowledge of computers,MS Office and statistical programmes | Must know |
| 8 BIOSTATISTICS | |
| 8.1 Introduction | Must know |
| 8.1.1 Definitions and terminologies | Must know |
| 8.2 Collection of data | Must know |
| 8.2.1 Methods of data collection and their advantages and disadvantages | Must know |
| 8.3 Presentation of data | Must know |
| 8.3.1 Methods of presentation of data and its interpretation | Must know |
| 8.4 Measures of central tendency | Must know |
| 8.4.1 Importance of mean, median,mode and their computation | Must know |
| 8.5 Measures of dispersion | Must know |
| 8.5.1 Standard deviation, variance and its computation | Must know |
| 8.6 Tests of significance | Must know |
| 8.6.1 Parametric and non-parametric tests and their application | Must know |
| 8.6.2 Performing statistical analysis of data | Desirable to know |
| 8.7 Sampling and sampling techniques | Must know |
| 8.7.1 Classification,methods, merits and demerits of each technique | Must know |
| 8.8 Errors and bias | Must know |
| 8.8.1 Definitions , Types of error, common biasesand ways of minimization | Must know |
| 8.9 Calibration | Must know |
| 8.9.1 Methods of calibration | Must know |
| 8.10 Blind trials | Must know |
| 9. Practice management | |
| 9.1 Introduction,Place and locality | Must know |
| 9.1.1 Definitions and terminologies | Must know |
| 9.1.2 Premises & Layout | Must know |

| | |
|---|---|
| 9.2Types of practice, advantages and disadvantages of each type of practice | Must know |
| 9.2.1 Selection of equipments | Must know |
| 9.2.2 Rules and regulations governing each practice | Must know |
| 9.2.3 Types of practices in various countries | Desirable to know |
| 9.2.4 recent advances and future trends in clincial practice | Good to know |
| 9.3 Maintenance of records / accounts / audit | Must know |
| 9.4 Requirements for starting a practice | Must know |
| 10. Dentist Act 1948 with amendment | |
| 10.1.1 Objectives, functions, composition, registration and membership of IDA | Must know |
| 10.2 Dental Council of India and State Dental Councils , Composition and responsibilities | Must know |
| 10.2.1 Objectives, functions and composition of centre and state DCI | Must know |
| 10.3 Indian Dental Association , Head Office, State, Local and branches | Must know |

## B. PRACTICAL (IV BDS)

Quota:

- Oral health status assessment using WHO oral health survey methods and indices
  - OHI – S
  - Silness and Loe Index for Plaque
  - Loe and Silness Index for Gingiva
  - CPI
  - DMFT and DMFS
  - Dft and dfs
  - Deans Fluorosis Index

- Visit to PHC, water Purification Plant, water Treatment plan, Public Health Lab
- Visit to the Institution of Special Care groups
- Application of Pit and fissure sealants- 2
- 2 Pit and Fissure sealant application on extracted mounted teeth as pre clinical exercise Fluoride Application- 2
- Comprehensives Health Care- 2 cases
- ART- 2
- Case history recording- 2
- Evidence Based Health Education Material

## C. RECOMMENDED BOOKS FOR READING

| Sr. No | Title | Author | Publisher |
|---|---|---|---|
| 1. | Essentials of preventive and community dentistry | Soben Peter | Arya(Medi) Publishing house |
| 2. | Park's textbook of preventive and social medicine | K.Park | Banarsidasbharat publisher |
| 3. | Prevention of Oral Diseases | JJ. Murray | Oxford university press |
| 4. | Fluorides in dentistry | Ole Fjerskov | Munksgaard |
| 5. | Dentistry dental practice and community | David F striffer Brian A Burt | W.B. Saunders company |
| 6. | Principles of Dental public health | Jameas Morse Dunning | Harvard university press (USA) |
| 7. | Dental Public Health- An introduction to Community Dentistry | Geoffery L Slack | John wright and sons, Bristol |
| 8. | Oral health Survey- Basic methods | W.H.O. | W.H.O, Geneva, 1997 |
| 9. | Introduction to Bio-statistics | B.k. Mahajan | Jaypee Publishers |
| 10. | Jong's Community Dental health | George M. Gluck Warren M. | Mosby. Publishers |

## D. SCHEME OF EXAMINATION

INTERNAL EXAMINATION SCHEME

I. First internal (Theory/Practical)- 20 Marks
II. Second Internal (Theory/Practical) – 20 Marks
III. Third Internal (Theory/Practical) – 60 Marks

Theory As per the university rules

UNIVERSITY PRACTICAL EXAM: (DISTRIBUTION OF MARKS)

Will be held for 90 marks.

1. Case History with treatment needs indicating level of prevention (20 marks)
2. Two epidemiological indices (30 marks including chair side viva)
3. Health education material preparation and delivery (20)
4. Spotter Identification (20)

## SECTION VI
## ETHICS IN DENTISTRY

ETHICS (20 hrs. of instruction)

Introduction:

There is a definite shift now from the traditional patient and doctor relationship and delivery of dental care. With advance in science and technology and the increasing needs of the patient, their families, and community, there is a concern for the health of the community as a whole. There is a shift to greater accountability to the society. Dental specialists like the other health professionals are confronted with many ethical problems. It is therefore absolutely necessary for each and every one in health care delivery to prepare themselves to deal with these problems. To accomplish this and develop human values the Council desires that all the trainees undergo ethical sensitisation by lectures or discussion on ethical issues, discussion of cases with an important ethical component.

Course content:

Introduction to ethics –

- What is ethics?
- What are values and norms?
- How to form a value system in one's personal and professional life?
- Hippocratic oath.
- Declaration of Helsinki, WHO declaration of Geneva, International code of ethics.
- DCI codes of ethics.

Ethics of the individual –

The right person as a person
Right to be respected
Truth and confidentiality
Autonomy of decision
Doctor Patient relationship

Profession Ethics –

Code of conduct
Contract and confidentiality
Charging of fees, fee splitting
Prescription of drugs
Over- investigating the patient
Malpractice and negligence

Research Ethics –

- Animal and experimental research/ humanness
- Human experimentation
- Human volunteer research- informed consent
- Drug trials

Ethical workshop of cases
Gathering all scientific factors
Gathering all value factors
Identifying the areas of value- conflict, setting of priorities
Working our criteria towards decisions

Recommended:
Medical Ethics, Francis C.M, I Ed.1993, Jaypee Brothers, New Delhi p.189

## SECTION VIII
## CURRICULUM OF DENTAL INTERNSHIP PROGRAM

- The duration of Internship shall be of one year.
- All parts of internship shall be done in the dental college duty recognized/approved by the Dental Council of India for the purpose of imparting education and training to dental graduates in the country.
- The internship shall be compulsory and rotating as per the regulation prescribed for the purpose.
- The degree BDS shall be granted after completion of internship.
- The applicants seeking NOC for doing their one year paid rotating internship programme from one recognised dental college to another recognised dental college, are hereby advised to apply online to DCI. The NOC of the DCI, in reference to the details submitted by the applicant on the portal of the DCI, will be sent to the concerned applicant at his/her email ID instantly as well as to the parent dental college and the transferee dental college of the applicant. (Council Letter No.DE-1 MiscIII/2017/16511 dated 04th January 2018).

Organization of content:

The Curriculum during the 4 year of BDS training is subject based with more emphasis on learning practical skill. During one year internship the emphasis will be on competency based and community oriented training. The practical skills to be mastered by the interns along with the minimum performance level are given under the course content of different departments of Dental Education. The supervisors should see that proper facilities are provided in all departments and attached institutions for their performance. Specification of teaching activities:

Didactic lectures are delivered during the four years training in BDS. These shall be voided during the internship program. Emphasis shall be on chair-side teaching small group teaching and discussions tutorials, seminars, ward posting, laboratory posting, field visits and self learning.

Use of Resource materials:

Overhand projectors, slide projectors, film projectors charts diagrams, photographs, posters, specimens, models and other audiovisual aids shall be provide in all the dental colleges and attached institutions and field area. If possible, television, video and tapes showing procedures and techniques to be mastered by the interns should be provided.

Determinantsof Curriculum for internship for interns:

The curricular contents of internship training shall be based on.

I. Dental health needs of the society.
II. Financial material and manpower resources available for the purpose.
III. Nation dental Health Policy.

V. Existing Dental as also the primary health care concept for the delivery of health services.

VI. Task analysis of what graduates in dentistry in various practice settings, private and government's service actually perform.

VII. Epidemiological studies conducted to find out prevalence of different dental health problem taking into consideration the magnitude of dental problem. Seventy of dental problems and social disruption caused by these problems.

## Objectives:

A. To facilitate reinforcement of learning and acquisition of addition knowledge.
   a. Reinforcement of knowledge.
   b. Technique& resources available to the individual and the community, Social and cultural setting.
   c. Training in a phased manner from a shared to full responsibility.

B. To facilitate the achievement of basic skills attaining competence Vs maintaining competence in
   i) History Taking
   ii) Clinical Examination
   iii) Performance and interpretation of essential data.
   iv) Data analysis and inference
   v) Communication skills aimed at imparting hope and optimism in the patient
   vi) Attributes for developing working relationship in clinical setting and community team work.

C. To facilitate attribute of sound attitudes and habits
   i) Emphasis on individual and human being and not on disease symptoms
   ii) Provision of comprehensive care rather than fragmentary treatment
   iii) Continuing Dental Education and Learning of accepting the responsibility

D. To facilitate understanding of professional and ethical principles
   i) Right and dignity of patients
   ii) Consultation with other professionals and referral to seniors/institutions
   iii) Obligations to peers colleagues patient families and community
   iv) Provision of free professional services in an emergency situation

E. To initiate individual and group action, leading to disease prevention and dental health promotion at the level of individual families and the community

## Content (Subject matter)

The Compulsory rotating paid Dental Internship shall include training in Oral Medicine & Radiology, Oral & Maxillofacial Surgery, Prosthodontics, Pediodontics, Conservative Dentistry Pedodonics Oral Pathology & Microbiology, Othodontics and Community Dentistry.

## General Guidelines:

1. It shall be task oriented training, Theinterns should participate in various institutions and field programmers and be given due responsibility to perform the activities in all the department of the dental College and associated Institutions.
2. To Facilitate achievement of basic skills and attitude the following facilities should be provide to all dental graduals:
   I. History taking, examination, diagnosis, charting and recording treatment plan of cases.
   II. Presentation of cases in a group of seminar.
   III. Care and sterilization of instruments used.
   IV. Performance and interpretation of essential laboratory tests and other relevant investigations.
   V. Data analysis and inference.
   VI. Proper use of antibiotics, anti-inflammatory and other drugs, as well as other therapeuticmodalities.
   VII. Education of patents, their relatives and community on all aspects of dental health care while working in the institution as also the field.
   VIII. Communication aimed at inspiring hope, confidence and optimism.
   IX. Legal rights of patients and obligations of dental graduate under forensic jurisprudence.
   X. Compulsory training on BLS 2. training on Adobe Photoshop and Corel Draw :
   XI. Conducting lectures, seminars, course for interns as capacity building trainning programmes on compulsory training on Basic Life Support, Courses on Soft skills, Communication, Biomedical waste, dental photography, practice management.

## A. Oral Medicine & Radiology:

1. Standardized examination of patients 25 Cases
2. Exposure to clinical, pathological laboratory procedures

and biopsies. 5 Cases

3. Effective training in taking of Radiographs. 2Full mouth
   (Intra-Oral) I.O.(Extra Oral) E.O 1
   Cephalogram 1
4. Effective management of cases in wards 2 Cases

5. Pre clinical exercise for intern 5 radiographic tracing of impacted 3rd molars on OPG and/or IOPAs

## B. Oral and Maxillofacial Surgery:

a. The Interns during their posting in oral surgery shall perform the following procedures:

1. Extractions 50
2. Surgical extractions 2
3. Impactions 2
4. Simple intra Maxillary Fixation 1
5. Cyst enucleations 1
6. Incision and drainage 2
7. Alveoloplasties, Biopsies &Frenetomies, etc… 3
8. Assisting/ observing major surgeries under general anaesthesia 2

b. The interns shall perform the following on cancer patients:

1. Maintain file work
2. Do extractions for radiotherapy cases.
3. Perform biopsies.
4. Project.
5. Observe varied cases of oral cancers.
6. Evidence based case presentation

Peer group teaching in clinics for interns,

7. This will enable students to manage emergency situation more competently.

c. The Interns shall have 15 days posting in emergency services of a dental general hospital with extended responsibilities in emergency dental care in the wards. During the period they shall attend to all emergencies under the direct supervision of surgeon during any operation:

1. Emergencies

(i) Toothache, (ii) Trigeminal neuralgia, (iii) Bleeding from mouth due to trauma, post extraction, bleeding disorder or hemophilia, (iv) airway obstruction due to fracture mandible and maxilla, dislocation of mandible, syncope or vasovagal attacks, ludwig's angina tooth fracture post intermaxillary fixation after general Anaesthesla.

2. Work in I.C.U. with particular reference to resuscitation procedures.
3. Conduct tutorials on medico-legal aspects including reporting on actual cases coming to casualty. They should have visits to law courts.
4. One Evidence based peer group discussion topic to be presented

## 3. Prosthodontics:

The Dental graduates during their internship posting in Prosthodontics shall make:

1. Complete Denture (upper & lower) 2
2. Removable Partial Denture 4
3. Fixed Partial Denture 1
4. Planned cast partial Denture 1
5. Miscellaneous eg: reline/over Denture/ repaints of Maxillofacial prosthesis 1
6. Learning Use of Face bow and semi adjustable articulators.
7. Crowns
8. Introduction of Implants
9. Project

## 4. Periodontics:

A. The Dental graduates shall perform the following procedures

1. Prophylaxis 15 Cases
2. Flap Operation 2 Cases
3. Root Planning 1 Case
4. Curettage 1 Case
5. Gingivectomy 1 Case
6. Perio-Endo Case 1 Case

B. During their one week posting in the community health centers, the interns shall educate the public in prevention of Periodontal diseases.

## 5. Conservative Dentistry:

To facilitate reinforcement of learning and achievement of basic skills, the interns shall perform the following procedures independently or under the guidance of supervisors:

1. Restoration of extensively mutilated tooth 5 Cases
2. Inlay and only Preparations 1 Cases
3. Use of tooth colored restorative materials 4 Cases
4. Treatment of discolored vital and non-vital teeth 1 Cases

5. Management of dento-alveolar fracture 1 Cases
6. Management of pulpless, single-rooted teeth without periapical lesion 4Cases
7. Management of acute dento alveolar infection 2 Cases
8. Management of pulpless, single-rooted teeth with periapical lesion 1Cases
9. Non-surgical management of traumatized teeth during formative period.

## **6.** Pedodontics and Preventive Dentistry:

During their posting in Pedodontics and dental home the dental gradates shall perform:

1. Topical Application of fluorides including varnish 5 Cases
2. Restorative procedures of carious deciduous teeth in children. 10 Cases
3. Pulpotomy 2 Cases
4. Pulpectomy 1 Cases
5. Fabrication and insertion of space maintainers 1 Cases
6. Oral habits breaking appliances 1 Cases

**7.** Project
**8.** Camps

## **7.** Oral Pathologyand Microbiology:

The interns shall perform the following:

1. History-recording and clinical examination 5 Cases
2. Blood, Urine and Sputum examination 5 Cases
3. Exfoliative Cytology and smears study, age determination 2 Cases
4. Biopsy-Laboratory Procedure & resorting
5. forensic odontology exercise 1 Case
6. Two days biodesigning will be added during the period of routine department posting
7. project/camp

## **8.** Orthodontics:

A. The interns shall observe the following procedures during their posting in orthodontics:

1. Detailed diagnostic procedures for 5 patients
2. Laboratory techniques including wire-bending for removable appliances, soldering and processing of myo-functional appliances.
3. Treatment of plan options and decisions
4. Making of bands, bonding procedures and wire insertions.
5. Use of extra oral anchorage and observation of force values.
6. Retainers.
7. Observe handing of Patients with oral habits causing malocclusions

The Interns shall do the following laboratory work:

| | |
|---|---|
| 1. Wire bending for removable appliances and space maintainers including welding and heat treatment procedure | 5 Cases |
| 2. Soldering exercises, banding & bonding procedures | 2 Cases |
| 3. Cold-cure and heat-cure acrylisation of simple Orthodontics appliances | 5 Cases |
| 4. Prpration of one model/chart | |

## **9.** Public Health Dentistry:

1. The interns shall conduct health education sessions for individuals and group on oral health public health nutrition, behavioral sciences, environmental health, preventive dentistry and epidemiology.

2. They shall conduct a short term epidemiological survey in the community or in the, alternate participate in the planning and methodology including RHS

3. They shall arrange effective demonstrations of:

| | |
|---|---|
| A) Preventive and interceptive producers for prevalent dental diseases. | |
| B) Mouth-rising and other oral hygiene demonstrations | 5Cases |
| C)Toothbrushing techniques | 5Cases |

4. Conduction of oral health education programmers at

| | |
|---|---|
| A) School setting | 2 |
| B) Community setting | 2 |
| C)Adult Education Programmers | 2 |

| | |
|---|---|
| 5. Preparation of Heath Education Materials | 5 |

6. Exposure to team concept and National health Care systems:

a) Observation of functioning of heath infrastructure.

b) Observation of functioning of heath care team including multipurpose workers male and female, health education and other workers.

c) Observation of at least one national Health Programme

d) Observation of interlinkages of delivery of oral health care with Primary Health Care. Mobile Dental clinics, as and when available, should be provided for this teachings.

## Elective Posting

The interns shall be posted for 15 days in any of dental departments of their choice mentioned in the foregoing.

**Continuing Dental Education:** The Interns shall from time to time attend various CDE programs, conferences inside and outside the campus.

The Institution shall compulsorily conduct Lecture series on topics like ethics and jurisprudence, Sterilization, infection control, waste management, CPR and Basic Life support, and courses on soft skills, communication, dental photography and Practice management etc. Attendance in these lectures conducted in the institution is compulsory for internship completion.

## Evaluation

1. Formative Evaluation:

Day to day assessment of the interns during their internship posting should be done. The objective is that all the items must acquire necessary minimum skill required for carrying out day to day professional work competently. This can be achieved by maintaining records and performance data book by all interns. This will not only provide demonstrable evidence of the processes of training but more importantly of the interns own acquisition of competencies as rotated to performance. It shall form a part of formative evaluation and shall also constitute component of final grading of interns.

2. Summative Evaluation:

It shall be based on the observation of the supervisors of different departments and the records and performance data / log book maintained by the interns. Grading shall be done accordingly.

Rural Service

In the rural services, the student will have to participate in –

1. Community Health Monitoring programs and services which include Preventive, Diagnostic and corrective procedures
2. To create educational awareness about dental hygiene and diseases.
3. Conduction of Oral Health Education Program at-
   (a) School Setting -5
   (b) Community Setting -5
   (c) Adult Education Program -5
4. Compulsory setup of satellite clinics in remote areas - 1
5. Lectures to create awareness and education in public forums about the harmful effects of tobacco consumption and the predisposition to oral cancer- Two Lectures per student.

## Period of Postings

1. Oral Medicine & Radiology - 1 month
2. Oral and Maxillofacial Surgery - 1 ½ months
3. Prosthodontics - 1 ½ months
4. Periodontics - 1 month
5. Conservative Dentistry - 1 month
6. Pedodontics - 1 month
7. Oral Pathology & Microbiology - 15 days
8. Orthodontics - 1 month
9. Community Dentistry /Rural Services - 3 months
10. Elective - 15 days

## B.PHARM. SEMESTER – I (BPH)
## SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY I -THEORY (BP101T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | -- | 4 | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

**Objectives:** Upon completion of the course the student shall be able to

1. Explain the gross morphology, structure and functions of various organs of the human body.
2. Describe the various homeostatic mechanisms and their imbalances.
3. Identify the various tissues and organs of different systems of human body.
4. Perform the various experiments related to special senses and nervous system.
5. Appreciate coordinated working pattern of different organs of each system

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | Cos |
|---|---|---|---|
| [1] | **Introduction to human body**<br>Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.<br>**Cellular level of organization**<br>Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine<br>**Tissue level of organization**<br>Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues. | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [2] | **Integumentary system**<br>Structure and functions of skin<br>**Skeletal system**<br>Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system<br>Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction<br>**Joints**<br>Structural and functional classification, types of joints movements and its Articulation | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [3] | **Body fluids and blood**<br>Body fluids, composition and functions of blood, hemopoeisis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system.<br>□ **Lymphatic system**<br>Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [4] | **Peripheral nervous system:**<br>Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system.<br>Origin and functions of spinal and cranial nerves.<br>**Special senses**<br>Structure and functions of eye, ear, nose and tongue and their disorders. | 08 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [5] | **Cardiovascular system**<br>Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart | 08 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Tailor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.
4. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Tailor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.


## D. REFERENCE BOOKS


1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remember | To get knowledge about the basic anatomy and function of the body and remember the position of the various parts of our body |
| CO2 | Remember, Understand and Apply | To know about the structural anatomy and working mechanism of various body parts |
| CO3 | Understand, Apply Evaluate, and Remember | To understand the composition structure and function of the body, and get knowledge about disease-produced by dysfunctioning of the system. |
| CO4 | Understand, Remember, Analyse and Evaluate | To know about the organization of the system its structure, structure of the body and disease occurs because of dysfunctioning of the organ system. |
| CO5 | Remember, Understand, Apply and evaluate | To get knowledge about the structure, function and disorder or disease that occurs due to the dysfunctioning of the system |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| CO2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 |
| Avg | 3 | 2.6 | 3 | 2.4 | 2.2 | 2.4 | 2.6 | 2 | 2.8 | 2.2 | 2.4 | 2.8 | 3 | 3 | 2.2 | 2.2 |


| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remember | To get knowledge about the basic anatomy and function of the body and remember the position of the various parts of our body |
| CO2 | Remember, Understand and Apply | To know about the structural anatomy and working mechanism of various body parts |
| CO3 | Understand, Apply Evaluate, and Remember | To understand the composition structure and function of the body, and get knowledge about disease-produced by dysfunctioning of the system. |
| CO4 | Understand, Remember, Analyse and Evaluate | To know about the organization of the system its structure, structure of the body and disease occurs because of dysfunctioning of the organ system. |
| CO5 | Remember, Understand, Apply and evaluate | To get knowledge about the structure, function and disorder or disease that occurs due to the dysfunctioning of the system |

## B.PHARM. SEMESTER – I (BPH)

## SUBJECT: PHARMACEUTICAL ANALYSIS I -THEORY (BP102T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Prac. | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 04 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**:. This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs

**Objectives:** Upon completion of the course student shall be able to

CO1 Understand the fundamentals of volumetric titrations, significance of quality control in pharmaceutical analysis

CO2 Learn and discuss in detail the working theories and principle of various volumetric methods

CO3 Learn about the indicators, solvents and end point detections in analytical and electroanalytical methods.

CO4 Understand the advantages of one method over the other, numerical calculations and learn to choose the most appropriate method for drugs analysis.

CO5 Application of various analytical and electro-analytical titrations in pharmaceutical drugs analysis.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **(a) Pharmaceutical analysis**<br><br>Definition and scope<br>i) Different techniques of analysis<br>ii) Methods of expressing concentration<br>iii) Primary and secondary standards.<br>iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate<br><br>**(b)Errors:** Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures | 10 | CO1<br>CO5 |
| [2] | **Acid base titration**: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves<br><br>**Non aqueous titration**: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl | 10 | CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [3] | **Precipitation titrations**: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.<br><br>**Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.<br><br>**Gravimetry**: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate. | 10 | CO2<br>CO3<br>CO4<br>CO5 |
| [4] | **Redox titrations**<br>(a) Concepts of oxidation and reduction<br>(b) Types of redox titrations (Principles and applications)<br><br>Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate | 08 | CO2<br>CO3<br>CO4<br>CO5 |
| [5] | Electrochemical methods of analysis<br><br>**Conductometry**- Introduction, Conductivity cell, Conductometric titrations, applications.<br>**Potentiometry -** Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.<br>**Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications | 07 | CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. G. H. Jeffery J. Bassett J. Mendham R C. Denney, *Vogel's textbook of quantitative chemical analysis*, 5th ed.; Bath press, Avon : Great Britain, 1989.
2. Health, O. Indian Pharmacopoeia 2010. Vol. 1; Ghaziabad Indian Pharmacopoeia Commission, 2010.
3. Skoog, Douglas A, F J. Holler, and Timothy A. Nieman, *Principles of Instrumental Analysis*, 7th ed.; Saunders College Pub: United stated of America, 2016.
4. Sharma B. K., *Analytical Chemistry*, 2nd ed.; Krishna Prakashan media (p) Ltd: Delhi, India, 2006.


## D. REFERENCE BOOKS


1. P. Gundu Rao, *Inorganic Pharmaceutical Chemistry (Pharma Chemistry-I)*, 2010
2. Arthur Owen Bentley; John Edmund Driver; Lewis Malcolm Atherden. *Bentley and Driver's Textbook of Pharmaceutical Chemistry.*; Oxford University Press: Oxford, 1977.
3. Kennedy, J. H. *Analytical Chemistry : Principles*; Saunders College Pub: New York, 1990.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, analyse, evaluate and apply | Understand the fundamentals of volumetric titrations, significance of quality control in pharmaceutical analysis |
| CO2 | Understand, analyse, evaluate and apply | Learn and discuss in detail the working theories and principle of various volumetric methods |
| CO3 | Understand, analyse, evaluate and apply | Learn about the indicators, solvents and end point detections in analytical and electroanalytical methods. |
| CO4 | Understand, analyse, evaluate and apply | Understand the advantages of one method over the other, numerical calculations and learn to choose the most appropriate method for drugs analysis. |
| CO5 | Understand, analyse, evaluate and apply | Application of various analytical and electro-analytical titrations in pharmaceutical drugs analysis. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 0 | 3 | 2 | 3 | 2 | 2 | 0 |
| CO2 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 0 | 3 | 2 | 3 | 2 | 2 | 0 |
| CO3 | 3 | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 0 | 3 | 2 | 3 | 2 | 2 | 1 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 0 | 3 | 2 | 3 | 2 | 2 | 0 |
| CO5 | 3 | 2 | 3 | 1 | 3 | 3 | 3 | 2 | 2 | 0 | 3 | 2 | 3 | 2 | 2 | 1 |
| Avg. | 3 | 1.4 | 2.6 | 1.4 | 1.8 | 3 | 1.8 | 1.2 | 1.4 | 0 | 3 | 2 | 3 | 2 | 2 | 0.4 |

**B.PHARM. SEMESTER – I (BPH)**
**SUBJECT: PHARMACEUTICS I -THEORY (BP103T)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: Course enables the student to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.
**Objectives:** Upon completion of the course the student shall be able to
1. Know the history of profession of pharmacy
2. Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
3. Understand the professional way of handling the prescription
4. Prepare various conventional dosage forms

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Historical background and development of profession of pharmacy:** History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.<br>· **Dosage forms:** Introduction to dosage forms, classification and definitions<br>· **Prescription:** Definition, Parts of prescription, handling of Prescription and Errors in prescription.<br>· **Posology:** Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area. | 10 | CO1<br>CO3 |
| [2] | **Pharmaceutical calculations**: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight.<br>· **Powders:** Definition, classification, advantages and disadvantages,Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.<br>· **Liquid dosage forms:** Advantages and disadvantages of liquid dosage forms.Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques | 10 | CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [3] | **Monophasic liquids:** Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.<br>· **Biphasic liquids:**<br>· **Suspensions:** Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome.<br>· **Emulsions:** Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome. | 08 | CO5 |
| [4] | **Suppositories**: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories.<br>· **Pharmaceutical incompatibilities**: Definition, classification, physical, chemical and therapeutic incompatibilities with examples. | 8 | CO2<br>CO5 |
| [5] | **Semisolid dosage forms:** Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms | 7 | CO5 |

## C. TEXT BOOKS


1. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.


## D. REFERENCE BOOKS


1. Ansel, H. C.; Allen, L. V.; Popovich, N. G. Pharmaceutical Dosage Forms and Drug Delivery Systems; Philadelphia, Pa Lippincott-Williams & Wilkins, 1999.
2. Arthur Owen Bentley; Ernest Alexander Rawlins. Bentley's Textbook of Pharmaceutics.; All India Traveller Book Seller: New Delhi, 2002.
3. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
4. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.
5. Françoise Nielloud; Marti-Mestres, G. Pharmaceutical Emulsions and Suspensions; Informa Healthcare, Cop: New York, 2010.
6. Ghebre-Sellassie, I. Pharmaceutical Pelletization Technology; Dekker: New York U.A., 1989.
7. Parikh, D. M. Handbook of Pharmaceutical Granulation Technology; Informa Healthcare: New York, N.Y., 2007.
8. Remington, J. P.; Gennaro, A. R. Remington : Volume 1 : The Science and Practice of Pharmacy; Mack Pub. Co: Easton, Pa., 1995.


## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|

| | | |
|---|---|---|
| **CO1** | Understand and Remember | To understand and remember the professional way of handling the prescription |
| **CO2** | Understand and Remember | To understand the basics of different dosage forms and pharmaceutical incompatibilities |
| **CO3** | Understand | To understand the history of profession of pharmacy |
| **CO4** | Perform | To perform the pharmaceutical calculations |
| **CO5** | Prepare and evaluate | To prepare and evaluate various conventional dosage forms |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO3** | 3 | 2 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| **CO4** | 3 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 2 | 1 |
| **CO5** | 3 | 1 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 3 | 3 | 1 | 1 |
| **Avg** | 3 | 1.8 | 2.8 | 2.6 | 1.2 | 2 | 1.8 | 2 | 1.8 | 1.4 | 2.6 | 2.8 | 2.6 | 3 | 2.2 | 2 |

## B.PHARM. SEMESTER – I (BPH)
## SUBJECT: PHARMACEUTICAL INORGANIC CHEMISTRY -THEORY (BP104T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

**Objectives:** Upon completion of the course the student shall be able to

- Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- Understand the medicinal and pharmaceutical importance of inorganic compounds

## B. COURSE CONTENT

**General methods of preparation**, assay for the compounds superscripted with **asterisk (*),** properties and medicinal uses of inorganic compounds belonging to the following classes

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Impurities in pharmaceutical substances:** History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate | 10 | CO1 |
| [2] | **Acids, Bases and Buffers:** Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.<br>**Major extra and intracellular electrolytes**: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.<br>**Dental products**: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement. | 10 | CO2 |
| [3] | **Gastrointestinal agents**<br>**Acidifiers:** Ammonium chloride* and Dil. HCl<br>**Antacid:** Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture<br>**Cathartics:** Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite<br>**Antimicrobials**: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations | 10 | CO3 |
| [4] | **Miscellaneous compounds**<br>**Expectorants:** Potassium iodide, Ammonium chloride*. **Emetics**: Copper sulphate*, Sodium potassium tartarate<br>**Haematinics:** Ferrous sulphate*, Ferrous gluconate<br>**Poison and Antidote:** Sodium thiosulphate*, Activated charcoal, Sodium nitrite333 | 8 | CO4 |

| | | | |
|---|---|---|---|
| | **Astringents**: Zinc Sulphate, Potash Alum | | |
| [5] | **Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide $I_{131}$, Storage conditions, precautions & pharmaceutical application of radioactive substances. | 7 | CO5 |

## C. TEXT BOOKS (LATEST EDITION)

1. Anand & G.R. Chatwal, Inorganic Pharmaceutical Chemistry, India, 2010
2. Suhagia B. N., Inorganic Pharmaceutical Chemistry, Nirav Prakashan, India, 2013

## D. REFERENCE BOOKS (LATEST EDITION)

1. Schroff, M. L. Pharmaceutical Chemistry; National Book Centre: Calcutta, 1968.
2. Arthur Owen Bentley; John Edmund Driver; Lewis Malcolm Atherden. Bentley and Driver's Textbook of Pharmaceutical Chemistry.; Oxford University Press: Oxford, 1977.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember, Understand & Analyse | To study about impurities in pharmaceutical substances |
| CO2 | Understand, Remember & Apply | To understand Acids, Bases and Buffers, Major extra and intracellular electrolytes. |
| CO3 | Remember, Understand and Analyse | To understand and learn about Gastrointestinal agents |
| CO4 | Remember, Apply and Analyse | To study about various miscellaneous compounds. |
| CO5 | Understand and Remember, Evaluate | To understand and remember radiopharmaceuticals and Dental products. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 2 | 2 | 1 | 1 | 1 |
| CO2 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | 2 | 1 | 3 | 2 | 2 | 1 | 1 | 1 |
| CO3 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | 1 | 1 | 3 | 2 | 2 | 1 | 1 | 1 |
| CO4 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | 1 | - | 3 | 2 | 2 | 1 | 1 | 1 |
| CO5 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - | 1 | 3 | 2 | 1 | 1 | 1 | 1 |
| Avg | 3 | 1 | 1 | 1 | 1 | 1 | 0.4 | 1 | 1.2 | 0.8 | 3 | 2 | 1.8 | 1 | 1 | 1 |

## B.PHARM. SEMESTER – I (BPH)

## SUBJECT: COMMUNICATION SKILLS –THEORY (BP105T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Prac. | Total | | Ext | Sess. | CM | Prac. | Total |
| 2 | - | - | 2 | 2 | 35 | 10 | 5 | - | 50 |

## A. COURSE OVERVIEW

**Scope**:.

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

**Objectives:** Upon completion of the course the student shall be able to

CO1 Learn to communicate effectively (Verbal and Non Verbal) and apply appropriate communication style in professional context

CO2 Develop Leadership qualities, writing skills, effective interview skills, group discussion skills, presentation skills and essentials.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Communication Skills:** Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context<br><br>**Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers<br><br>**Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment | 07 | CO1<br>CO2 |

| | | | |
|---|---|---|---|
| [2] | **Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication<br><br>**Communication Styles:** Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style | 07 | CO1<br>CO2 |
| [3] | **Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations<br><br>**Effective Written Communication:** Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication<br><br>**Writing Effectively:** Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message | 07 | CO1<br>CO2<br>CO3 |
| [4] | **Interview Skills:** Purpose of an interview, Do's and Dont's of an interview<br><br>**Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery | 05 | CO4<br>CO5 |
| [5] | **Group Discussion:** Introduction, Communication skills in group discussion, Do's and Dont's of group discussion | 04 | CO3<br>CO5 |

## C. TEXT BOOKS


1. Mosam Sinha. *Effective Communication Skills*; Aavishkar Publishers, Distributors: Jaipur, 2017.
2. Lisel Erasmus-Kritzinger. *Introductory Communication : The Ultimate Guide to Effective Communication Skills, Study Skills, Life Skills*; Nasou Via Afrika: Cape Town, 2007.
3. Araya, M. MTD Training Effective Communication Skills. *www.academia.edu*.


## D. REFERENCE BOOKS


4. Rutherfoord, A. J. *Basic Communication Skills for Technology*; Englewood Cliffs, Nj Prentice Hall, 1991.

5. Worth, R. *Communication Skills.*; Ferguson: New York, 2019.
6. Nira Konar. *Communication Skills for Professionals*; Phi Learning Private Limited: New Delhi, 2011.
7. Mitra, B. K. *Personality Development and Soft Skills*; Oxford University Press: New Delhi, 2011.
8. Wentz, F. H. *Soft Skills Training : A Workbook to Develop Skills for Employment*; Createspace: Charleston, Sc, 2012.
9. Peter, F. S. J. *Soft Skills and Professional Communication*; Tata Mcgraw-Hill: New Delhi, 2012.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, remember, analyse, apply and evaluate | Learn to communicate effectively (Verbal and Non Verbal) and apply appropriate communication style in professional context |
| CO2 | Understand, remember, analyse, apply and evaluate | Develop Leadership qualities, writing skills, effective interview skills, group discussion skills, presentation skills and essentials. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 0 | 1 | 0 | 0 | 3 | 3 | 0 | 3 | 1 | 0 | 3 | 1 | 1 | 0 | 3 | 0 |
| CO2 | 0 | 1 | 0 | 0 | 3 | 3 | 0 | 3 | 1 | 0 | 3 | 1 | 1 | 0 | 3 | 0 |
| Avg. | 0 | 1 | 0 | 0 | 3 | 3 | 0 | 3 | 1 | 0 | 1.8 | 1 | 1 | 0 | 3 | 0 |

## B.PHARM. SEMESTER – I (BPH)
## SUBJECT: REMEDIAL BIOLOGY -THEORY (BP106RBT)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 2 | -- | --- | 2 | 2 | 35 | 10 | 5 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.
**Objectives:** Upon completion of the course the student shall be able to

1. know the classification and salient features of five kingdoms of life
2. Understand the basic components of anatomy & physiology of plant
3. Know understand the basic components of anatomy & physiology animal with special reference to human

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Living world:**<br>Definition and characters of living organisms<br>□ Diversity in the living world<br>□ Binomial nomenclature<br>□ Five kingdoms of life and basis of classification. Salient features of Monera, Potista, Fungi, Animalia and Plantae, Virus,<br>**Morphology of Flowering plants**<br>□ Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.<br>□ General Anatomy of Root, stem, leaf of monocotyledons & Dicotylidones | 7 | CO1<br>CO2 |
| [2] | **Body fluids and circulation**<br>□ Composition of blood, blood groups, coagulation of blood<br>□ Composition and functions of lymph<br>□ Human circulatory system<br>□ Structure of human heart and blood vessels<br>□ Cardiac cycle, cardiac output and ECG<br>**Digestion and Absorption**<br>□ Human alimentary canal and digestive glands<br>□ Role of digestive enzymes<br>□ Digestion, absorption and assimilation of digested food<br>**Breathing and respiration**<br>□ Human respiratory system<br>□ Mechanism of breathing and its regulation<br>□ Exchange of gases, transport of gases and regulation of respiration<br>□ Respiratory | 7 | CO1<br>CO2 |

| | | | |
|---|---|---|---|
| [3] | **Excretory products and their elimination**<br>□ Modes of excretion<br>□ Human excretory system- structure and function<br>□ Urine formation<br>□ Rennin angiotensin system<br>**Neural control and coordination**<br>□ Definition and classification of nervous system<br>□ Structure of a neuron<br>□ Generation and conduction of nerve impulse<br>□ Structure of brain and spinal cord<br>□ Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata<br>**Chemical coordination and regulation**<br>□ Endocrine glands and their secretions<br>□ Functions of hormones secreted by endocrine glands<br>**Human reproduction**<br>□ Parts of female reproductive system<br>□ Parts of male reproductive system<br>□ Spermatogenesis and Oogenesis<br>□ Menstrual cycle | 07 | CO1<br>CO2 |
| [4] | **Plants and mineral nutrition:**<br>□ Essential mineral, macro and micronutrients<br>□ Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation<br>**Photosynthesis**<br>□ Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis. | 05 | CO1<br>CO2 |
| [5] | **Plant respiration:**<br>Respiration, glycolysis, fermentation (anaerobic).<br>**Plant growth and development**<br>□ Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators<br>**Cell - The unit of life**<br>□ Structure and functions of cell and cell organelles. Cell division<br>**Tissues**<br>□ Definition, types of tissues, location and functions | 04 | CO1<br>CO2 |

## C. TEXT BOOKS


1. A Gokhale, S. B.; Kokate, C. K.; Gokhale, A. S.; Kalaskar, M. G. Pharmacognosy of Traditional Drugs - I; Nirali Prakashan, August: Pune, 2014.
2. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.


## D. REFERENCE BOOKS


1. Gokhale, S. B.; Kokate, C. K.; Gokhale, A. S.; Kalaskar, M. G. Pharmacognosy of Traditional Drugs - I; Nirali Prakashan, August: Pune, 2014.
2. Dutta, A. C. Botany for Degree Students.; Oxford University Press: Kolkata, 1996.
3. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Remember, Apply, Evaluate | To get knowledge about the living world, Morphology and general anatomy of flowering plants & anatomy and function of the various parts of the body. |
| CO2 | Remember and understand, Evaluate, Analyze | To understand the basic components of anatomy and physiology of plant and animal with special reference to human. plant and mineral nutrition, respiration, plant growth development, Cell and tissue. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| Avg | 3 | 2 | 2 | 2.5 | 2.5 | 2.5 | 2.5 | 2 | 3 | 2.5 | 3 | 2.5 | 2.5 | 3 | 2 | 2.5 |

## B.PHARM.SEMESTER–I(BPH)
## SUBJECT:REMEDIALMATHEMATICS-THEORY(BP106RMT)

| TeachingScheme(Hours/Week) | | | | Credits | ExaminationScheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 2 | - | - | 2 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSEOVERVIEW

**Scope:** This is an introductory course in mathematics. This subject deals with the introduction toPartial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differentialequationandLaPlacetransform.

**Objectives:**Uponcompletionofthiscoursethestudentshouldbeableto

- Knowthetheoryandtheirapplicationin Pharmacy.
- Solvethedifferenttypes ofproblemsbyapplyingtheory.
- Appreciatetheimportant applicationofmathematicsinPharmacy.
- Applymathematicsinsolvingstatisticalproblemsinpharmacy.
- Knowthebasicsofmathematicalproblem-solvingskillsinPharmacy.

## B. COURSECONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | **Partialfraction** | **06** | CO1, CO2. |
| | Introduction, Polynomial, Rational fractions, Proper and Improper fractions,Partialfraction,ResolvingintoPartialfraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics<br>**Logarithms**<br>Introduction,Definition,Theorems/Propertiesoflogarithms,Common logarithms,CharacteristicandMantissa,workedexamples,applicationof logarithmtosolvepharmaceuticalproblems.<br>**Function:**<br>RealValuedfunction,Classificationofrealvaluedfunctions.<br>**Limitsand continuity:**<br>Introduction,Limitofafunction,Definitionoflimitofafunction.(ϵ-δ definition) $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$, $\lim_{\theta\to 0}\frac{\sin\theta}{\theta}=1$, | | |
| [2] | **Matrices and Determinant:** Introduction matrices, Types of matrices,Operationonmatrices,Transposeofamatrix,MatrixMultiplication,Determinants, Properties of determinants, Product of determinants, Minorsand co-Factors, Adjoin or adjutant of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear ofequations using matrix method,Cramer'srule, Characteristics equation androotsofasquarematrix,Cayley–Hamiltontheorem,Application of Matrices in solving Pharmacokinetic equations. | **06** | CO1, CO2. |
| [3] | **Calculus**Differentiation: Introductions, Derivative of a function ,Derivative of a constant, Derivative of a product of a constant and afunction, Derivative of the sum or difference of two functions, Derivativeoftheproductoftwofunctions(productformula),Derivativeofthequotientoftwofunctions(Quotientformula)–Without Proof,Derivativeof $x^n$w.r.tx,wherenisanyrationalnumber,Derivativeof $e^x$, Derivativeoflog | **06** | CO1, CO2. |

| | | | |
|---|---|---|---|
| | $e^x$,Derivativeofa$^x$,Derivative of trigonometric functionsfromfirstprinciples(withoutProof),Successive Differentiation,Conditionsfor a functiontobeamaximumoraminimumat apoint.Application | | |
| [4] | **AnalyticalGeometry**<br>Introduction:SignsoftheCoordinates,Distanceformula,<br>Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points,Slope–intercept form ofastraightline<br>Integration:Introduction,Definition,Standardformulae,Rulesofintegration, Methodofsubstitution,MethodofPartialfractions,Integration by parts,definite integrals, application | **06** | CO1, CO2. |
| [5] | **DifferentialEquations**:Somebasicdefinitions,Orderanddegree,Equations in separable form, Homogeneous equations, Linear Differential equations,Exactequations,Application in solving Pharmacokinetic equations Laplace<br>**Transform:** Introduction, Definition, Properties of La place transform,Laplace Transforms of elementary functions, Inverse Laplace transforms,Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations | **06** | CO1, CO2. |

## C. TEXTBOOKS

1. HariKishan.*Differential Calculus*;AtlanticPublishers&Distributors:NewDelhi,2007.
2. Ranganath,G.K.*RemedialMathematics.*2017.

## D. REFERENCEBOOKS

1. HariKishan.*Differential Calculus*;AtlanticPublishers&Distributors:NewDelhi,2007.
2. Ranganath,G.K.*RemedialMathematics.*2017.
3. Hyma,P.*PharmaceuticalMathematicswithApplicationtoPharmacy*;AnmolPublicationsPvt.Ltd: NewDelhi,India, 2017.
4. HS GovindaRao.*HigherEngineeringMathematics*;VivaBooks:NewDelhi,2007.

## E. COURSEOUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Evaluate,Remember and apply | Know the theory and their application in Pharmacy,Appreciate the important application of mathematics in Pharmacy. |
| CO2 | Understand,Analyse, Evaluate and apply | Solve the different types of problems by applying theory,Applymathametics in solving statistical problems in pharmacy. |

## F. COURSEMATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 3 | 3 | 1 | 2 |
| CO2 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2 | 3 | 3 | 1 | 3 | 3 | 2 | 2.5 | 2 | 1.5 | 2.5 | 3 | 3 | 2 | 2.5 |

## B.PHARM. SEMESTER – I (BPH)
## SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY I -PRACTICAL (BP107 P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| --- | -- | 4 | 4 | 2 | 35 | 10 | 5 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

**Objectives:**

- Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject

## B. COURSE CONTENT

| NO | TOPIC | P (Hrs) | COs |
|---|---|---|---|
| [1] | 1. Study of compound microscope.<br>2. Microscopic study of epithelial and connective tissue<br>3. Microscopic study of muscular and nervous tissue<br>4. Identification of axial bones<br>5. Identification of appendicular bones<br>6. Introduction to hemocytometry.<br>7. Enumeration of white blood cell (WBC) count<br>8. Enumeration of total red blood corpuscles (RBC)<br>9. Determination of bleeding time<br>10. Determination of clotting time<br>11. Estimation of haemoglobin count<br>12. Determination of blood group<br>13. Determination of erythrocyte sedimentation rate (ESR)<br>14. Determination of heart rate and pulse rate<br>15. Recording of blood pressure. | **60** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
2. Sri Nageswari K; Sharma, R. Practical Workbook of Human Physiology; Jaypee Brothers Medical Publishers (P) Ltd, 2006.


## D. REFERENCE BOOKS


1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.

3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remember | To get knowledge about the basic instruments used in this subject and how to operate it |
| CO2 | Remember, Understand and evaluate | To know about the working mechanism of the instruments, understanding of models and result evaluation. |
| CO3 | Understand Apply Evaluate and remember | To understand about procedure for measurement of various biochemical parameter, evaluation of result and after interpretation of result |
| CO4 | Understand Apply and Evaluate | To know the value, obtain from the test and apply it in healthy or disease condition and give interpretation |
| CO5 | Remember, Apply and evaluate | To get knowledge about parts of the instrument used in lab, its working principle, measurement and interpretation of result |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 1 |
| CO2 | 3 | 2 | 2 | 3 | 1 | 3 | 2 | 2 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 1 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 |
| Avg | 3 | 2.4 | 2.8 | 3 | 1.6 | 2.6 | 2.6 | 2.2 | 2.8 | 1.8 | 2.4 | 2.6 | 3 | 3 | 2.4 | 1.6 |

## B.PHARM. SEMESTER – I (BPH)
## SUBJECT: PHARMACEUTICAL ANALYSIS I -PRACTICAL (BP108P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope**:This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.

**Objectives:**Upon completion of the course student shall be able to

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- Develop analytical skills

## B. COURSE CONTENT

| NO | TOPIC | P(Hrs) | COs |
|---|---|---|---|
| [1] | **Preparation and standardization of**<br>(1) Sodium hydroxide<br>(2) Sulphuric acid<br>(3) Sodium thiosulfate<br>(4) Potassium permanganate<br>(5) Ceric ammonium sulphate<br>**Assay of the following compounds along with Standardization of Titrant**<br>(1) Ammonium chloride by acid base titration<br>(2) Ferrous sulphate by Cerimetry<br>(3) Copper sulphate by Iodometry<br>(4) Calcium gluconate by complexometry<br>(5) Hydrogen peroxide by Permanganometry<br>(6) Sodium benzoate by non-aqueous titration<br>(7) Sodium Chloride by precipitation titration<br>**Determination of Normality by electro-analytical methods**<br>(1) Conductometric titration of strong acid against strong base<br>(2) Conductometric titration of strong acid and weak acid against strong base<br>(3) Potentiometric titration of strong acid against strong base | **60** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Ministry, India.; Indian Pharmacopoeia Commission. *Indian Pharmacopoeia, 2010*; Indian Pharmacopoeia Commission: Ghaziabad, 2010.
2. Jain, D. S. M.; Patel, D. V. B. *Pharmaceutical Analysis*; NiraliPrakashan, 2018.


## D. REFERENCE BOOKS


1. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988

2. Muhammad Sajid Hamid Akash; Kanwal Rehman. *Essentials of Pharmaceutical Analysis*; Singapore Springer, 2020.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, learn and remember | Understand, learn and remember various calculations for quantification of drugs by analytical and electroanalytical methods. |
| CO2 | Learn and remember | Learn and remember the concept of calibration of apparatus and instruments |
| CO3 | Understand and apply | Understand and apply the analytical and electroanalytical methods for assay and quantification of drugs in an unknown samples. |
| CO4 | Understand | Understand the importance of data integrity and ethical practices in every steps of drugs quantification |
| CO5 | Develop | Develop skills in performing the volumetric titration and handling electroanalytical instruments |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 2 | - | 3 | 3 | 3 | 2 | 2 | - |
| CO2 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | - | 3 | 3 | 3 | 2 | 2 | - |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 1 |
| CO4 | 3 | 1 | 3 | 1 | 2 | 2 | 1 | 1 | 2 | - | 3 | 3 | 3 | 2 | 2 | 1 |
| CO5 | 3 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | - |
| Avg | 3 | 2.6 | 2.2 | 1.8 | 1.4 | 1.8 | 1 | 1 | 2 | 0.4 | 3 | 3 | 3 | 2 | 2 | 0.4 |

## B.PHARM. SEMESTER – I (BPH)
## SUBJECT: PHARMACEUTICAL ANALYSIS I -PRACTICAL (BP108P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope**:. This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.

**Objectives:** Upon completion of the course student shall be able to

CO1 Understand, learn and remember various calculations for quantification of drugs by analytical and electroanalytical methods.
CO2 Learn and remember the concept of calibration of apparatus and instruments.
CO3 Understand and apply the analytical and electroanalytical methods for assay and quantification of drugs in an unknown samples.
CO4 Understand the importance of data integrity and ethical practices in every steps of drugs quantification
CO5 Develop skills in performing the volumetric titration and handling electroanalytical instruments

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Preparation and standardization of**<br>(1) Sodium hydroxide<br>(2) Sulphuric acid<br>(3) Sodium thiosulfate<br>(4) Potassium permanganate<br>(5) Ceric ammonium sulphate<br>**Assay of the following compounds along with Standardization of Titrant**<br>(1) Ammonium chloride by acid base titration<br>(2) Ferrous sulphate by Cerimetry<br>(3) Copper sulphate by Iodometry<br>(4) Calcium gluconate by complexometry<br>(5) Hydrogen peroxide by Permanganometry<br>(6) Sodium benzoate by non-aqueous titration<br>(7) Sodium Chloride by precipitation titration<br>**Determination of Normality by electro-analytical methods**<br>(1) Conductometric titration of strong acid against strong base<br>(2) Conductometric titration of strong acid and weak acid against strong base<br>(3) Potentiometric titration of strong acid against strong base | 60 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. Ministry, India.; Indian Pharmacopoeia Commission. *Indian Pharmacopoeia, 2010*; Indian Pharmacopoeia Commission: Ghaziabad, 2010.

2. Jain, D. S. M.; Patel, D. V. B. *Pharmaceutical Analysis*; Nirali Prakashan, 2018.

## D. REFERENCE BOOKS

1. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988
2. Muhammad Sajid Hamid Akash; Kanwal Rehman. *Essentials of Pharmaceutical Analysis*; Singapore Springer, 2020.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, remember, analyse, apply and evaluate | Understand, learn and remember various calculations for quantification of drugs by analytical and electroanalytical methods. |
| CO2 | Understand, remember, analyse, apply and evaluate | Learn and remember the concept of calibration of apparatus and instruments |
| CO3 | Understand, remember, analyse, apply and evaluate | Understand and apply the analytical and electroanalytical methods for assay and quantification of drugs in an unknown samples. |
| CO4 | Understand, remember, analyse, apply and evaluate | Understand the importance of data integrity and ethical practices in every steps of drugs quantification |
| CO5 | Understand, remember, analyse, apply and evaluate | Develop skills in performing the volumetric titration and handling electroanalytical instruments |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 2 | 1 | 2 | 1 | 0 |
| CO2 | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 3 | 1 | 3 | 2 | 1 | 2 | 1 | 0 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 1 | 3 | 1 | 2 | 2 | 3 | 1 | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 1 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 1 |
| Avg | 3 | 2.6 | 2.4 | 2 | 2.4 | 1.8 | 1.4 | 1 | 3 | 1.6 | 3 | 2.6 | 2 | 2.2 | 2.2 | 0.8 |

## B.PHARM. SEMESTER – I (BPH)
## SUBJECT:PHARMACEUTICAL INORGANIC CHEMISTRY-PRACTICAL(BP110P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with the monographs of inorganic drugs and pharmaceuticals.
**Objectives:**Upon completion of the course the student shall be able to

- know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- understand the medicinal and pharmaceutical importance of inorganic compounds

## B. COURSE CONTENT

| NO | TOPIC | P(Hrs) | COs |
|---|---|---|---|
| [1] | **Limit tests for following ions**<br>Limit test for Chlorides and Sulphates<br>Modified limit test for Chlorides and Sulphates<br>Limit test for Iron<br>Limit test for Heavy metals<br>Limit test for Lead<br>Limit test for Arsenic<br>**Identification test** Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate<br>**Test for purity**<br>Swelling power of Bentonite<br>Neutralizing capacity of aluminum hydroxide gel<br>Determination of potassium iodate and iodine in potassium Iodide<br>**Preparation of inorganic pharmaceuticals**<br>Boric acid Potash alum Ferrous sulphate | **60** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS (LATEST EDITION)

1. Dhake A S, Inorganic pharmaceutical chemistry, First edition,Career publications,India, 2004

## D. REFERENCE BOOKS (LATEST EDITION)

1. Ministry, India.; Indian Pharmacopoeia Commission. Indian Pharmacopoeia, 2010. Addendum 2012; Indian Pharmacopoeia Commission: Ghaziabad, 2012.
2. Anand & G.R. Chatwal, Inorganic Pharmaceutical Chemistry, India, 2010

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Apply | To study limit tests of various inorganic compounds |
| CO2 | Understand and Remember | To perform identification tests of various inorganic compounds |
| CO3 | Understand and Remember | To understand and remember the preparations of various inorganic pharmaceuticals |
| CO4 | Understand and Remember | To understand and remember the reactions involved in preparation of various inorganic pharmaceuticals |
| CO5 | Understand and Evaluate | To understand and evaluate tests for purity of various inorganic pharmaceuticals |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | - | 1 | - | 1 | 1 | - | 2 | 3 | 3 | 3 | 2 | 1 | 1 |
| CO2 | 3 | 1 | 1 | - | 1 | - | - | 1 | - | - | 3 | 3 | 2 | 2 | - | - |
| CO3 | 2 | 1 | 1 | - | 1 | - | - | 1 | - | - | 3 | 3 | 2 | - | - | 1 |
| CO4 | 2 | - | - | - | - | - | - | - | - | - | 3 | 1 | - | - | - | - |
| CO5 | 3 | 1 | 1 | - | 1 | - | 1 | 1 | 1 | - | 3 | 3 | 3 | 2 | 1 | 1 |
| Avg | 2.6 | 0.8 | 0.8 | - | 0.8 | - | 0.4 | 0.8 | 0.2 | 0.4 | 3 | 2.6 | 2 | 1.2 | 0.4 | 0.6 |

## B.PHARM. SEMESTER – I (BPH)

## SUBJECT: COMMUNICATION SKILLS -PRACTICAL (BP111P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Prac. | Total | | Ext | Sess. | CM | Prac. | Total |
| - | - | 2 | 2 | 1 | 15 | 5 | 5 | - | 25 |

## A. COURSE OVERVIEW

**Scope**:.
**Objectives:**

CO1 Understand and learn the basics of communication and apply it appropriately in professional and social context
CO2 Learn, remember and apply the key concepts of pronunciations in speaking
CO3 Display competence in oral, written, and visual communication
CO4 Learn to prepare an audience – centric presentation
CO5 Understand, Learn and apply the requisites for an effective writing skills and listening skills

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Basic communication covering the following topics**<br>Meeting People<br>Asking Questions<br>Making Friends<br>What did you do?<br><br>**Pronunciations covering the following topics**<br>Pronunciation (Consonant Sounds)<br>Pronunciation and Nouns<br>Pronunciation (Vowel Sounds)<br><br>**Advanced Learning**<br>Listening Comprehension / Direct and Indirect Speech<br>Figures of Speech<br>Effective Communication<br>Writing Skills<br>Effective Writing<br>Interview Handling Skills<br>E-Mail etiquette<br>Presentation Skills | **30** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Thomson, A. J.; Martinet, A. V. A *Practical English Grammar*; Oxford Univ. Press, 2012.
2. Fujishin, R. *The Art of Communication : Improving Your Fundamental Communication Skills*; Rowman & Littielfied: Lanham, 2016.

3. Pandey, M.; Phil, M.; Lit, E.; Lib, M. *FIRST YEAR B. PHARM. Semester I*

## D. REFERENCE BOOKS

1. Burton, L.; Dalley, D.; University Of Learning Ltd. *Developing Your Influencing Skills : A Guide to Developing the 7 Traits of Influential People*; Universe Of Learning: Great Britain, 2010.
2. Shikha Kapoor. *Personality Development and Soft Skills : Preparing for Tomorrow*; I.K. International Publishing House Pvt. Ltd: New Delhi, 2018.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and learn | Understand and learn the basics of communication and apply it appropriately in professional and social context |
| CO2 | Learn, remember and apply | Learn, remember and apply the key concepts of pronunciations in speaking |
| CO3 | Display/ Demonstrate | Display competence in oral, written, and visual communication |
| CO4 | Learn | Learn to prepare an audience – centric presentation |
| CO5 | Understand, learn and apply | Understand, Learn and apply the requisites for an effective writing skills and listening skills |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 1 | 0 | 1 | 2 | 0 | 0 | 3 | 0 |
| CO2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 3 | 0 | 0 | 2 | 0 | 0 | 3 | 0 |
| CO3 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 3 | 0 | 2 | 2 | 0 | 0 | 3 | 0 |
| CO4 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 3 | 0 | 0 | 2 | 0 | 0 | 3 | 0 |
| CO5 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 3 | 0 | 2 | 2 | 0 | 0 | 3 | 0 |
| Avg. | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 3 | 0 | 1 | 2 | 0 | 0 | 3 | 0 |

**B.PHARM. SEMESTER – I (BPH)**

**SUBJECT: REMEDIAL BIOLOGY -PRACTICAL (BP112RBP)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | - | Total |
| - | - | 2 | 2 | 1 | 15 | 5 | 5 | - | 25 |

## A. COURSE OVERVIEW

**Scope**: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

**Objectives:** Upon completion of the course, the student shall be able to

- know the classification and salient features of five kingdoms of life
- understand the basic components of anatomy & physiology of plant
- know understand the basic components of anatomy & physiology animal with special reference to human

## B. COURSE CONTENT

| NO | TOPIC | P (hrs) | COs |
|---|---|---|---|
| 1 | 1. Introduction to experiments in biology<br>a) Study of Microscope<br>b) Section cutting techniques<br>c) Mounting and staining<br>d) Permanent slide preparation<br>2. Study of cell and its inclusions<br>3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications<br>4. Detailed study of frog by using computer models<br>5. Microscopic study and identification of tissues pertinent to Stem, Root Leaf, seed, fruit and flower<br>6. Identification of bones<br>7. Determination of blood group<br>8. Determination of blood pressure<br>9. Determination of tidal volume | 30 | CO1<br>CO2 |

## C. TEXT BOOKS


1. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.
2. Kale, S. R.; Kale, R. R. Practical Human Anatomy and Physiology for First Year Diploma Course in Pharmacy; Nirali Prakashan: Pune, India, 2007.


## D. REFERENCE BOOKS

1. Kale, S. R.; Kale, R. R. Practical Human Anatomy and Physiology for First Year Diploma Course in Pharmacy; Nirali Prakashan: Pune, India, 2007.
2. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.
3. Shafi, M.J.H. Biology practical manual according to National core curriculum .Biology forum of Karnataka.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Apply, Evaluate | To understand about morphology, anatomy and physiology of plants. Study of cell and tissues. |
| CO2 | Apply, Remember, Create | To know about the anatomy and function of various parts of the body, study of cell, introduction to experiments in biology. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 1 | 3 | 2 | 3 | 3 | 3 | 1 |
| CO2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| | | | | | | | | | | | | | | | | |
| Avg | 2 | 2.5 | 2.5 | 3 | 2 | 2.5 | 2.5 | 2 | 3 | 1.5 | 3 | 2.5 | 3 | 3 | 2.5 | 1.5 |

## B.PHARM. SEMESTER – II (BPH)
## SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY II -THEORY (BP201T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

**Objectives:** Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the haematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time, etc. and also record blood pressure, heart rate, pulse and respiratory volume.
- Appreciate coordinated working pattern of different organs of each system.
- Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | **Nervous system**<br>Organization of nervous system, neuron, neuroglia, classification andproperties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters.<br>**Central nervous system:** Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity) | **10** | CO1 |
| [2] | **Digestive system**<br>Anatomy of GI Tract with special reference to anatomy and functions of stomach, ( Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.<br>**Energetics**<br>Formation and role of ATP, Creatinine Phosphate and BMR. | **06** | CO2<br>CO4 |

| | | | |
|---|---|---|---|
| [3] | **Respiratory system**<br>Anatomy of respiratory system with special reference to anatomy of lungs,mechanism of respiration, regulation of respiration. Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.<br>**Urinary system**<br>Anatomy of urinary tract with special reference to anatomy of kidney and Nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney. | **10** | CO3<br>CO4 |
| [4] | **Endocrine system**<br>Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, Adrenal gland, pancreas, pineal gland, thymus and their disorders. | **10** | C04 |
| [5] | **Reproductive system**<br>Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition<br>**Introduction to genetics**<br>Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance | **09** | CO4<br>CO5 |

## C. TEXT BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.

## D. REFERENCE BOOKS

1. Sembulingam, K. Essentials of Medical Physiology: With Free Review of Medical Physiology. Jaypee Brothers: S.L., 2019.
2. Waugh, A.; Ross, J. S.; Grant, A.; Wilson, K. J. W. Ross and Wilson Anatomy and Physiology in Health and Illness : Anne Waugh, Allison Grant ; Illustrations by Graeme Chambers.; Churchill Livingstone: Edinburgh, 2001.
3. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Tailor's Physiológical Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
4. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
5. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.
6. Singh, I. Textbook of Human Histology: (with Colour Atlas & Practical Guide); Jaypee Brothers Medical Publishers: New Delhi, 2011.
7. Ghai, C. L. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
8. Srinageswari, K.; Sharma, R. Practical workbook of Human Physiology; Jaypee brother's medical publishers, New Delhi
9. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Tailor's Physiológical Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
10. Chatterjee, C. C. Human Physiology: For Preclinical Medical and Degree Courses in Physiology; CBS Publishers & Distributors: New Delhi, 2016.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember, Understand and Apply | To know the basic fundamental structural features of neurons, mechanism of neurotransmitters along with processes of neuroconduction and neurotransmission. |
| CO2 | Remember, Understand and Apply | To understand the basic biochemical processes occurs in the body related to digestion and energy production |
| CO3 | Understand and remember | To understand the structure and basic functioning of the respiratory tract and urinary tract. |
| CO4 | Understand and remember | To know about various hormones in the body and its related disorders |
| CO5 | Understand and remember | To get knowledge about human reproductive system and its importance and know the basic genetics processes |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO2 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| Avg | 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |

## B.PHARM. SEMESTER – II (BPH)
## SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY I -THEORY (BP202T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

**Objectives:** Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

## B. COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Classification, nomenclature and isomerism**<br>Classification of Organic Compounds<br>Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds)<br>Structural isomerisms in organic compounds | **07** | CO1 |
| [2] | **Alkanes*, Alkenes* and Conjugated dienes**<br>SP3hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP2 hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E 1 verses E 2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.<br>Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement | **10** | CO2<br>CO3<br>CO4<br>CO5 |
| [3] | **Alkyl halides**<br>SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.<br>SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions<br>Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.<br>Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol | **10** | CO1<br>CO2<br>CO3<br>CO4 |
| [4] | **Carbonyl compounds**<br>Nucleophilic addition, Electromeric effect, aldol condensation, Crossed | **10** | CO1<br>CO2 |

| | | | |
|---|---|---|---|
| | Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde. | | CO3<br>CO4 |
| [5] | **Carboxylic acids**<br>Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids ,amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid<br>**Aliphatic amines** - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine | **8** | CO1<br>CO2<br>CO3<br>CO5 |

## C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

## D. REFERENCE BOOKS (LATEST EDITION)

1. Robert Thornton Morrison; Robert Neilson Boyd. Organic Chemistry. 2 : Study Guide; Allyn And Bacon: Boston, Mass., 1987.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Eduation: India, 2003.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember, Understand and Apply | Understand IUPAC nomenclature, classification and uses of selected organic compounds |
| CO2 | Understand, Apply and Analyse | Understand the fundamental concepts and principles of organic chemistry |
| CO3 | Understand and Apply | To understand reaction, mechanism and orientation of reactions |
| CO4 | Understand and Analyse | To understand the reactivity/stability of organic compounds |
| CO5 | Understand and Create | To discuss the preparation of organic compounds |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 3 | 3 | 2 | 2 | 1 | - |
| CO2 | 3 | 1 | 2 | 2 | - | - | - | 1 | 1 | - | 3 | 3 | 2 | 2 | 1 | - |
| CO3 | 3 | 1 | 2 | 2 | - | - | - | 1 | 1 | - | 3 | 3 | 2 | 2 | 1 | - |
| CO4 | 3 | 1 | 2 | 2 | - | - | - | 1 | 1 | - | 3 | 3 | 2 | 2 | 1 | - |
| CO5 | 3 | - | - | 2 | - | - | - | 1 | 1 | 3 | 3 | 3 | 2 | 3 | 1 | - |
| Avg | 3 | 0.8 | 1.2 | 2 | - | - | - | 1 | 1 | 0.6 | 3 | 3 | 2 | 2.2 | 1 | - |

## B.PHARM. SEMESTER – II (BPH)

## SUBJECT: BIOCHEMISTRY (BP203T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac. | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 04 | 04 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**:.
Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

**Objectives:** Upon completion of course student shell able to

| CO Number | Statement |
|---|---|
| CO1 | Learn and remember the basics of biomolecules and bioenergetics |
| CO2 | Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes. |
| CO3 | Understand and apply the concept of the metabolism of heme and protein molecules in physiological and pathological clinical investigation |
| CO4 | Understand and apply the concept of the metabolism of carbohydrate and nucleic acid molecules in physiological and pathological clinical investigation |
| CO5 | Understand and apply the concept of genetic transfer and the metabolism of lipids in physiological and pathological clinical investigation |

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|

| | | | |
|---|---|---|---|
| [1] | **Carbohydrate metabolism**<br><br>Glycolysis – Pathway, energetics and significance<br>Citric acid cycle- Pathway, energetics and significance<br>HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency<br>Glycogen metabolism Pathways and glycogen storage diseases (GSD)<br>Gluconeogenesis- Pathway and its significance<br>Hormonal regulation of blood glucose level and Diabetes mellitus<br><br>**Biological oxidation**<br><br>Electron transport chain (ETC) and its mechanism.<br>Oxidative phosphorylation & its mechanism and substrate level phosphorylation<br>Inhibitors ETC and oxidative phosphorylation/Uncouplers | **10** | CO2<br>CO4 |
| [2] | **Lipid metabolism**<br><br>β-Oxidation of saturated fatty acid (Palmitic acid)<br>Formation and utilization of ketone bodies; ketoacidosis<br>De novo synthesis of fatty acids (Palmitic acid)<br>Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D<br>Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.<br><br>**Amino acid metabolism**<br><br>General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders<br>Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia)<br>Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline<br>Catabolism of heme; hyperbilirubinemia and jaundice | 10 | CO2<br>CO4 |
| [3] | **Nucleic acid metabolism and genetic information transfer**<br>Biosynthesis of purine and pyrimidine nucleotides<br>Catabolism of purine nucleotides and Hyperuricemia and Gout disease<br>Organization of mammalian genome<br>Structure of DNA and RNA and their functions<br>DNA replication (semi conservative model)<br>Transcription or RNA synthesis<br>Genetic code, Translation or Protein synthesis and inhibitors | 10 | CO3<br>CO4 |

| | | | |
|---|---|---|---|
| [4] | **Biomolecules**<br><br>Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.<br><br>**Bioenergetics**<br><br>Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential.<br>Energy rich compounds; classification; biological significances of ATP and cyclic AMP | 08 | CO2<br>CO4<br>CO5 |
| [5] | **Enzymes**<br><br>Introduction, properties, nomenclature and IUB classification of enzymes<br>Enzyme kinetics (Michaelis plot, Line Weaver Burke plot)<br>Enzyme inhibitors with examples<br>Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation<br>Therapeutic and diagnostic applications of enzymes and isoenzymes<br>Coenzymes –Structure and biochemical functions | 07 | CO1 |

## C. TEXT BOOKS


1. Murray, R.; Bender, D.; Botham, K.; Kennelly, P.; Rodwell, V.; Weil, P.; York, N.; San, C.; Lisbon, F.; Madrid, L.; City, M.; Delhi, M.; Juan, S. *Twenty-Eighth Edition*..
2. U Satyanarayana. *Biochemistry*; Elsevier India: New Delhi, 2021.


## D. REFERENCE BOOKS


1. Cox, D. L. *Lehninger principles of biochemistry: International Edition.*; W H Freeman & Co Ltd: S.L., 2021..
2. Berg, J. M.; Tymoczko, J. L.; J, G.; Lubert Stryer. *Biochemistry*; W.H. Freeman/Mcmillan Learning: New York, 2019..


## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, remember, analyse, apply and evaluate | Learn and remember the basics of biomolecules and bioenergetics |
| CO2 | Understand, remember, analyse, apply and evaluate | Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes. |
| CO3 | Understand, remember, analyse, apply and evaluate | Understand and apply the concept of the metabolism of heme and protein molecules in physiological and pathological clinical investigation |

| | | |
|---|---|---|
| **CO4** | Understand, remember, analyse, apply and evaluate | Understand and apply the concept of the metabolism of carbohydrate and nucleic acid molecules in physiological and pathological clinical investigation |
| **CO5** | Understand, remember, analyse, apply and evaluate | Understand and apply the concept of genetic transfer and the metabolism of lipids in physiological and pathological clinical investigation |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 0 | 3 | 1 | 0 | 2 | 1 | 1 | 3 | 0 | 2 | 3 | 2 | 2 | 2 | 1 |
| **CO2** | 3 | 0 | 3 | 1 | 0 | 2 | 1 | 1 | 3 | 0 | 2 | 3 | 2 | 2 | 2 | 1 |
| **CO3** | 3 | 0 | 3 | 1 | 0 | 2 | 1 | 1 | 3 | 0 | 2 | 3 | 2 | 2 | 2 | 1 |
| **CO4** | 3 | 0 | 3 | 1 | 0 | 2 | 1 | 1 | 3 | 0 | 2 | 3 | 2 | 2 | 2 | 1 |
| **CO5** | 3 | 0 | 3 | 1 | 0 | 2 | 1 | 1 | 3 | 0 | 2 | 3 | 2 | 2 | 2 | 1 |
| **Avg.** | 3 | 0 | 3 | 1 | 0 | 2 | 1 | 1 | 3 | 0 | 2 | 3 | 2 | 2 | 2 | 1 |

## B.PHARM. SEMESTER – II (BPH)
## SUBJECT: PATHOPHYSIOLOGY-THEORY (BP 204T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | --- | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

**Objectives:** Upon completion of the course the student shall be able to

1. Describe the etiology and pathogenesis of the selected disease states;
2. Name the signs and symptoms of the diseases; and
3. Mention the complications of the diseases.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | Cos |
|---|---|---|---|
| [1] | **Basic principles of Cell injury and Adaptation:**<br>Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance<br>**Basic mechanism involved in the process of inflammation and repair:**<br>Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [2] | **Cardiovascular System:**<br>Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis)<br>□ **Respiratory system**: Asthma, Chronic obstructive airways diseases.<br>□ **Renal system** : Acute and chronic renal failure . | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [3] | **Haematological Diseases:**<br>Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia<br>□ **Endocrine system**: Diabetes, thyroid diseases, disorders of sex hormones<br>□ **Nervous system**: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.<br>□ **Gastrointestinal system**: Peptic Ulcer | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [4] | Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.<br>□ **Disease of bones and joints**: Rheumatoid arthritis, osteoporosis and gout<br>□ **Principles of cancer**: classification, etiology and pathogenesis of cancer<br>□ **Diseases of bones and joints**: Rheumatoid Arthritis, Osteoporosis, Gout<br>□ **Principles of Cancer**: Classification, etiology and pathogenesis of Cancer | 08 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [5] | **Infectious diseases**: Meningitis, Typhoid, Leprosy, Tuberculosis<br>Urinary tract infections<br>□ **Sexually transmitted diseases**: AIDS, Syphilis, Gonorrhea | 07 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Harsh Mohan; Damjanov, I. Textbook of Pathology; Jaypee Brothers Medical Publishers:New Delhi, 2019.
2. Walker, R.; Cate Whittlesea. Clinical Pharmacy and Therapeutics; Churchill Livingstone: Edinburgh ; New York, 2007.

1. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020
2. Walker, R.; Cate Whittlesea. Clinical Pharmacy and Therapeutics; Churchill Livingstone: Edinburgh ; New York, 2007.
3. Blumenthal, D. K.; Rollins, D. E. Workbook and Casebook for "Goodman and Gilman's the Pharmacological Basis of Therapeutics"; Mcgraw Hill: New York ; Madrid Etc, 2016.
4. Davidson's Principles and Practice of Medicine.; Elsevier Health Sciences: S.L., 2022.


## RECOMMENDED JOURNALS


1. Toner, P. G. The Journal of Pathology 1999, 187 (1), 187. https://doi.org/3.0.co;2-n">10.1002/(sici)1096-9896(199901)187:1<187::aid-path269>3.0.co;2-n.
2. Robbins, J. KCNQ Potassium Channels: Physiology, Pathophysiology, and Pharmacology. Pharmacology & Therapeutics 2001, 90 (1), 1–19. https://doi.org/10.1016/s0163-7258(01)00116-4.
3. Quiz Page. Indian Journal of Pathology and Microbiology 2015, 58 (4), 568. https://doi.org/10.4103/0377-4929.168897.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Analyse and remember | To get knowledge about the mechanism behind cell death/cell injury or cause of diseases, inflammatory processes, and Disease-associated due to dysfunctioning of the body system |
| CO2 | Remember, Understand and Apply | To know about the system and function of the body and diseases associated with the dysfunctioning of the system and symptoms of the diseases. |
| CO3 | Understand Apply and Evaluate, Analyse | To understand the mechanism behind the generation of the disease and/or cause of diseases and its symptoms. |
| CO4 | Understand, Remember, Analyse | To know about the pathway and causative agents responsible for various diseases and clinical signs of the diseases. |
| CO5 | Remember, Understand, Apply and evaluate | To get knowledge about the physiology of disease and the pathway of diseases. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 1 |
| CO2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 |
| Avg | 3 | 2.6 | 2.4 | 2.8 | 2 | 2.6 | 2.6 | 3 | 2.8 | 2.8 | 2 | 2.8 | 3 | 3 | 2.2 | 2.2 |

## B.PHARM. SEMESTER – II (BPH)
## SUBJECT:COMPUTER APPLICATIONS IN PHARMACY-THEORY (BP205T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | - | - | 3 | 3 | 50 | 15 | 10 | - | 75 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

**Objectives:** Upon completion of the course the student shall be able to

- Know the various types of application of computers in pharmacy
- Know the various types of databases
- Know the various applications of databases in pharmacy

## B. COURSE CONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | **Number system:** Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement ,Two's complement method, binary multiplication, binary division<br>**Concept of Information Systems and Software :**Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project | **06** | CO2 |
| [2] | **Web technologies**: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products<br>Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database | **06** | CO3<br>CO4 |
| [3] | **Application of computers in Pharmacy** – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System | **06** | CO1 |
| [4] | **Bioinformatics:** Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery | **06** | CO5 |
| [5] | **Computers as data analysis in Preclinical development**: Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS) | **06** | CO1 |

## C. TEXT BOOKS

1. V. Bhagat, S. Narkhede, D. Kardile, S. Shankar.*Computer Application in Pharmacy*.NiraliPrakashan, Pune. 1st Edition 2018.

## D. REFERENCE BOOKS

1. William E Fassett; Dale B Christensen. *Computer Application in Pharmacy*. Lea and Febiger, USA, 1986.
2. Sean Ekins. *Computer Application in Pharmaceutical Research and Development*. Wiley-Interscience, USA, 2006.
3. S.C. Rastogi. *Bioinformatics: Concept, Skills and Applications*. CBS Publishers and Distributors, New Delhi, 2nd Edition 2019.
4. Cary N. Prague. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath.* Wiley Dreamtech India (P) Ltd., New Delhi,

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | Understand various applications of computers in pharmacy |
| CO2 | Understand and apply | Understand and apply concept of Information Systems and Software |
| CO3 | Remember and Evaluate | Remember and evaluate various types of databases |
| CO4 | Understand and Remember | Understand and remember about Web technologies |
| CO5 | Understand and analyse | Understand and anlyse concept of Bioinformatics |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 3 | - | 2 | - | - | 1 | - | 3 | 2 | 2 | 1 | - | - |
| CO2 | 2 | 1 | 1 | 2 | - | 1 | - | - | 1 | - | 2 | 1 | 2 | 1 | - | - |
| CO3 | 1 | - | 2 | 2 | - | - | - | - | - | - | 1 | 1 | 1 | - | - | - |
| CO4 | - | - | 1 | 1 | - | - | - | 1 | - | - | 2 | 2 | 1 | - | - | - |
| CO5 | 2 | 1 | - | 3 | - | - | 1 | - | 1 | - | - | 2 | 3 | 1 | - | - |
| Avg | 1.4 | 0.8 | 1.2 | 2.2 | - | 0.6 | 0.2 | 0.2 | 0.6 | - | 1.6 | 1.6 | 1.8 | 0.6 | - | - |

## B.PHARM. SEMESTER – II (BPH)

## SUBJECT: ENVIRONMENTAL SCIENCES- THEORY (BP206T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 2 | 0 | - | 2 | 3 | 50 | 15 | 10 | - | 75 |

## A. COURSE OVERVIEW

**Scope:** Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

**Objectives:** Upon completion of the course the student shall be able to**:**

- Create the awareness about environmental problems among learners.
- Impart basic knowledge about the environment and its allied problems.
- Develop an attitude of concern for the environment.
- Motivate learner to participate in environment protection and environment improvement.
- Acquire skills to help the concerned individuals in identifying and solving environmental problems.
- Strive to attain harmony with Nature.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | The Multidisciplinary nature of environmental studies<br>Natural Resources<br>Renewable and non-renewable resources:<br>Natural resources and associated problems<br>a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources. | **10** | CO1<br>CO2 |
| [2] | Ecosystems<br>▪ Concept of an ecosystem.<br>▪ Structure and function of an ecosystem.<br>▪ Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) | **10** | CO1<br>CO2 |
| [3] | Environmental Pollution: Air pollution; Water pollution; Soil pollution | **10** | CO1<br>CO2 |

## C. TEXT BOOKS

1. S.S. Randhava, Environmental Sciences, Vikas and Company Medical Publishers, Pee vee publication, Jalandhar, 2019.
2. Prof. M. K. Gupta, Prof. Manish Jaimini, Environmental sciences,Vikas Pandey, published by Nirali Prakashan, Pune, 2018

## D. REFERENCE BOOKS

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. Environmental Biology, Nidi Publ. Ltd. Bikaner, 2001
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2001, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Analyse, create and Evaluate | To understand the Multidisciplinary nature of environmental studies, Natural Resources and associated problems and to create an attitude of concern for the environment protection and environment improvement. |
| CO2 | Remember, Analyse, Evaluate and create | To study the concept of Ecosystems, and structure & function of it, renewable and non-renewable resources and to analyse the environmental pollution. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 1 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| Avg | 2.5 | 3 | 3 | 2 | 2.5 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |

## B.PHARM. SEMESTER – II (BPH)
## SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY II - PRACTICAL (BP207P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 5 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: Practical physiology is complimentary to the theoretical discussions in physiology.
**Objectives:** Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

## B. COURSE CONTENT

| NO | TOPIC | P(Hrs) | COs |
|---|---|---|---|
| [1] | 1. To study the integumentary and special senses using specimen, models, etc.,<br>2. To study the nervous system using specimen, models, etc.,<br>3. To study the endocrine system using specimen, models, etc<br>4. To demonstrate the general neurological examination<br>5. To demonstrate the function of olfactory nerve<br>6. To examine the different types of taste.<br>7. To demonstrate the visual acuity<br>8. To demonstrate the reflex activity<br>9. Recording of body temperature<br>10. To demonstrate positive and negative feedback mechanism.<br>11. Determination of tidal volume and vital capacity.<br>12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens.<br>13. Recording of basal mass index<br>14. Study of family planning devices and pregnancy diagnosis test.<br>15. Demonstration of total blood count by cell analyser<br>16. Permanent slides of vital organs and gonads. | **60** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. Ghai, C. L. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
2. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991

## D. REFERENCE BOOKS

1. Waugh, A.; Ross, J. S.; Grant, A.; Wilson, K. J. W. Ross and Wilson Anatomy and Physiology in Health and Illness : Anne Waugh, Allison Grant ; Illustrations by Graeme Chambers.; Churchill Livingstone: Edinburgh, 2001.
2. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remember | To get knowledge about basic anatomy and physiology of the human organ systems |
| CO2 | Remember, Understand and evaluate | To know about performance of experiments like neurological reflex, body temperature measurement, body mass index, olfaction, gestation reflex and eye sight, etc. |
| CO3 | Understand Apply Evaluate and remember | To understand about procedure for measurement of various haematological parameter, evaluation and interpretation of result |
| CO4 | Understand Apply and Evaluate | To know about family planning |
| CO5 | Remember, Apply and evaluate | To know the histological structures of the body organs |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 1 | 1 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.2 | 2.2 | 3 | 3 | 3 | 2.2 | 3 | 3 | 2.6 | 2.8 | 3 | 3 | 3 | 3 | 3 |

## B.PHARM. SEMESTER – II (BPH)
## SUBJECT:PHARMACEUTICAL ORGANIC CHEMISTRY I-PRACTICAL(BP208P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with classification and nomenclature of simple organiccompounds, structural isomerism, intermediates forming in reactions, important physicalproperties, reactions and methods of preparation of these compounds. The syllabus alsoemphasizes on mechanisms and orientation of reactions.

**Objectives:** Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

## B. COURSE CONTENT

| NO | TOPIC | P (Hrs) | COs |
|---|---|---|---|
| [1] | 1. Systematic qualitative analysis of unknown organic compounds like Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.<br>2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test<br>3. Solubility test<br>4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.<br>5. Melting point/Boiling point of organic compounds<br>6. Identification of the unknown compound from the literature using melting point/ boiling point.<br>7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point.<br>8. Minimum 5 unknown organic compounds to be analysed systematically.<br>2. Preparation of suitable solid derivatives from organic compounds<br>3. Construction of molecular models | **60** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav &RoopalPrakashan,India, 2008

## D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..

2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.
3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Remember | To understand the various preliminary test for organic compounds |
| CO2 | Understand and apply | To perform nature identification test for various organic compounds |
| CO3 | Understand and evaluate | Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test |
| CO4 | Understand and evaluate | To study about various functional groups identification for organic compounds |
| CO5 | Understand & Apply | Identification of unknown organic compound from the literature using melting point/boiling point |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | - | 1 | - | - | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | 1 |
| CO2 | 3 | 1 | 2 | - | 1 | - | - | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | 1 |
| CO3 | 3 | 1 | 2 | - | 1 | - | - | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | 1 |
| CO4 | 3 | 1 | 2 | - | 1 | - | - | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | 1 |
| CO5 | 3 | 1 | 2 | - | 1 | - | - | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | 1 |
| Avg | 3 | 1 | 2 | - | 1 | - | - | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | 1 |

## B.PHARM. SEMESTER – II (BPH)
## SUBJECT: BIOCHEMISTRY PRACTICAL (BP209P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Prac. | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | | 35 | 10 | 5 | - | 50 |

## A. COURSE OVERVIEW

**Scope**:.
The scope of the subject deals with complete understanding of different qualitative test to be performed for identification of carbohydrates, lipids and proteins. It is also emphasizing on quantitative estimation of sugars and proteins, preparation of buffers and studying the activity of enzyme.

**Objectives:** Upon completion of course student shell able to

CO1 Understand, remember, learn principles and perform various tests for qualitative analysis of carbohydrates, proteins and abnormal constituent in urine.
CO2 Understand, learn and perform the quantitative test for analysis of reducing sugars and protein.
CO3 Analyse and evaluate the factors affecting enzyme activity
CO4 Understand and learn the concept of buffers
CO5 Evaluation and interpretation of data emanating from a pathological lab for various carbohydrates, lipids and protein.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch)<br>Identification tests for Proteins (albumin and Casein)<br>Qualitative analysis of urine for abnormal constituents<br>Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)<br>Determination of blood creatinine<br>Determination of blood sugar<br>Determination of serum total cholesterol<br>Preparation of buffer solution and measurement of pH<br>Study of enzymatic hydrolysis of starch.<br>Determination of Salivary amylase activity<br>Study the effect of Temperature on Salivary amylase activity.<br>Study the effect of substrate concentration on salivary amylase activity. | 60 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. G. Raval, H. Practicals in biochemistry
2. Gupta, R. C. *Practical Biochemistry*; Cbs Publishers And Distributors: New Delhi, 2006.

## D. REFERENCE BOOKS


1. Plummer David T. *An Introduction to Practical Biochemistry*; Tata Mcgraw Hill: New Delhi, 1990.
2. G Rajagopal; Es Rāmakiruṣṇan̲. *Practical Biochemistry for Medical Students*; Orient Longman ; New York, Ny: Hyderabad, 1983.
3. Varley, H. *Practical Clinical Biochemistry*; Cbs Publishers & Distributors: Delhi, 1988.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, remember, analyse, apply and evaluate | Understand, remember, learn principles and perform various test ethically for qualitative analysis of carbohydrates, proteins and abnormal constituent in urine. |
| CO2 | Understand, remember, analyse, apply and evaluate | Understand, learn and perform the quantitative test for analysis of reducing sugars and protein. |
| CO3 | Understand, remember, analyse, apply and evaluate | Analyse and evaluate the factors affecting enzyme activity |
| CO4 | Understand, remember, analyse, apply and evaluate | Understand and learn the concept of buffers |
| CO5 | Understand, remember, analyse, apply and evaluate | Evaluation and interpretation of data emanating from a pathological lab for various carbohydrates, lipids and protein. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 0 | 3 | 1 |
| CO2 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 0 | 3 | 1 |
| CO3 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 0 | 3 | 1 |
| CO4 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 0 | 3 | 1 |
| CO5 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 0 | 3 | 1 |
| | | | | | | | | | | | | | | | | |
| Avg. | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 0 | 3 | 1 |

## B.PHARM. SEMESTER – II (BPH)
## SUBJECT:COMPUTER APPLICATIONS IN PHARMACY-PRACTICAL(BP210P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 2 | 2 | 1 | 15 | 5 | 5 | - | 25 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

**Objectives:** Upon completion of the course the student shall be able to

- Know the various types of office tools and their applications
- Create he various databases
- Know the various applications of databases in pharmacy

## B. COURSE CONTENT

| NO | TOPIC | P (Hrs) | CO |
|---|---|---|---|
| [1] | 1. Design a questionnaire using a word processing package to gather information about a particular disease.<br>2. Create a HTML web page to show personal information<br>3. Retrieve the information of a drug and its adverse effects using online tools<br>4. Creating mailing labels Using Label Wizard , generating label in MS WORD<br>5. Create a database in MS Access to store the patient information with the required fields Using access<br>6. Design a form in MS Access to view, add, delete and modify the patient record in the database<br>7. Generating report and printing the report from patient database<br>8. Creating invoice table using – MS Access<br>9. Drug information storage and retrieval using MS Access<br>10. Creating and working with queries in MS Access<br>11. Exporting Tables, Queries, Forms and Reports to web pages<br>12. Exporting Tables, Queries, Forms and Reports to XML pages | **60** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. V. Bhagat, S. Narkhede, D. Kardile, S. Shankar.*Computer Application in Pharmacy*.NiraliPrakashan, Pune. 1st Edition 2018.


## D. REFERENCE BOOKS


1. William E Fassett; Dale B Christensen. *Computer Application in Pharmacy*. Lea and Febiger, USA, 1986.

2. Sean Ekins. *Computer Application in Pharmaceutical Research and Development*. Wiley-Interscience, USA, 2006.
3. S.C. Rastogi. *Bioinformatics: Concept, Skills and Applications*. CBS Publishers and Distributors, New Delhi, 2nd Edition 2019.
4. Cary N. Prague. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath.* Wiley Dreamtech India (P) Ltd., New Delhi,

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand and Apply | Understand basic tools of MS Word, MS Excel and MS Power point and apply them to create documents. |
| **CO2** | Remember, Understand and Create | Remember and Understand HTML tags and create HTML web page. |
| **CO3** | Create | Create mailing labels Using Label Wizard, generating label in MS WORD |
| **CO4** | Design | Design questionnaire/reports using a word processing package to gather information about a particular disease. |
| **CO5** | Understand and Apply | Understand tools of MS Access and apply in creating database, queries, relationship and reports from patient database |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | - | 1 | 2 | - | - | - | 2 | - | - | 1 | 1 | 2 | - | - | - |
| **CO2** | - | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | - | - | - | 1 | - | - | - | 1 | - | - | 1 | 1 | - | - | 1 | - |
| **CO4** | 1 | - | 1 | 2 | - | - | - | 1 | 1 | - | - | 1 | 1 | - | - | - |
| **CO5** | 1 | - | 1 | 2 | - | - | - | - | - | - | - | 1 | - | - | - | - |
| **Avg** | 0.6 | - | 0.6 | 1.6 | - | - | - | 0.8 | 0.2 | - | 0.4 | 0.8 | 0.6 | - | 0.2 | - |

## B.PHARM. SEMESTER – III (BPH)
## SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY II -THEORY (BP301T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

**Objectives:** Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- prepare organic compounds

## B. COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

| NO | TOPIC | L (hrs) | Cos |
|---|---|---|---|
| [1] | **Benzene and its derivatives**<br>**A.** Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule<br>**B.** Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel crafts alkylation- reactivity, limitations, Friedel crafts acylation.<br>**C.** Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction<br>**D.** Structure and uses of DDT, Saccharin, BHC and Chloramine | **10** | CO1<br>CO2<br>CO4<br>CO5 |
| [2] | **Phenols* -** Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols<br>**Aromatic Amines* -** Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts<br>**Aromatic Acids* –** Acidity, effect of substituents on acidity and important reactions of benzoic acid. | **10** | CO1<br>CO2<br>CO4<br>CO5 |
| [3] | **Fats and Oils**<br>a. Fatty acids – reactions.<br>b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.<br>c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination. | **10** | CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [4] | **Polynuclear hydrocarbons:**<br>a. Synthesis, reactions<br>b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives | **8** | CO1<br>CO2<br>CO4<br>CO5 |
| [5] | **Cyclo alkanes***<br>Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only | **7** | CO2<br>CO4<br>CO5 |

## C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

## D. REFERENCE BOOKS (LATEST EDITION)

1. Robert Thornton Morrison; Robert Neilson Boyd. Organic Chemistry. 2 : Study Guide; Allyn And Bacon: Boston, Mass., 1987.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Eduation: India, 2003.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember, Understand and Apply | Remember structure and uses of selected organic compounds |
| CO2 | Remember, Understand and Apply | Understand the basic concepts and reactivity/stability of aromatic compounds and cycloalkanes |
| CO3 | Remember, Understand and Analyse | Describe properties, reactions and analysis of fats and oils |
| CO4 | Remember, Understand and Apply | Discuss methods of reactions of selected compounds and functional groups. |
| CO5 | Remember, Understand and Create | Discuss methods of preparation of selected compounds and functional groups. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 2 | 1 | 1 | - | 1 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 1 |
| CO2 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | 3 | 2 | 3 | 3 | 3 | 1 | 1 | 1 |
| CO3 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 1 | 1 |
| CO4 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 1 | 1 |
| CO5 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 1 | 1 |
| Avg | 3 | 1 | 1 | 1.2 | 1 | 1 | - | 1 | 2.6 | 2 | 3 | 3 | 3 | 2 | 1 | 1 |

## B.PHARM. SEMESTER – III (BPH)
## SUBJECT: PHYSICAL PHARMACEUTICS I-THEORY (BP302T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

**Objectives:** Upon completion of the course the student shall be able to

1. Understand various physicochemical properties of drug molecules in thedesigning the dosage forms
2. Know the principles of solubility, pH &buffers to use them for designing of formulations

## B. COURSE CONTENT

| NO | TOPIC | L(hrs) | COs |
|---|---|---|---|
| [1] | **Solubility of drugs:** Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partiallymiscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications | **10** | CO1<br>CO4 |
| [2] | **States of Matter and properties of matter:** State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation, critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid crystalline, amorphous & polymorphism.<br>**Physicochemical properties of drug molecules:** Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications | **10** | CO1<br>CO2<br>CO3<br>CO4 |
| [3] | **Surface and interfacial phenomenon:** Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface. | **10** | CO4 |
| [4] | **Complexation and protein binding:** Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants | **08** | CO3<br>CO5 |
| [5] | **pH, buffers and Isotonic solutions:** Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions. | **07** | CO4<br>CO5 |

## C. TEXT BOOKS

1. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: VallabhPrakashan. 2000.

## D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Analyse | Understand and analyse the basic principles of solubility, partition coefficient and states of matter |
| CO2 | Remember, Evaluate and apply | Remember and evaluate various physicochemical properties of drug molecules and apply in the designing the dosage form |
| CO3 | Understand and Apply | Understand and apply physical principles of states of matter, complexation and protein binding. |
| CO4 | Remember and evaluate | Remember and evaluate the methods of measurement of various properties of solids, liquids and solutions. |
| CO5 | Understand | Understand the importance and role of surfactants, complexation, interfacial phenomenon and adsorption as well as pH and buffers in pharmaceutical dosage forms and maintaining stability |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 3 | 2 | 3 | 1 | 1 |
| CO2 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 1 |
| CO3 | 3 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 1 | 2 | 2 | 1 |
| CO4 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 2 |
| CO5 | 3 | 0 | 0 | 2 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 1 | 1 |
| Avg | 3 | 0.8 | 1 | 1 | 0.8 | 0.6 | 0.8 | 0.6 | 1 | 1.2 | 1 | 3 | 1.8 | 2 | 1.4 | 1.2 |

## B.PHARM. SEMESTER – III (BPH)
## SUBJECT: PHARMACEUTICAL MICROBIOLOGY-THEORY (BP303T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: Course enables the student to learn all categories of microorganisms especially for the production of alcohol, antibiotics, vaccines, vitamins, enzymes etc.
**Objectives:** Upon completion of the course the student shall be able to understand the concepts related to various microorganisms, sterility testing and its application in pharmaceutical industries.

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | Introduction, history of microbiology, its branches, scope and its importance.<br>Introduction to Prokaryotes and Eukaryotes<br>Study of ultrastructure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count).<br>Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy. | **10** | CO1 |
| [2] | Identification of bacteria using staining techniques (simple, Gram's &Acid fast staining) and biochemical tests (IMViC).<br>Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization.<br>Evaluation of the efficiency of sterilization methods.<br>Equipment employed in large scale sterilization.<br>Sterility indicators. | **10** | CO2<br>CO3 |
| [3] | Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses.<br>Classification and mode of action of disinfectants<br>Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions<br>Evaluation of bactericidal & Bacteriostatic.<br>Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP. | **10** | CO5 |
| [4] | Designing of aseptic area, laminar flow equipment; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.<br>Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids.<br>Assessment of a new antibiotic. | **08** | CO2<br>CO5 |
| [5] | Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, | **07** | CO4 |

| | | | |
|---|---|---|---|
| | assessment of microbial contamination and spoilage.<br>Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.<br>Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures.<br>Application of cell cultures in pharmaceutical industry and research. | | |

## C. TEXT BOOKS

1. Pelczar, M. J.; Chan, E. C. S.; Krieg, N. R. *Microbiology*; Tata Mcgraw-Hill: New Delhi, 2010.

## D. REFERENCE BOOKS

1. Denyer, S. P.; Hodges, N. A.; Gorman, S. P.; Hugo, W. B.; Russell, A. D. *Pharmaceutical Microbiology*; Blackwell Science: Malden, 2004.
2. Prescott; Dunn. *Industrial Microbiology*, 4th edition.; CBS Publishers & Distributors, Delhi.
3. Denyer, S. P.; Hugo, W. B. *Hugo and Russell's Pharmaceutical Microbiology*; Wiley-Blackwell: Chichester, West Sussex, Uk ; Hoboken, Nj, 2011.
4. Rose, A. H. *Industrial Microbiology*; Butterworths: London, 1961.
5. Probisher; Hinsdill. *Fundamentals of Microbiology*, 9th ed.; Japan.
6. Cooper, J. W.; Gunn, C.; Sidney James Carter. *Cooper and Gunn's Tutorial Pharmacy*; Cbs Publishers: Editorial: New Delhi, 2005.
7. Peppler, H. J.; Perlman, D. *Microbial Technology.*; New York, Etc., Academic P, 1979.
8. I.P., B.P., U.S.P.- latest editions.
9. Edward Alcamo. *Fundamentals of Microbiology*; Jones And Bartlett: Sudbury, Mass., 2001.
10. Jain, N. K. *Pharmaceutical Microbiology.*; Vallabh Prakashan: Delhi, 2001.
11. Brenner, D. J.; Krieg, N. R.; Staley, J. T.; Garrity, G. M. *Bergey's Manual of Systematic Bacteriology. Volume Two, the Proteobacteria. Part A, Introductory Essays. Part B, the Gammaproteobacteria. Part C, the Alpha-, Beta-, Delta-, and Epsilonproteobacteria*; Springer: New York, 2005.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand Apply and Evaluate | To Understand methods of identification, cultivation and preservation of various microorganisms |
| CO2 | Remember, Understand and Evaluate | To understand the importance and implementation of sterilization in pharmaceutical processing and industry |
| CO3 | Understand Apply and Evaluate | To Understand the cell culture technology and its applications in pharmaceutical industries |
| CO4 | Understand and Remember | To understand structure and growth of bacteria, virus and fungi |
| CO5 | Understand Apply and Evaluate | To perform and evaluate microbial assay of various antibiotics and vitamin |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 0 | 2 | 0 | 3 | 2 | 3 | 3 | 3 | 1 | 3 | 2 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | - | 2 | 3 | 2 | 2 | 0 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 1 | 3 | 2 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Avg** | 3 | 2 | 2.6 | 2.8 | 1.6 | 2.4 | 1.6 | 2.6 | 2 | 2.8 | 2.8 | 3 | 2.2 | 3 | 2.4 | 3 |

## B.PHARM. SEMESTER – III (BPH)

## SUBJECT: PHARMACEUTICAL ENGINEERING - THEORY (BP304T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

**Objectives:** Upon completion of the course student shall be able:

1. To know various unit operations used in Pharmaceutical industries.
2. To understand the material handling techniques.
3. To perform various processes involved in pharmaceutical manufacturing process.
4. To carry out various test to prevent environmental pollution.
5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.
6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Flow of fluids:** Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.<br>**Size Reduction:** Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.<br>**Size Separation:** Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank. | 10 | CO1<br>CO4 |
| [2] | **Heat Transfer:** Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.<br>**Evaporation:** Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.<br>**Distillation:** Basic Principles and methodology of simple distillation,flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation | 10 | CO2<br>CO3 |
| [3] | **Drying:** Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer. | 08 | CO4<br>CO1 |

| | | | |
|---|---|---|---|
| | **Mixing:** Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier | | |
| [4] | **Filtration:** Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.<br>**Centrifugation:** Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge. | 8 | CO5<br>CO1<br>CO3 |
| [5] | **Materials of pharmaceutical plant construction, Corrosion and its prevention:** Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems. | 7 | CO4<br>CO3 |

## C. TEXT BOOKS


1. C V S Subrahmanyam; J Thimma Setty; Suresh, S.; V Kusum Devi. Pharmaceutical Engineering : Principles and Practices.; Vallabh Prakashan: Delhi, 2002.
2. C V S Shubramanyam. Pharmaceutical Engineering : Unit Operations - II; Vallabh Prakashan: Delhi, 2014.


## D. REFERENCE BOOKS


1. Badger, W. L. Introduction to Chemical Engineering; Mc Graw Hill: Auckland, 1987.
2. Cooper, J. W.; Gunn, C.; Sidney James Carter. Cooper and Gunn's Tutorial Pharmacy; Cbs Publishers: Editorial: New Delhi, 2005.
3. Joseph Price Remington; Eric Wentworth Martin. Remington's Practice of Pharmacy Easton, Pa. Mack, 1961.
4. Khar, R. K.; Vyas, S. P.; Ahmad, F. J.; Jain, G. K. Lachman/Lieberman's the Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributor, Repr: New Delhi, 2015.
5. Mccabe, W. L.; Smith, J. C.; Harriott, P. Unit Operations of Chemical Engineering; Chennai Mcgraw-Hill Education (India) Private Limited, 2014.
6. Simpson, N. J. K. Solid-Phase Extraction Principles, Techniques, and Applications; New York, N.Y. Dekker, 2000.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember and Understand | To understand and remember the various unit operations used in Pharmaceutical industries for size reduction, separation and fluid flow, drying, mixing, filtration, centrifugation. |
| CO2 | Understand | To understand and remember the various unit operations used in Pharmaceutical industries involving heat transfer principles. |
| CO3 | Apply and Evaluate | To perform various processes involved in pharmaceutical manufacturing processes such as distillation, evaporation, filtration. |
| CO4 | Understand and apply | To perform various operation involving drying, flow of fluid and to appreciate and comprehend significance of plant lay out design for optimum use of resources and to carry out various test to prevent environmental pollution and various preventive methods used for corrosion control |
| CO5 | Apply and evaluate | To perform various separation processes involving filtration and centrifugation and material of plant construction. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 1 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 2 | 3 | 2 |
| CO4 | 3 | 1 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO5 | 3 | 1 | 2 | 3 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 1 | 3 |
| Avg | 3 | 1.4 | 2.4 | 3 | 1.6 | 1.4 | 1.2 | 1.8 | 1.6 | 2.4 | 2.6 | 3 | 2.8 | 2.6 | 2.2 | 2.6 |

| PSO No | PSO for B. Pharm | BP304T.1 | BP304T.2 | BP304T.3 | BP304T.4 | BP304T.5 | Average |
|---|---|---|---|---|---|---|---|
| PSO 1 | To prepare graduate for careers in various pharmaceutical industry and/ or institute and /or Health care system by providing real time curriculum teaching and exposure to industrial training. | 3 | 3 | 3 | 3 | 3 | **3** |
| PSO 2 | To motivate graduate to learn and adapt constantly developing trends in pharmaceutical science and healthcare. | 3 | 3 | 3 | 2 | 3 | **2.8** |
| PSO 3 | To ingress student with fundamental knowledge in science, formulation technology, synthetic knowledge, Discovery tools and pharmacology as per the requirement of Pharmaceutical sectors. | 3 | 3 | 2 | 2 | 3 | **2.6** |
| PSO 4 | To strengthen the professional and ethical attitude, communication skills, teamwork skills, multidisciplinary learning and research approach, and an ability to relate pharmaceutical sciences issues to broader social context. | 3 | 2 | 3 | 2 | 1 | **2.2** |
| PSO 5 | Act responsibly towards environment, follow ethical principles, be able to comprehend, interpret and apply laws pertinent to all spheres of pharmaceutical and allied domains. | 3 | 2 | 2 | 3 | 3 | **2.6** |

## B.PHARM. SEMESTER – III (BPH)
## SUBJECT:PHARMACEUTICAL ORGANIC CHEMISTRY II-PRACTICAL(BP305P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

**Objectives:**Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- prepare organic compounds

## B. COURSE CONTENT

| NO | TOPIC | P(Hrs) | COs |
|---|---|---|---|
| [1] | **Experiments involving laboratory techniques**<br>• Recrystallization<br>• Steam distillation<br><br>**Determination of following oil values (including standardization of reagents)**<br>• Acid value<br>• Saponification value<br>• Iodine value<br><br>**Preparation of compounds**<br>• Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction.<br>• 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/ Acetanilide by halogenation (Bromination) reaction. 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.<br>• Benzoic acid from Benzyl chloride by oxidation reaction.<br>• Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction. Benzil from Benzoin by oxidation reaction.<br>• Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction<br>• Cinnammic acid from Benzaldehyde by Perkin reaction, *P*-Iodo benzoic acid from *P*-amino benzoic acid | 60 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav &RoopalPrakashan,India, 2008

## D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.
3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Apply | To understand the experimental laboratory techniques |
| CO2 | Understand and Remember | Determination of oils values for fats and oils |
| CO3 | Understand and Apply | To study the name of the reaction involved in the organic compound |
| CO4 | Understand and Remember | To understand the preparation of organic compound |
| CO5 | Understand & Evaluate | To perform the purification of compound |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | 1 | 1 | - | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 3 | 1 | 1 |
| CO2 | 3 | 1 | 2 | 1 | 1 | - | 1 | 1 | 3 | 1 | 2 | 2 | 3 | 3 | 1 | 1 |
| CO3 | 3 | 1 | 2 | 1 | 1 | - | - | 1 | 3 | 2 | 1 | 2 | 3 | 2 | 1 | 1 |
| CO4 | 3 | 1 | 2 | 1 | 1 | - | 1 | 1 | 3 | 1 | 2 | 2 | 3 | 2 | 1 | 1 |
| CO5 | 3 | 1 | 2 | 1 | 1 | - | 1 | 1 | 3 | 2 | 1 | 2 | 3 | 3 | 1 | 1 |
| Avg | 3 | 1 | 2 | 1 | 1 | - | 0.8 | 1 | 2.8 | 1.4 | 1.4 | 2 | 3 | 2.6 | 1 | 1 |

## B.PHARM. SEMESTER – III (BPH)
## SUBJECT:PHYSICAL PHARMACEUTICS I-PRACTICAL(BP306P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 5 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: The course deals with the various physical and physicochemical properties, and principals involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

**Objectives:** Upon completion of the course the student shall be able to

- Know and determine physical properties such as solubility, surface tension, partition coefficient and pKa and apply in the design of dosage forms.
- Know the principles of solubility, pH &buffers to use them for designing of formulations

## B. COURSE CONTENT

| NO | TOPIC | P (Hrs) | COs |
|---|---|---|---|
| [1] | 1. Determination the solubility of drug at room temperature<br>2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation<br>3. Determination of Partition co- efficient of benzoic acid in benzene and water<br>4. Determination of Partition co- efficient of Iodine in $CCl_4$ and water<br>5. Determination of % composition of NaCl in a solution using phenol-water system by CST method<br>6. Determination of surface tension of given liquids by drop count and drop weight method<br>7. Determination of HLB number of a surfactant by saponification method<br>8. Determination of Freundlich and Langmuir constants using activated char coal<br>9. Determination of critical micellar concentration of surfactants<br>10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method<br>11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method | 60 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Sen, K. K., Dutta, S. K. A Laboratory Manual of Physical Pharmaceutics. India: PharmaMed Press. 2019.

## D. REFERENCE BOOKS


1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.
8. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Evaluate and Apply | Understand and evaluate physical properties such as solubility, surface tension, partition coefficient and pKa and apply in the design of dosage forms. |
| CO2 | Understand and apply | Understand and apply Henderson – Hasselbalch equation for determination of pKa value of drugs. |
| CO3 | Understand and Evaluate | Understand and evaluate the HLB value and critical micellar concentration of a surfactant. |
| CO4 | Understand and Evaluate | Understand adsorption isotherms and determine Freundlich-Langmuir adsorption isotherm. |
| CO5 | Evaluate | Evaluate the stability constants of complexes by various methods. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | 1 | - | - | - | - | - | 1 | - | - | 3 | - | 3 | - | - |
| CO2 | 3 | - | 1 | - | - | - | - | - | 1 | - | - | 3 | - | 3 | - | - |
| CO3 | 3 | - | 1 | - | - | - | - | - | 1 | - | - | 3 | - | 3 | - | - |
| CO4 | 3 | - | 1 | - | - | - | - | - | 1 | - | - | 3 | - | 3 | - | - |
| CO5 | 3 | - | 1 | - | - | - | - | - | 1 | - | - | 3 | - | 3 | - | - |
| | | | | | | | | | | | | | | | | |
| Avg | 3 | - | 1 | - | - | - | - | - | 1 | - | - | 3 | - | 3 | - | - |

## B.PHARM. SEMESTER – III (BPH)
## SUBJECT:PHARMACEUTICAL MICROBIOLOGY-PRACTICAL(BP307P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 5 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: Course enables the student to learn all categories of microorganisms especially for the production of alcohol, antibiotics, vaccines, vitamins enzymes etc..
**Objectives:** Upon completion of the course the student shall be able to

- Understand methods of identification, cultivation and preservation of various microorganisms.
- To understand the importance and implementation of sterilization in pharmaceutical processing and industry
- Learn sterility testing of pharmaceutical products.
- Carried out microbiological standardization of Pharmaceuticals.
- Understand the cell culture technology and its applications in pharmaceutical industries.

## B. COURSE CONTENT

| NO | TOPIC | P(Hrs) | COs |
|---|---|---|---|
| [1] | 1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.<br>2. Sterilization of glassware, preparation and sterilization of media.<br>3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.<br>4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical).<br>5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques<br>6. Microbiological assay of antibiotics by cup plate method and other methods<br>7. Motility determination by Hanging drop method.<br>8. Sterility testing of pharmaceuticals.<br>9. Bacteriological analysis of water<br>10. Biochemical test. | 60 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

(1) Arora, B.; Arora, D. R. *Practical Microbiology*; Cbs Publishers & Distributors, Pvt Ptd: New Delhi, 2020.

## D. REFERENCE BOOKS

(1) G Sirockin; Cullimore, S. *Practical Microbiology*; London Mcgraw-Hill C, 1969.
(2) Pelczar, M. J.; Chan, E. C. S.; Krieg, N. R. *Microbiology*; Tata Mcgraw-Hill: New Delhi, 2010.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand Apply and Evaluate | To perform and Evaluate sterility testing of pharmaceutical products. |
| CO2 | Understand Apply and Evaluate | To perform microbiological standardization of Pharmaceuticals. |
| CO3 | Understand Apply and Evaluate | To perform staining techniques for different microbes |
| CO4 | Understand Apply and Evaluate | To evaluate motility of microorganism |
| CO5 | Understand Apply and Evaluate | To perform microbial assay of antibiotics |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 1 |
| CO4 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| Avg | 3 | 3 | 3 | 2.4 | 1 | 1 | 2 | 2.4 | 2.2 | 2.4 | 1.8 | 2.4 | 2.2 | 3 | 2 | 2 |

**B.PHARM. SEMESTER – III (BPH)**
**SUBJECT: PHARMACEUTICAL ENGINEERING I -PRACTICAL (BP308P)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | - | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 5 | - | 50 |

## A. COURSE OVERVIEW

**Scope:** This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.
**Objectives:** Upon completion of the course student shall be able:
1. To know various unit operations used in Pharmaceutical industries.
2. To understand the material handling techniques.
3. To perform various processes involved in pharmaceutical manufacturing process.
4. To carry out various test to prevent environmental pollution.
5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.
6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

## B. COURSE CONTENT

| NO | TOPIC | P (hrs) | COs |
|---|---|---|---|
| [1] | 1. Determination of radiation constant of brass, iron, unpainted and painted glass.<br>2. Steam distillation – To calculate the efficiency of steam distillation.<br>3. To determine the overall heat transfer coefficient by heat exchanger.<br>4. Construction of drying curves (for calcium carbonate and starch).<br>5. Determination of moisture content and loss on drying.<br>6. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.<br>7. Description of Construction working and application of Pharmaceutical<br>8. Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill,de humidifier.<br>9. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.<br>10. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.<br>11. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such othermajor equipment.<br>12. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity<br>13. To study the effect of time on the Rate of Crystallization.<br>14. To calculate the uniformity Index for given sample by using Double Cone Blender. | **60** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. Momin M, Mehta T, Practical Manual of Pharmaceutical Engineering, B.S. Shah Prakashan, Ahmedabad, Gujarat, 2002.

## D. REFERENCE BOOKS

1. C V S Shubramanyam. Pharmaceutical Engineering : Unit Operations - II; Vallabh Prakashan: Delhi, 2014.
2. C V S Subrahmanyam; J Thimma Setty; Suresh, S.; V Kusum Devi. Pharmaceutical Engineering : Principles and Practices.; Vallabh Prakashan: Delhi, 2002.
3. Badger, W. L. Introduction to Chemical Engineering; Mc Graw Hill: Auckland, 1987.
4. Cooper, J. W.; Gunn, C.; Sidney James Carter. Cooper and Gunn's Tutorial Pharmacy; Cbs Publishers: Editorial: New Delhi, 2005.

## E. COURSE OUTCOMES

(Minimum 5 COs are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remember | To understand and convert the values of factors in different units to perform various unit operations in Pharmaceutical industries. |
| CO2 | Apply | To perform basic unit operations such as filtration, centrifugation, drying etc. |
| CO3 | Evaluate | To check the effect of various processing parameters on different unit operations. |
| CO4 | Apply | To create plant lay out design for optimum use of resources and to carry out various tests to prevent environmental pollution. |
| CO5 | Apply and evaluate | To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 1 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 1 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| 1.2 | | | | | | | | | | | | | | | | |
| Avg | 3 | 2.2 | 3 | 3 | 1.8 | 1.8 | 1.2 | 2 | 2 | 1.8 | 3 | 3 | 3 | 2.4 | 2.2 | 2.2 |

## B. PHARM. SEMESTER – VII (BPH)
## SUBJECT:INTRODUCTION TO YOGA (BP309P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 2 | 2 | - | - | - | - | - | - |

* Non-University Examination with grading satisfactory/ unsatisfactory

## A. COURSE OVERVIEW

**Scope**: This subject is designed to impart basic knowledge and practical skill of Yoga

**Objectives:**Upon completion of the course student shall be able

- To introduce the student to the fundamentals of a Yoga practice in a safe, supportive and academic environment.
- To learn proper body alignment & the basics of breathing techniques (pranayama)
- To understand various forms of yoga mediation& yogic asanas.

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) |
|---|---|---|
| [1] | TRAINING IN YOGIC ASANAS, PRANAYAMS AND MUDRAS<br>– Kapalbhati, Anulom-vilom, Pranayam, Omkar Pranayam, Bharmari, Pranayam, Body Roration, Shavasan, Suryanamaskar,<br>– Asans for Meditaion: Padmasan, Swastikasan, Siddhasan, Bhadrasan, Vajrasan, Makarasan, Savasan.<br>– Asans to be performed in Standing Position: Trikonasan, Pervatasan, Utkatukasan, Hastpadsan<br>– Asans to be performed while lying in Supine position: Servangasan, Halasan, Savasan, Kosthavishramasan, Matshendrasan, Suptavajrasan<br>– Asans to be performed while lying in Prone position: Uttanpadasan, Uttanadhasan, Serpasan, Bhujasan, Salabhasan, Dhanurasan, Makarasan<br>– Asans to be performed in sitting position: Pavanmuktasan, Hastapadasan, Vajrasan, Ardhamatshyendrasan, Shishuasan, Saptamudrasan, Gomukhasan.<br>– Yoga Mudras (Seven Types) | 30 |

## B.PHARM. SEMESTER – IV (BPH)
## SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY III -THEORY (BP401T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

**Objectives:** At the end of the course, the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

## B. COURSE CONTENT

To emphasize on definition, types, mechanisms, examples, uses/applications

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Stereo isomerism**<br>Optical isomerism –<br>Optical activity, enantiomerism, diastereoisomerism, meso compounds<br>Elements of symmetry, chiral and achiral molecules<br>DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers<br>Reactions of chiral molecules<br>Racemic modification and resolution of racemic mixture.<br>Asymmetric synthesis: partial and absolute | **10** | CO1<br>CO2 |
| [2] | Geometrical isomerism<br>Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems)<br>Methods of determination of configuration of geometrical isomers.<br>Conformational isomerism in Ethane, n-Butane and Cyclohexane.<br>Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity.<br>Stereospecific and stereoselective reactions | **10** | CO1<br>CO2 |
| [3] | **Heterocyclic compounds:**<br>Nomenclature and classification<br>Synthesis, reactions and medicinal uses of following compounds/derivatives<br>Pyrrole, Furan, and Thiophene<br>Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene | **10** | CO3<br>CO4 |
| [4] | Synthesis, reactions and medicinal uses of following compounds/derivatives<br>Pyrazole, Imidazole, Oxazole and Thiazole.<br>Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine<br>Synthesis & medicinal uses of Pyrimidine, Purine, azepines and their dvts | **8** | CO3<br>CO4 |

| | | | |
|---|---|---|---|
| [5] | **Reactions of synthetic importance**<br>Metal hydride reduction (NaBH 4 and LiAlH 4 ), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.<br>Oppenauer-oxidation and Dakin reaction.<br>Beckmanns rearrangement and Schmidt rearrangement.<br>Claisen-Schmidt condensation | **7** | CO5 |

## C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

## D. REFERENCE BOOKS (LATEST EDITION)

1. Bansal R, Heterocyclic Chemistry; New Age International (P) Limited, Publishers: New Delhi, 2014.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Eduation: India, 2003.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember, Understand and Apply | Understand stereochemical aspects of organic compounds |
| CO2 | Remember, Understand and Apply | Describe stereoisomerism and stereochemical reactions |
| CO3 | Remember, Understand and Apply | Remember nomenclature and medicinal uses of heterocyclic compounds |
| CO4 | Remember, Understand and Apply | Discuss important methods of synthesis and/or chemical reactions of selected heterocyclic rings |
| CO5 | Understand, Analyse and Create | Explain various reactions of synthetic importance |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | - | 3 | 3 | 2 | 3 | 1 | 1 |
| CO2 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | - | 3 | 3 | 2 | 3 | 1 | 1 |
| CO3 | 3 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | - | 3 | 3 | 2 | 3 | 1 | 1 |
| CO4 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 1 | 1 |
| CO5 | 3 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | - | 3 | 3 | 3 | 3 | 2 | 1 |
| Avg | 3 | 1 | 1 | 2.6 | 1 | 1 | 1 | 1 | 1 | 0.2 | 3 | 3 | 2.4 | 3 | 1.2 | 1 |

## B.PHARM. SEMESTER – IV (BPH)
## SUBJECT: MEDICINAL CHEMISTRY I -THEORY (BP402T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

**Objectives:** Upon completion of the course the student shall be able to

1. understand the chemistry of drugs with respect to their pharmacological activity
2. understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. know the Structural Activity Relationship (SAR) of different class of drugs
4. write the chemical synthesis of some drugs

## B. COURSE CONTENT

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

| NO | TOPIC | L (hrs) | Cos |
|---|---|---|---|
| [1] | **Introduction to Medicinal Chemistry**<br>**History and development of medicinal chemistry**<br>**Physicochemical properties in relation to biological action**<br>Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.<br>**Drug metabolism**<br>Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects. | **10** | CO1 |
| [2] | **Drugs acting on Autonomic Nervous System**<br>**Adrenergic Neurotransmitters:**<br>Biosynthesis and catabolism of catecholamine.<br>Adrenergic receptors (Alpha & Beta) and their distribution.<br>**Sympathomimetic agents: SAR of Sympathomimetic agents**<br>Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.<br>● Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine.<br>● Agents with mixed mechanism: Ephedrine, Metaraminol.<br>**Adrenergic Antagonists:**<br>**Alpha adrenergic blockers:** Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.<br>**Beta adrenergic blockers:** SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol. | **10** | CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [3] | **Cholinergic neurotransmitters:**<br>Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.<br>**Parasympathomimetic agents: SAR of Parasympathomimetic agents**<br>**Direct acting agents:** Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.<br>**Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible):** Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.<br>**Cholinesterase reactivator:** Pralidoxime chloride.<br>**Cholinergic Blocking agents: SAR of cholinolytic agents**<br>**Solanaceous alkaloids and analogues:** Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.<br>**Synthetic cholinergic blocking agents:** Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride. | **10** | CO2<br>CO3<br>CO4<br>CO5 |
| [4] | **Drugs acting on Central Nervous System**<br>**A. Sedatives and Hypnotics:**<br>**Benzodiazepines:** SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem<br>**Barbiturtes:** SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital<br>**Miscelleneous:** Amides & imides: Glutethmide. Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.<br>**B. Antipsychotics**<br>**Phenothiazeines:** SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.<br>**Ring Analogues of Phenothiazeines:** Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.<br>**Fluro buterophenones:** Haloperidol, Droperidol, Risperidone.<br>**Beta amino ketones:** Molindone hydrochloride.<br>**Benzamides:** Sulpieride.<br>**C. Anticonvulsants:** SAR of Anticonvulsants**,** mechanism of anticonvulsant action<br>**Barbiturates**: Phenobarbitone, Methabarbital. **Hydantoins:** Phenytoin*, Mephenytoin, Ethotoin **Oxazolidine diones:** Trimethadione, Paramethadione **Succinimides:** Phensuximide, Methsuximide, Ethosuximide* **Urea and monoacylureas**: Phenacemide, Carbamazepine* **Benzodiazepines**: Clonazepam **Miscellaneous:** Primidone, Valproic acid , Gabapentin, Felbamate | **8** | CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [5] | **Drugs acting on Central Nervous System**<br>**General anesthetics:**<br>**Inhalation anesthetics:** Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.<br>**Ultra short acting barbitutrates:** Methohexital sodium*, Thiamylal sodium, Thiopental sodium.<br>**Dissociative anesthetics:** Ketamine hydrochloride.*<br>**Narcotic and non-narcotic analgesics**<br>**Morphine and related drugs:** SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.<br>**Narcotic antagonists:** Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.<br>**Anti-inflammatory agents:** Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone. | **7** | CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS (LATEST EDITION)

1. Kadam S S, Bothara, K G Principles of Medicinal Chemistry, Volume I & II, 17th edition, Nirali Prakashan, India, 2008
2. Alagarswamy, V Textbookm of Medicinal Chemistry, Volume I & II, Elesevier, India 2012

## D. REFERENCE BOOKS (LATEST EDITION)

1. Delgado, J. N.; Remers, W. A. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry; Lippincott-Raven: Philadelphia, 1998.
2. Foye, W. O.; Lemke, T. L.; Williams, D. A. Principles of Medicinal Chemistry; Williams & Wilkins, Cop: Baltimore Etc., 1995.
3. Remington, J. P.; Gennaro, A. R. Remington's Pharmaceutical Sciences; Mack Pub. Co: Easton, Pa., 1990.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Remember, Understand and Apply | Understand the general principles of medicinal chemistry and drug metabolism |
| **CO2** | Remember, Understand and Apply | Understand the chemistry of drugs with respect to their pharmacological activity |
| **CO3** | Remember, Understand and Apply | Understand therapeutic use and mechanism of drugs. |
| **CO4** | Remember, Understand and Analyse | Discuss structure activity relationship studies of selected classes of drugs |

| | | |
|---|---|---|
| **CO5** | Understand, Apply and Create | Understand the drug metabolic pathways, adverse effect and synthesis of drugs. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | - | - | 1 | 1 | 1 | - | - | 2 | - | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO2** | 3 | - | - | 1 | 1 | 1 | - | - | 2 | - | 3 | 3 | 1 | 2 | 1 | 1 |
| **CO3** | 3 | - | - | 1 | 1 | 1 | - | - | 2 | - | 3 | 3 | 3 | 2 | 1 | 1 |
| **CO4** | 3 | - | - | 1 | 1 | 1 | - | - | 1 | - | 3 | 3 | 2 | 2 | 1 | 1 |
| **CO5** | 3 | - | - | 1 | 1 | 1 | - | - | 2 | - | 3 | 3 | 1 | 2 | 1 | 1 |
| | | | | | | | | | | | | | | | | |
| **Avg** | 3 | - | - | 1 | 1 | 1 | - | - | 1.8 | - | 3 | 3 | 2 | 2 | 1 | 1 |

## B. PHARM. SEMESTER – IV (BPH)
## SUBJECT: PHYSICAL PHARMACEUTICS-II-THEORY (BP403T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

**Objectives:** Upon completion of the course the student shall be able to

- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Know basics of the dispersed systems and colloidal dispersions.

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | **Colloidal dispersions:** Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action. | **07** | CO1<br>CO3 |
| [2] | **Rheology:** Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers<br>**Deformation of solids:** Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus | **08** | CO2 |
| [3] | **Coarse dispersion:** Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method. | **10** | CO1<br>CO3 |
| [4] | **Micromeretics:** Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties. | **10** | CO4 |
| [5] | **Drug stability:** Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention. | **10** | CO5 |

## C. TEXT BOOKS

1. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.

## D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and apply | Understand basics of the dispersed systems and apply principles of colloidal dispersions as well as coarse dispersion. |
| CO2 | Interpret and Evaluate | Interpret the rheological behaviour of fluids and evaluate the physics of tablet compression. |
| CO3 | Evaluate and apply | Formulate and evaluate coarse dispersions making use of rheological and electrical properties of colloidal dispersion. |
| CO4 | Understand, Evaluate and apply | Understand and evaluate the properties of powders and apply them in formulation development. |
| CO5 | Understand and Analyse | Understand principles of kinetics in the stabilization of dosage forms. Analyze the chemical stability of various drug products |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | 1 | - | - | - | - | - | 2 | - | - | 3 | 2 | 3 | - | - |
| CO2 | 3 | - | 1 | - | - | - | - | - | 2 | - | - | 3 | 2 | 3 | - | - |
| CO3 | 3 | - | 1 | - | - | - | - | - | 2 | - | - | 3 | 2 | 3 | - | - |
| CO4 | 3 | - | 1 | - | - | - | - | - | 2 | - | - | 3 | 2 | 3 | - | - |
| CO5 | 3 | - | 2 | - | - | - | - | - | 3 | - | - | 3 | 2 | 3 | - | - |
| Avg | 3 | - | 1.2 | - | - | - | - | - | 2.2 | - | - | 3 | 2 | 3 | - | - |

## B.PHARM. SEMESTER – IV (BPH)
## SUBJECT: PHARMACOLOGY I -THEORY (BP404T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | --- | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

**Objectives:** Upon completion of the course the student shall be able to

1. Understand the pharmacological actions of different categories of drugs
2. Explain the mechanism of drug action at organ system/sub cellular/macromolecular levels.
3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4. Observe the effect of drugs on animals by simulated experiments
5. Appreciate correlation of pharmacology with other bio medical sciences

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | Cos |
|---|---|---|---|
| [1] | **1. General Pharmacology**<br>a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists ( competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.<br>**b. Pharmacokinetics-**<br>Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination | 08 | CO1<br>CO2<br>CO3 |
| [2] | **General Pharmacology**<br>**a. Pharmacodynamics-** Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.<br>**b. Adverse drug reactions**.<br>**c. Drug interactions** (pharmacokinetic and pharmacodynamic)<br>**d. Drug discovery and clinical evaluation of new drugs** -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance | 12 | CO1<br>CO2 |

| | | | |
|---|---|---|---|
| [3] | **Pharmacology of drugs acting on peripheral nervous system**<br>a. Organization and function of ANS.<br>b. Neurohumoral transmission-transmission and classification of neurotransmitters.<br>c. Parasympathomimetic, Parasympatholytic, Sympathomimetics, sympatholytic.<br>d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).<br>e. Local anaesthetic agents.<br>f. Drugs used in myasthenia gravis and glaucoma | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [4] | **Pharmacology of drugs acting on central nervous system**<br>a. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.<br>b. General anaesthetics and pre-anaesthetics.<br>c. Sedatives, hypnotics and centrally acting muscle relaxants.<br>d. Anti-epileptics<br>e. Alcohols and disulfiram. | 08 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [5] | **Pharmacology of drugs acting on central nervous system**<br>a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents,<br>anti-manic and hallucinogens.<br>b. Drugs used in Parkinson's disease and Alzheimer's disease.<br>c. CNS stimulants and nootropics.<br>d. Opioid analgesics and antagonists<br>e. Drug addiction, drug abuse, tolerance and dependence. | 07 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.


## D. REFERENCE BOOKS


1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.3.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.
4. Bickley, L. S.; Bates, B. Bates' Guide to Physical Examination and History Taking.; Lippincott Williams & Wilkins: Philadelphia, 2020.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Remember, Analyse | To know about general idea of pharmacology subject, the contents of the subject, the basic about the drug its action inside the body and adverse effect produced by the drugs |
| CO2 | Remember, Understand and Apply | To get knowledge about how to body react towards the drug and basic action and adverse effects produced by the drugs |
| CO3 | Understand Apply Evaluate, Analyse and Remember | To understand about the system, disease and drug used in treatment of that type of disease |
| CO4 | Understand and remember, Analyse | To know about how disease occurs and drugs used in those disease and drug interaction with others. |
| CO5 | Remember, Understand, Apply, Analyse and evaluate | To get knowledge about various agonist and antagonist and drugs dependence abuse and tolerance about certain drugs |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2 | 3 | 3 | 3 | 3 | 2.4 | 3 | 3 | 2.4 | 2.8 | 2.8 | 3 | 3 | 3 | 3 |

## B.PHARM. SEMESTER – IV (BPH)
## SUBJECT:PHARMACOGNOSY AND PHYTOCHEMISTRY-THEORY(BP405T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

**Objectives:** Upon completion of the course, the student shall be able

- To know the techniques in the cultivation and production of crude drugs.
- To know the crude drugs, their uses and chemical nature.
- Know the evaluation techniques for the herbal drugs.
- To carry out the microscopic and morphological evaluation of crude drugs.

## B. COURSE CONTENT

| NO | TOPIC | L(hrs) | COs |
|---|---|---|---|
| [1] | **Introduction to Pharmacognosy:**<br>(a) Definition, history, scope and development of Pharmacognosy<br>(b) Sources of Drugs – Plants, Animals, Marine & Tissue culture<br>(c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).<br>**Classification of drugs:**<br>Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero-taxonomical classification of drugs<br>**Quality control of Drugs of Natural Origin:**<br>Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida. | **10** | CO1<br>CO2 |
| [2] | **Cultivation, Collection, Processing and storage of drugs of natural origin:** Cultivation and Collection of drugs of natural origin<br>Factors influencing cultivation of medicinal plants. Plant hormones and their applications.<br>Polyploidy, mutation and hybridization with reference to medicinal plants<br>**Conservation of medicinal plants** | **10** | CO1<br>CO2 |
| [3] | **Plant tissue culture:**<br>Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines | **07** | CO3<br>CO4 |
| [4] | **Pharmacognosy in various systems of medicine:**<br>Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.<br>**Introduction to secondary metabolites:**<br>Definition, classification, properties and test for identification of | **10** | CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| | Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins | | |
| **[5]** | Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs<br>**Plant Products:**<br>Fibers - Cotton, Jute, Hemp<br>Hallucinogens, Teratogens, Natural allergens<br>**Primary metabolites:**<br>General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic uses and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:<br>**Carbohydrates:** Acacia, Agar, Tragacanth, Honey<br>**Proteins and Enzymes :**Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).<br>**Lipids(Waxes, fats, fixed oils)** : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax .<br>**Marine Drugs:**<br>Novel medicinal agents from marine sources. | **08** | CO4<br>CO5 |

## C. TEXT BOOKS


1. Dr.Shukla P., Dr. Shashi, A. &Dr. Shukla P., A textbook of "Pharmacognosy& Phytochemistry-I" 1st Edition, NiraliPrakashan, 2019.
2. Kabra, A., Dr. Ashok PK. & Setia, S., A textbook of "Pharmacognosy & Phytochemistry-I", Pee Vee Book , S. Vikas & Company ( Medical Publishers) ,2019.


## D. REFERENCE BOOKS


1. Deore SL., **"**Pharmacognosy & Phytochemistry-I-A Comprehensive Approach" 2nd edition, Pharma Med. Press, 2019.
2. Ali, M., "Pharmacognosy- Pharmacognosy & Phytochemistry-I", Volume-I CBS Publishers & Distributors PVT. Ltd., 2018
3. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry" , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
4. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers &Distributors PVT. Ltd., 2020.
5. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications,2017.
6. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
7. Jarald EE. &Jarald SE., "Textbook of Pharmacognosy & Phytochemistry" 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.
8. Neha Tyagi &Dr. Verma Santosh Kumar "A textbook of Pharmacognosy & Phytochemistry-I", 1st Edition, BFC Publication, 2020.
9. Gokhale, SB., Dr.Kokate CK., Dr.Tatiya AV., Dr.Kalaskar MG., "Pharmacognosy & Phytochemistry-I" 1st Edition, NiraliPrakashan, 2019.
10. Ashutosh Kar, "Pharmacognosy& Phytochemistry-I ", 1st Edition, New Age International Private LTD. Publishers. 2020.
11. Dr. Das K., "Pharmacognosy & Phytochemistry-I" 1st Edition, NiraliPrakashan, 2019.
12. Kalia AN., Textbook of "Pharmacognosy & Phytochemistry-I" CBS Publishers & Distributors PVT. Ltd., 2021.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Evaluate, Apply and Analyse | To understand the history, scope and introduction of pharmacognosy, classification of drugs, quality control of drugs of natural origin and plant hormones and their applications. |
| CO2 | Remember,Create, Analyse and Evaluate | To know the techniques of cultivation, collection, processing, storage adulteration, evaluation of drugs of natural origin |
| CO3 | Remember, Analyse and Apply, Evaluate | To know the basic principle and techniques of Plant tissue culture, edible vaccines and pharmacognosy in various systems of medicine. |
| CO4 | Understand, Evaluate, Analyse and Apply | To understand the introduction of secondary metabolites and plant products. |
| CO5 | Understand, Create, Evaluate and Apply | To understand the study of primary metabolites and study of drugs of natural origin. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | - | 2 | - | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 1 |
| CO2 | 3 | 2 | 2 | 2 | - | 2 | 2 | 1 | 2 | 1 | 2 | 3 | 2 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 2 | 1 | - | 2 | 3 | 2 | 2 | 1 | 2 | 3 | 2 | 3 | 3 | 1 |
| CO4 | 3 | 2 | 2 | 2 | - | 2 | 2 | 1 | 2 | 1 | 2 | 3 | 2 | 2 | 3 | 1 |
| CO5 | 3 | 2 | 2 | 2 | - | 2 | - | 2 | 2 | 1 | 2 | 3 | 2 | 2 | 2 | 1 |
| Avg | 3 | 2 | 2 | 1.8 | - | 2 | 1.4 | 1.6 | 2 | 1.4 | 2 | 3 | 2 | 2.4 | 2.4 | 1 |

## B.PHARM. SEMESTER – IV (BPH)
## SUBJECT:MEDICINAL CHEMISTRY I-PRACTICAL(BP406P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

**Objectives:**Upon completion of the course the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

## B. COURSE CONTENT

| NO | TOPIC | P(Hrs) | COs |
|---|---|---|---|
| [1] | **Preparation of drugs/ intermediates**<br>1,3-pyrazole<br>1,3-oxazole<br>Benzimidazole<br>Benztriazole<br>2,3- diphenyl quinoxaline<br>Benzocaine<br>Phenytoin<br>Phenothiazine<br>Barbiturate<br>**Assay of drugs**<br>Chlorpromazine<br>Phenobarbitone<br>Atropine<br>Ibuprofen<br>Aspirin<br>Furosemide<br>**Determination of Partition coefficient for any two drugs** | **60** | CO1<br>CO2<br>CO4<br>CO5 |

## C. TEXT BOOKS (LATEST EDITION)


1. Raval H G, Practical organic Chemistry, First edition, Nirav &RoopalPrakashan,India, 2008


## D. REFERENCE BOOKS (LATEST EDITION)


1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.
3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Apply | To determine the partition coefficient of some drugs |
| CO2 | Understand and Apply | To carry out the synthesis of drugs |
| CO3 | Understand and Evaluate | To perform the assay of drugs using various analytical methods |
| CO4 | Understand and Apply | To synthesize intermediates using different chemical reaction |
| CO5 | Understand and Apply | To purify synthesized compounds and determine their physical constants |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | 1 | - | 3 | 3 | 1 | 2 | 1 | 0 |
| CO2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 3 | 1 | 1 |
| CO3 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | 1 | - | 3 | 3 | 1 | 1 | 1 | 1 |
| CO4 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 | 1 | 1 | 3 | 3 | 2 | 2 | 1 | 1 |
| CO5 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 2 | 1 | 2 |
| Avg | 3 | 1 | 1 | 1 | 1 | 1 | 0.4 | 1 | 1 | 0.6 | 3 | 3 | 1.4 | 2 | 1 | 1 |

## B.PHARM. SEMESTER – IV (BPH)
## SUBJECT:PHYSICAL PHARMACEUTICS-II-PRACTICAL(BP407P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 5 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

**Objectives:** Upon completion of the course the student shall be able to

- Know the principles of chemical kinetics & to use them for stability testing anddetermination of expiry date of formulations
- Know basics of the micromeritics, dispersed systems and colloidal dispersions

## B. COURSE CONTENT

| NO | TOPIC | P (Hrs) | COs |
|---|---|---|---|
| [1] | 1. Determination of particle size, particle size distribution using sieving method<br>2. Determination of particle size, particle size distribution using Microscopic method<br>3. Determination of bulk density, true density and porosity<br>4. Determine the angle of repose and influence of lubricant on angle of repose<br>5. Determination of viscosity of liquid using Ostwald's viscometer<br>6. Determination sedimentation volume with effect of different suspending agent<br>7. Determination sedimentation volume with effect of different concentration of single suspending agent<br>8. Determination of viscosity of semisolid by using Brookfield viscometer<br>9. Determination of reaction rate constant first order.<br>10. Determination of reaction rate constant second order<br>11. Accelerated stability studies | 60 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. Sen, K. K., Dutta, S. K. A Laboratory Manual of Physical Pharmaceutics. India: PharmaMed Press. 2019.

## D. REFERENCE BOOKS


1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.
8. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Evaluate | Understand and evaluate basic, derived and flow properties of powders and apply to prepare a stable formulation. |
| CO2 | Understand and Evaluate | Understand and evaluate viscosity of fluids and formulations. |
| CO3 | Remember and Analyse | Remember various type of suspending agent and anlyse them to formulate a stable suspension. |
| CO4 | Apply and Analyse | Apply principles of chemical kinetics in determination of rate constants as per the chemical reaction. |
| CO5 | Understand and Analyse | Understand and analyse the shelf life of a formulation by accelerated stability studies. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | 1 | - | - | - | - | - | 2 | - | - | 3 | 2 | 3 | - | - |
| CO2 | 3 | - | 1 | - | - | - | - | - | 1 | - | - | 3 | 1 | 3 | - | - |
| CO3 | 3 | - | 1 | - | - | - | - | - | 1 | - | - | 3 | 1 | 3 | - | - |
| CO4 | 3 | - | 2 | - | - | - | - | - | 1 | - | - | 3 | 2 | 3 | - | - |
| CO5 | 3 | - | 2 | - | - | - | - | - | 1 | - | - | 3 | 2 | 3 | - | - |
| Avg | 3 | - | 1.4 | - | - | - | - | - | 1.2 | - | - | 3 | 1.6 | 3 | - | - |

## B.PHARM. SEMESTER – IV (BPH)
## SUBJECT: PHARMACOLOGY I -PRACTICAL (B408 P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| -- | -- | 4 | 4 | 2 | 35 | 10 | 5 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

**Objectives:** Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the various experiments related to special senses and nervous system.
- Appreciate coordinated working pattern of different organs of each system

## B. COURSE CONTENT

| NO | TOPIC | P (Hrs) | COs |
|---|---|---|---|
| [1] | 1. Introduction to experimental pharmacology.<br>2. Commonly used instruments in experimental pharmacology.<br>3. Study of common laboratory animals.<br>4. Maintenance of laboratory animals as per CPCSEA guidelines.<br>5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anaesthetics and euthanasia used for animal studies.<br>6. Study of different routes of drugs administration in mice/rats.<br>7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.<br>8. Effect of drugs on ciliary motility of frog oesophagus<br>9. Effect of drugs on rabbit eye.<br>10. Effects of skeletal muscle relaxants using rota-rod apparatus.<br>11. Effect of drugs on locomotor activity using actophotometer.<br>12. Anticonvulsant effect of drugs by MES and PTZ method.<br>13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.<br>14. Study of anxiolytic activity of drugs using rats/mice.<br>15. Study of local anaesthetics by different methods Microscopic study of epithelial and connective tissue | **60** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.

## D. REFERENCE BOOKS

1. Kulkarni, R. S. Index Theorems of Atiyah, Bott, Patodi and Curvature Invariants; Presses De L'université De Montreal: Montreal, 1975.
2. F Hoffmeister; G Stille. Handbook of Experimental Pharmacology. Vol. 55/2, Psychotropic Agents, Part 2, Anxiolytics, Gerontopsychopharmacological Agents, and Psychomotor Stimulants; Springer: Berlin, 1981.
3. Kapadia, S. R.; Chew, D.; Cura, F.; L'allier, P. L.; Roffi, M.; E Murat Tuzcu. Textbook of Interventional Cardiology: A Global Perspective; Jaypee: The Health Sciences Publisher: New Delhi, 2017.
4. Fundamentals of Experimental Pharmacology; Hilton & Company: Kolkata, 2015.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | To know about general idea of pharmacology subject, the contents of the subject, the basic instrument used in pharmacology |
| CO2 | Remember, Understand and Apply | To get knowledge about animals used in experimental pharmacology its detail, housing, feeding, dissection etc |
| CO3 | Understand Apply and Evaluate | To understand about the drugs acting on the animals body part and instruments used to check the activity of the animal |
| CO4 | Understand and remember | To know about how diseases are produced in the animals and drug used for those diseases. |
| CO5 | Remember, Understand, Apply and evaluate | To get knowledge about which animals, which instrument and which kind of drug we can used to induce the disease and for treatment of those disease, |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| Avg | 3 | 2.6 | 3 | 3 | 2 | 3 | 2.4 | 3 | 3 | 2 | 2.2 | 2.8 | 3 | 3 | 3 | 2.8 |

## B.PHARM. SEMESTER – IV (BPH)
## SUBJECT:PHARMACOGNOSY AND PHYTOCHEMISTRY I -PRACTICAL(BP409P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

**Objectives:**Upon completion of the course, the student shall be able

- To know the techniques in the cultivation and production of crude drugs.
- To know the crude drugs, their uses and chemical nature.
- Know the evaluation techniques for the herbal drugs.
- To carry out the microscopic and morphological evaluation of crude drugs.

## B. COURSE CONTENT

| NO | TOPIC | P(hrs) | COs |
|---|---|---|---|
| [1] | 1. Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil.<br>1. Determination of stomatal number and stomatal index.<br>2. Determination of vein islet number, vein islet termination and palisade ratio.<br>3. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer.<br>4. Determination of Fiber length and width<br>5. Determination of number of starch grains by Lycopodium spore method<br>6. Determination of Ash value.<br>7. Determination of Extractive values of crude drugs.<br>8. Determination of moisture content of crude drugs.<br>9. Determination of swelling index and foaming index. | **60** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Rana, M. &Kabra A., "Practical Mannual - Pharmacognosy & Phytochemistry-I" Pee Vee Book , S. Vikas & Company ( Medical Publishers) ,2019.
2. Dr.Khandelwal, KR., "Practical Pharmacognosy" 19th edition, NiraliPrakashan, 2008.


## D. REFERENCE BOOKS


1. Kabra, A., Dr. Ashok PK. & Setia, S., A textbook of "Pharmacognosy & Phytochemistry-I", Pee Vee Book , S. Vikas & Company ( Medical Publishers) ,2019.
2. Deore, SL., "Pharmacognosy & Phytochemistry-I-A Comprehensive Approach" 2nd edition, Pharma Med. Press, 2019.
3. Ali, M., "Pharmacognosy- Pharmacognosy & Phytochemistry-I", Volume-I CBS Publishers & Distributors PVT. Ltd., 2018.
4. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry" , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.

5. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
6. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
7. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
8. Jarald EE. &Jarald SE., "Textbook of Pharmacognosy & Phytochemistry" 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember, Evaluateand Analyse | Identify and Analyse unorganised and organized crude drugs by chemical tests. |
| CO2 | Understand and Evaluate | Evaluation of Crude drug by qualitative and quantitative microscopic method. |
| CO3 | Understand, Evaluate and Analyse | Discuss the evaluation and analyse Physicochemical parameters for crude drugs. |
| CO4 | Remember, Analyse and Apply | Describe the principle of different microscopic measurement techniques. |
| CO5 | Understand, Apply and Analyse | Explain evaluation of crude drugs. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | - | 2 | - | 1 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 1 |
| CO2 | 3 | 3 | 2 | 3 | - | 2 | - | 1 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 1 |
| CO3 | 3 | 3 | 2 | 3 | - | 2 | - | 1 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 1 |
| CO4 | 3 | 3 | 2 | 3 | - | 1 | - | 1 | 1 | 1 | 3 | 2 | 2 | 3 | 2 | 1 |
| CO5 | 3 | 3 | 2 | 3 | - | 2 | - | 1 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 1 |
| Avg | 3 | 3 | 2 | 3 | - | 1.8 | - | 1 | 1.8 | 1 | 3 | 2 | 2 | 3 | 2 | 1 |

## B.PHARM. SEMESTER – V (BPH)
## SUBJECT: MEDICINAL CHEMISTRY II -THEORY (BP501T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

**Objectives**: Upon completion of the course the student shall be able to

- Understand the chemistry of drugs with respect to their pharmacological activity
- Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
- Know the Structural Activity Relationship of different class of drugs
- Study the chemical synthesis of selected drugs

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Classification, mechanism of action, uses, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*) of following class of drugs in all units.**<br>**Antihistaminic agents**: Histamine, receptors and their distribution in the human body<br>**H1–antagonists:** Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines cuccinate, Clemastine fumarate, Diphenylphyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium<br>**H2-antagonists:** Cimetidine*, Famotidine, Ranitidin<br>**Gastric Proton pump inhibitors:** Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole<br>**Anti-neoplastic agents:**<br>**Alkylating agents:** Meclorethamine*, Cyclophosphamide, Melphalan Chlorambucil, Busulfan, Thiotepa<br>Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine<br>Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate<br>**Miscellaneous:** Cisplatin, Mitotane. | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [2] | **Anti-anginal:**<br>**Vasodilators:** Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole<br>**Calcium channel blockers:** Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine<br>**Diuretics:**<br>**Carbonic anhydrase inhibitors:** Acetazolamide*, Methazolamide, Dichlorphenamide<br>**Thiazides:** Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide<br>**Loop diuretics:** Furosemide*, Bumetanide, Ethacrynic acid<br>**Potassium sparing Diuretics:** Spironolactone, Triamterene, Amiloride.<br>**Osmotic Diuretics:** Mannitol<br>**Anti-hypertensive Agents:** Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride. | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [3] | **Anti-arrhythmic Drugs:** Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcainide hydrochloride, Amiodarone, Sotalol<br>**Anti-hyperlipidemic agents:** Clofibrate, Lovastatin, Cholesteramine and Cholestipol<br>**Coagulant & Anticoagulants:** Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel<br>**Drugs used in Congestive Heart Failure:** Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [4] | **Drugs acting on Endocrine system**<br>Nomenclature, Stereochemistry and metabolism of steroids<br>**Sex hormones:** Testosterone, Nandralone, Progestrones, Oestriol, Oestradiol, Oestrione, Diethyl stilbestrol<br>**Drugs for erectile dysfunction:** Sildenafil, Tadalafil<br>**Oral contraceptives:** Mifepristone, Norgestril, Levonorgestrol<br>**Corticosteroids:** Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone<br>**Thyroid and antithyroid drugs:** L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole | 08 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [5] | **Antidiabetic agents:**<br>Insulin and its preparations<br>**Sulfonylureas:** Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin.<br>**Thiazolidinediones:** Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acrabose, Voglibose.<br>Local Anesthetics: SAR of Local anesthetics<br>**Benzoic Acid derivatives;** Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine<br>**Amino Benzoic acid derivatives:** Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate<br>**Lidocaine/Anilide derivatives:** Lignocaine, Mepivacaine, Prilocaine, Etidocaine.<br>**Miscellaneous:** Phenacaine, Diperodon, Dibucaine.* | 07 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Alagarsamy, V. Textbook of Medicinal Chemistry, Volume I and Volume II, 3rd ed.; CBS Publishers, India, 2016
2. Kadam, S.S., Mahadik, K.R., Bothara, K.G. Principles of Medicinal Chemistry, Volume I and II, 20th ed.; Nirali Prakashan, India, 2010


## D. REFERENCE BOOKS


1. Hansch, C., Semmes, P.G., Taylor, J.B. Comprehensive Medicinal Chemistry, Volume I to VI, 1st ed.; Elsevier, India, 2005
2. Abraham, D.J. Burger's Medicinal Chemistry and Drug Discovery, Volume I to VI, 6th ed.; Wiley-Interscience, New Jersey, 2003
3. Lemke, T.L., Williams, D.A. FOYE'S Principles of Medicinal Chemistry, 7th ed.; Lippincott Williams & Wilkins, Baltimore, 2013
4. Baele, J.M., Block J. H. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th ed.; Lippincott Williams & Wilkins; Baltimore, 2011
5. Lendnicer, D., Mitscher, L.A. The Organic Chemistry of Drug Synthesis, Volume I to VI, Wiley-Interscience, New Jersey, 2008
6. Johnson, D.S., Li, J.J. Art of Drug Synthesis, 1st ed,; Wiley-Interscience, New Jersey, 2007
7. Smith, J.H., Williams, H. Smith and Williamson's Introduction to the Principles of Drug Design and Action, 3rd ed; CRC Press, The Netherlands, 2005
8. Vardanyan, R., Hruby, V. Synthesis of Essential Drugs, Volume I & II, 1st ed.; Elsevier, The Netherlands, 2006


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Remember | To describe classification and chemistry of various classes of drugs. |

| | | |
|---|---|---|
| **CO2** | Analyse | To explain development and structure activity relationship of different classes of drugs. |
| **CO3** | Create | To report synthetic protocol of selected drugs. |
| **CO4** | Understand, Remember | To describe mechanism of action and therapeutic importance of various classes of drugs. |
| **CO5** | Apply, Understand | To understand metabolic pathways and adverse effects of important drugs. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 0 | 1 | 1 | - | - | - | - | - | 0 | 3 | 2 | 3 | 1 | 1 | 0 |
| **CO2** | 3 | 0 | 2 | 2 | - | - | - | - | - | 0 | 3 | 2 | 3 | 1 | 2 | 0 |
| **CO3** | 3 | 0 | 1 | 2 | - | - | - | - | - | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 0 | 1 | 1 | - | - | - | - | - | 0 | 3 | 2 | 3 | 1 | 1 | 0 |
| **CO5** | 3 | 3 | 3 | 2 | - | - | - | - | - | 0 | 3 | 2 | 3 | 1 | 2 | 0 |
| | | | | | | | | | | | | | | | | |
| **Avg** | 3 | 0.6 | 1.6 | 1.6 | - | - | - | - | 2.2 | 0.6 | 3 | 2 | 3 | 1.4 | 1.6 | 0.6 |

## B. PHARM. SEMESTER – V (BPH)
## SUBJECT: INDUSTRIAL PHARMACY I -THEORY (BP502T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.
**Objectives:** Upon completion of the course the student shall be able to

- Know the various pharmaceutical dosage forms and their manufacturing techniques.
- Know various considerations in development of pharmaceutical dosage forms
- Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | **Pre-formulation Studies:** Introduction to pre-formulation, goals and objectives, study of physicochemical characteristics of drug substances.<br>a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism<br>b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization<br>BCS classification of drugs & its significant<br>Application of pre-formulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms. | **07** | CO1 |
| [2] | **Tablets:**<br>a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems, equipments and tablet tooling.<br>b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating.<br>c. Quality control tests: In process and finished product tests<br>**Liquid orals:** Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia | **10** | CO2<br>CO3 |
| [3] | **Capsules:** a. Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules.<br>b. soft gelatin capsules: Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications.<br>**Pellets:** Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets | **08** | CO2<br>CO3 |

| | | | |
|---|---|---|---|
| [4] | **Parenteral Products:**<br>a. Definition, types, advantages and limitations. Pre-formulation factors and essential requirements, vehicles, additives, importance of isotonicity<br>b. Production procedure, production facilities and controls, aseptic processing<br>c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products.<br>d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products.<br>Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labelling, containers; evaluation of ophthalmic preparations | **10** | CO2<br>CO3 |
| [5] | **Cosmetics:** Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens.<br>**Pharmaceutical Aerosols:** Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies.<br>**Packaging Materials Science:** Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests. | **10** | CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.


## D. REFERENCE BOOKS


1. Lieberman, H. A. Pharmaceutical Dosage Forms. Tablets, Vol. 1; New York, Ny Dekker, 1989.
2. Lieberman, H. A.; Lachmann, L.; Kenneth Edwards Avis. Pharmaceutical Dosage Forms : Parenteral Medications;Vol-1-3; M. Dekker: New York, 1984.
3. Lieberman, H. A.; Rieger, M. M.; Banker, G. S. Pharmaceutical Dosage Forms-- Disperse Systems. Volume 1- 3; Dekker: New York, 1998.
4. Banker, G. S.; Rhodes, C. T. Modern Pharmaceutics; Marcel Dekker: New York, 2002.
5. Beringer, P. Remington : The Science and Practice of Pharmacy.; Lippincott Williams & Wilkins: Philadelphia ; London, 2011.
6. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
7. Ansel, H. C. Introduction to Pharmaceutical Dosage Forms; Lea & Febiger: Philadelphia, 1985.
8. Rhodes, C. T.; Jens Thurø Carstensen. Drug Stability : Principles and Practices; Marcel Dekker: New York, 2000.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Analyse | To understand pre-formulation considerations in development of pharmaceutical dosage forms. |
| CO2 | Remember, Understand and Evaluate | To get knowledge of various pharmaceutical dosage forms and their manufacturing techniques. |
| CO3 | Understand Apply and Evaluate | To understand various quality control test for pharmaceutical dosage forms and apply it to maintain quality drug product and packaging. |
| CO4 | Understand and Remember | To know packaging requirements and evaluate various packaging materials for pharmaceutical dosage forms. |
| CO5 | Understand | To understand formulation and preparation of cosmetic products. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 1 | - | 1 | 1 | - | 2 | 3 | 3 | 3 | 2 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 1 | 3 | 1 | 3 | 3 | 3 | 1 | 1 | 1 |
| CO3 | 3 | 1 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | - | 3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 3 | 1 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | - | 3 | 3 | 3 | 1 | 2 | 2 |
| CO5 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 1 | 1 | 1 |
| Avg | 3 | 2.2 | 3 | 3 | 1 | 2 | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 1.4 | 1.4 | 1.4 |

## B.PHARM. SEMESTER – V (BPH)
## SUBJECT: PHARMACOLOGY-II–THEORY (BP503T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications)of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.

**Objectives:** Upon completion of this course the student should be able to

- Understand the mechanism of drug action and its relevance in the treatment of different diseases
- Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
- Demonstrate the various receptor actions using isolated tissue preparation
- Appreciate correlation of pharmacology with related medical sciences

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Pharmacology of drugs acting on cardio vascular system**<br>a. Introduction to hemodynamic and electrophysiology of heart.<br>b. Drugs used in congestive heart failure<br>c. Anti-hypertensive drugs.<br>d. Anti-anginal drugs.<br>e. Anti-arrhythmic drugs.<br>f. Anti-hyperlipidaemia drugs. | 10 | CO1, CO2, CO4. |
| [2] | **Pharmacology of drugs acting on cardio vascular system**<br>a. Drug used in the therapy of shock.<br>b. Haematinics, coagulants and anticoagulants.<br>c.Fibrinolytics and anti-platelet drugs<br>d. Plasma volume expanders<br>**Pharmacology of drugs acting on urinary system**<br>a. Diuretics<br>b. Anti-diuretics. | 10 | CO1, CO2, CO4. |
| [3] | **Autacoids and related drugs**<br>a.Introduction to autacoids and classification<br>b. Histamine, 5-HTandtheirantagonists.<br>c. Prostaglandins, Thromboxane's and Leukotrienes.<br>d. Angiotensin, Bradykinin and Substance P.<br>e. Non-steroidal anti-inflammatory agents<br>f.Anti-goutdrugs<br>g. Anti-rheumatic drugs | 10 | CO1, CO2, CO3, CO5. |
| [4] | **Pharmacology of drugs acting on endocrine system**<br>a. Basic concepts in endocrine pharmacology.<br>b. Anterior Pituitary hormones-analogues and their inhibitors. | 08 | CO1, CO3, CO4. |

| | | | |
|---|---|---|---|
| | c. Thyroid hormones-analogues and their inhibitors.<br>d. Hormones regulating plasma calcium level-Parathormone, Calcitonin and Vitamin-D.<br>e. Insulin, Oral Hypoglycaemic agents and glucagon.<br>f. ACTH and corticosteroids. | | |
| [5] | **Pharmacology of drugs acting on endocrine system**<br>a. Androgens and Anabolic steroids.<br>b. Estrogens, progesterone and oral contraceptives.<br>c. Drugs acting on the uterus.<br>**Bioassay**<br>a. Principles and applications of bioassay.<br>b. Types of bioassay<br>c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT. | 07 | CO3, CO4, CO5. |

## C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

## D. REFERENCE BOOKS


1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; Mcgraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; KnollmannB. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; Mcgraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's.*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.


## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Apply and Analyse | Correlate the pathophysiology and mechanism of drug action of drugs and is application in treatment of the disease. |
| CO2 | Remember, Apply and Analyse | Understand the mechanism of drug action and its relevance in the treatment of different diseases. |
| CO3 | Create, Remember | Create the choice of medicine based on various receptor actions |

| | | |
|---|---|---|
| | and Evaluate | using isolated tissue preparation. |
| **CO4** | Understand, Apply and Analyse | Appreciate correlation of pharmacology of various medicines and its choice in therapy. |
| **CO5** | Understand, analyse and Evaluate | Apply practical and clinical skills in ethical practice in pharmacy practice. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO2** | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO3** | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO5** | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 0 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| **Avg** | 3 | 1 | 3 | 3 | 1.4 | 3 | 3 | 1.2 | 3 | 3 | 3 | 2.8 | 3 | 3 | 2 | 3 |

## B.PHARM. SEMESTER – V (BPH)
## SUBJECT: PHARMACOGNOSY & PHYTOCHEMISTRY-II -THEORY (BP504T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and Phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine

**Objectives:** Upon completion of the course, the student shall be able

- To know the modern extraction techniques, characterization and identification of the herbal drugs and Phytoconstituents.
- To understand the preparation and development of herbal formulation.
- To understand the herbal drug interactions.
- To carryout isolation and identification of phytoconstituents.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Metabolic pathways in higher plants and their determination**<br>a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.<br>b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies. | 07 | CO1 |
| [2] | General introduction, composition, chemistry & chemical classes, biological source, therapeutic uses and commercial applications of following secondary metabolites:<br>**Alkaloids:** Vinca, Rauwolfia, Belladonna, Opium,<br>**Phenylpropanoids and Flavonoids:** Lignans, Tea, Ruta<br>**Steroids, Cardiac Glycosides & Triterpenoids**: Liquorice, Dioscorea, Digitalis<br>**Volatile oils**: Mentha, Clove, Cinnamon, Fennel, Coriander,<br>**Tannins:** Catechu, Pterocarpus<br>**Resins:** Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony<br>**Glycosides:** Senna, Aloes, Bitter Almond<br>**Iridoids, Other terpenoids & Naphthaquinones:** Gentian, Artemisia, taxus, carotenoids. | 14 | CO2<br>CO3 |
| [3] | **Isolation, Identification and Analysis of Phytoconstituents**<br>a) Terpenoids: Menthol, Citral, Artemisin<br>b) Glycosides: Glycyrhetinic acid & Rutin<br>c) Alkaloids: Atropine,Quinine,Reserpine,Caffeine<br>d) Resins: Podophyllotoxin, Curcumin. | 06 | CO3<br>CO4<br>CO5 |
| [4] | **Industrial production, estimation and utilization of the following phytoconstituents:**<br>Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine. | 10 | CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [5] | **Basics of Phytochemistry.**<br>Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs. | 08 | CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Dr. Shukla P., Dr. Shashi, A. & Dr. Shukla P., "Pharmacognosy & Phytochemistry-II" NiraliPrakashan, 1st Edition, 2019.
2. Kabra, A., Dr. Ashok PK. & Setia, S., A textbook of "Pharmacognosy & Phytochemistry-II", Pee Vee, S. Vikas & Company Medical Publishers, 2019.


## D. REFERENCE BOOKS


1. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry", 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
2. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
3. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
4. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
5. Jarald EE. & Jarald SE., "Textbook of Pharmacognosy & Phytochemistry" 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.
6. Dr. Sudha T., Mrs. Rajeshwari, R.,Dr. Ravikumar VR. & Dr. Nimbakar TP., Current trend in "Pharmacognosy & Phytochemistry-II" Part-2, PV Publication, 2019.
7. Dr. Das K., "Pharmacognosy & Phytochemistry-II" 1st Edition, Nirali Prakashan, 2019.


3

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember, Understand and Apply. | To describe various metabolic pathways and utilization of radioactive isotopes in biosynthetic pathway. |
| CO2 | Remember, Apply and analyse. | Pharmacognostical description of Naturally origin crude drug. |
| CO3 | Understand, analyse and evaluate | Isolation, identification and Analysis of Phytoconstituents. |
| CO4 | Understand, apply and analysis | Industrial production, estimate & application of Phytoconstituents. |
| CO5 | Remember, Understand and Analyse. | Detail description of extraction and analytical techniques used for phytoconstituents. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 3 | - | 1 | - | 1 | 2 | 1 | 3 | 3 | 2 | 3 | 1 | 1 |
| CO2 | 3 | 2 | 2 | 3 | - | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 3 | 3 | - | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 3 | - | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 |
| CO5 | 3 | 2 | 2 | 3 | - | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 |
| Avg | 3 | 2 | 2 | 3 | 0 | 2 | 1.2 | 1.8 | 2.4 | 2.2 | 2.6 | 3 | 2.4 | 3 | 2 | 1 |

## B.PHARM. SEMESTER – V (BPH)
## SUBJECT:PHARMACEUTICAL JURISPRUDENCE–THEORY(BP505T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India.

**Objectives**: Upon completion of the course, the student shall be able to understand:

- The Pharmaceutical legislations and their implications in the development and marketing of Pharmaceuticals.
- Various Indian pharmaceutical Acts and Laws.
- The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
- The code of ethics during the pharmaceutical practice.

## B. COURSE CONTENT

| NO | TOPIC | L(hrs) | COs |
|---|---|---|---|
| [1] | **Drugs and Cosmetics Act, 1940 and its rules 1945:** Objectives, Definitions, Legal definitions of schedules to the Act and Rules<br>**Import of drugs** – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties.<br>**Manufacture of drugs** – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license. | 10 | CO1<br>CO2<br>CO4 |
| [2] | **Drugs and Cosmetics Act, 1940 and its rules 1945.** Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA)<br>**Sale of Drugs** – Wholesale, Retail sale and Restricted license. Offences and penalties<br>**Labeling &Packing of drugs-** General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.<br>**Administration of the Act and Rules** – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors. | 10 | CO1<br>CO2<br>CO4 |
| [3] | **Pharmacy Act –1948**: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences andPenalties<br>**Medicinal and Toilet Preparation Act –1955**: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties. | 10 | CO1<br>CO2<br>CO3 |

| | | | |
|---|---|---|---|
| | **Narcotic Drugs and Psychotropic substances Act-1985 and Rules**: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties. | | |
| [4] | **Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties.<br>**Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties.<br>**National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM). | 08 | CO1<br>CO4<br>CO5 |
| [5] | **Pharmaceutical Legislations** – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee.<br>**Code of Pharmaceutical ethics:**Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath<br>**Medical Termination of Pregnancy Act :**<br>**Right to Information Act:**<br>**Introduction to Intellectual Property Rights (IPR):** | 07 | CO2<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Dua, J. and Sharma,S., "Pharmaceutical Jurisprudence", S Vikas and Company, Pee vee publishers, India, 2019.
2. Jani, GK.,"Pharmaceutical Jurisprudence, Forensic Pharmacy", Atul Prakashan, India, 2019


## D. REFERENCE BOOKS


1. Jain, NK., "A text book of Forensic Pharmacy" Second edition-Reprint, Vallabh Prakashan,2007.
2. Mithal, BM., "Text book of Forensic Pharmacy" first edition, Vallabh Prakashan, 1988.
3. Suresh, B.,A text book of "Forensic Pharmacy" 20th edition, Birla publication PVT. LTD., 2019.
4. Governmentf India, Ministry of Health and Family Welfare, "Drugs and Cosmetics Act and Rules" 2016.
5. Dr. Agrawal, SP. And Dr. Khanna, R., " Pharmaceutical Jurisprudence And Ethics" 5th edition, Birla publication PVT. LTD.,2008.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Evaluate and apply, | To understand the Drugs and cosmetics Act and its Rules and to understand the knowledge of Laws. |
| CO2 | Remember, Evaluate and Apply | To Explain basic principle of Indian pharmaceutical Acts and Laws. |
| CO3 | Understand and Apply, Evaluate | To study about Pharmacy Act, Medicinal and Toilet Preparation Act, Narcotic drugs and Psychotropic substances Act. |
| CO4 | Remember, Analyse and Apply | To get the knowledge of DPCO, prevention of cruelty to animals act and drug and magic remedies act and Laws. |
| CO5 | Understand, Evaluate and Apply | To know code of ethics, Pharmaceutical legislation, IPR and Right to information Act. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | - | 2 | 2 | 3 | 2 | 2 | - | 3 | 3 | 2 | 1 | 3 | 1 |
| CO2 | 3 | 1 | 2 | - | 2 | 2 | 3 | 2 | 2 | - | 3 | 3 | 2 | 1 | 3 | 1 |
| CO3 | 3 | 2 | 2 | - | 2 | 2 | 3 | 2 | 2 | - | 3 | 3 | 2 | 2 | 3 | 1 |
| CO4 | 3 | 2 | 2 | - | 2 | 2 | 3 | 2 | 2 | - | 3 | 3 | 2 | 2 | 3 | 1 |
| CO5 | 3 | 2 | 2 | - | 2 | 2 | 3 | 2 | 2 | - | 3 | 3 | 2 | 2 | 3 | 1 |
| | | | | | | | | | | | | | | | | |
| Avg | 3 | 1.6 | 2 | - | 2 | 2 | 3 | 2 | 2 | - | 3 | 3 | 2 | 1.6 | 3 | 1 |

## B.PHARM. SEMESTER – V (BPH)
## SUBJECT:INDUSTRIAL PHARMACY I-PRACTICAL (BP506P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: Course enables the student to understand and apply various manufacturing techniques to formulate different pharmaceutical dosage forms.

**Objectives:** Upon completion of the course the student shall be able to

- To design pre-formulation protocol and evaluation of various preformulation parameters for drugs.
- To prepare and evaluate different dosage forms like tablets, capsules, liquids, semisolids, sterile etc.
- To formulate cosmetic products.

## B. COURSE CONTENT

| NO | TOPIC | P(Hrs) | COs |
|---|---|---|---|
| [1] | 1. Preformulation studies on paracetamol/aspirin/or any other drug<br>2. Preparation and evaluation of Paracetamol tablets<br>3. Preparation and evaluation of Aspirin tablets<br>4. Coating of tablets- film coating of tables/granules<br>5. Preparation and evaluation of Tetracycline capsules<br>6. Preparation of Calcium Gluconate injection<br>7. Preparation of Ascorbic Acid injection<br>8. Quality control test of (as per IP) marketed tablets and capsules<br>9. Preparation of Eye drops/ and Eye ointments<br>10. Preparation of Creams (cold / vanishing cream)<br>11. Evaluation of Glass containers (as per IP) | 60 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Goudanavar, Prakash. Practical Manual for Industrial Pharmacy I: As per Syllabus Prescribed by PCI for B.Pharm v Sem; OrangeBooks Publication, 2020.
2. Patil, Ketan., Patil, Paresh., Patil, Narendra., Kshirsagar, Sandip. The Theory and Practical Book of Industrial Pharmacy-I; Ip Innovative Publication Pvt. Ltd: New Delhi, 2020.


## D. REFERENCE BOOKS


1. Kohli, D. P. S.; Shah, D. H. Drug Formulations Manual; Business Horizons: New Delhi, 2012.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Apply and Create | To apply knowledge of preformulation in designing preformulation protocol and designing dosage forms. |
| CO2 | Create and Evaluate | To prepare and evaluate tablet, capsules, of different APIs |
| CO3 | Create and Evaluate | To prepare and evaluate sterile dosage form like injections and ophthalmic products. |
| CO4 | Create | To prepare cosmetic products. |
| CO5 | Evaluate | Evaluation of packaging materials for dosage forms as perpharmacopoeial standards. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 2 | 3 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 3 | 3 | 1.2 | 2.6 | 2.2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

## B.PHARM. SEMESTER – V (BPH)
## SUBJECT:PHARMACOLOGY-II–PRACTICAL(BP507P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope:** This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.

**Objectives:**Upon completion of this course the student should be ableto

- Perform different types of bioassay.
- Isolate different organs/tissues from the laboratory animals by simulated experiments.
- Analyse various receptor actions using isolated tissue preparation.
- Evaluate and analyse different types of analgesic and anti-inflammatory drugs
- To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

## B. COURSE CONTENT

| NO | TOPIC | P(Hrs) | COs |
|---|---|---|---|
| [1] | 1) Introduction to in-vitro pharmacology and physiological salt solutions.<br>2) Effect of drugs on isolated frog heart.<br>3) Effect of drugs on blood pressure and heart rate of dog.<br>4) Study of diuretic activity of drugs using rats/mice.<br>5) DRC of acetylcholine using frog rectus abdominis muscle.<br>6) Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis-muscle and rat ileum respectively.<br>7) Bioassay of histamine using guinea pig ileum by matching method<br>8) Bioassay of oxytocin using rat uterine horn by interpolation method.<br>9) Bioassay of serotonin using rat fundus strip by three point bioassay.<br>10) Bioassay of acetylcholine using rat ileum/colon by four point bioassay.<br>11) Determination of PA2value of prazosin using rat anococcygeus muscle (by Schilds plot method).<br>12) Determination of PD2 value using guinea pig ileum.<br>13) Effect of spasmogens and spasmolytic using rabbit jejunum.<br>14) Anti-inflammatory activity of drugs using carrageenan induced paw-oedema model.<br>15) Analgesic activity of drug using central and peripheral methods. | **60** | CO1, CO2, CO3, CO4, CO5. |

## C. TEXT BOOKS


1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

## D. REFERENCE BOOKS


1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; Mcgraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; KnollmannB. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; Mcgraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's.*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Perform, Apply and Quantify. | Perform different types of bioassay. |
| CO2 | Understand and Isolate | Isolate different organs/tissues from the laboratory animals by simulated experiments. |
| CO3 | Analyse | Analyse various receptor actions using isolated tissue preparation. |
| CO4 | Analyse an Evaluate. | Evaluate and analyse different types of analgesic and anti-inflammatory drugs |
| CO5 | Evaluate and analyse | To evaluate the drugs on different organs/tissues from the laboratory animals by invivo/invitro analysis. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 1 | 3 | 2 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |
| Avg | 3 | 2 | 3 | 3 | 3 | 3 | 2.4 | 3 | 3 | 2.4 | 2.8 | 3 | 2.4 | 2.8 | 2.6 | 3 |

## B.PHARM. SEMESTER – VI (BPH)
## SUBJECT: MEDICINAL CHEMISTRY III -THEORY (BP601T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | 4 | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

**Objectives**: Upon completion of the course student shall be able to

- Understand the importance of drug design and different techniques of drug design.
- Understand the chemistry of drugs with respect to their biological activity.
- Know the metabolism, adverse effects and therapeutic value of drugs.
- Know the importance of SAR of drugs.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Classification, mechanism of action, uses, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*) of following class of drugs in all units.**<br>**Antibiotics**<br>Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.<br>**β-Lactam antibiotics:** Penicillin, Cepholosporins, β- Lactamase inhibitors, Monobactams<br>**Aminoglycosides:** Streptomycin, Neomycin, Kanamycin<br>**Tetracyclines:** Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline | 10 | CO1<br>CO2<br>CO3<br>CO4 |
| [2] | **Antibiotics**<br>**Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes.**<br>**Macrolide:** Erythromycin Clarithromycin, Azithromycin<br>**Miscellaneous:** Chloramphenicol*, Clindamycin<br>**Prodrugs:** Basic concepts and application of prodrugs design<br>**Antimalarials:** Etiology of malaria<br>**Quinolines:** SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine<br>**Biguanides and dihydro triazines:** Cycloguanil pamoate, Proguanil<br>**Miscellaneous:** Pyrimethamine, Artesunete, Artemether, Atovoquone | 10 | CO1<br>CO2<br>CO3<br>CO4 |
| | | | |

| | | | |
|---|---|---|---|
| [3] | **Anti-tubercular Agents**<br>**Synthetic anti tubercular agents:** Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*<br>**Anti tubercular antibiotics:** Rifampicin, Rifabutin, Cycloserine Streptomycine, Capreomycin sulphate<br>**Urinary tract anti-infective agents**<br>**Quinolones:** SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin<br>**Miscellaneous:** Furazolidine, Nitrofurantoin*, Methanamine<br>**Antiviral agents:**<br>Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirdine, Ribavirin, Saquinavir, Indinavir, Ritonavir | 10 | CO1<br>CO2<br>CO3<br>CO4 |
| [4] | **Antifungal agents:**<br>**Antifungal antibiotics:** Amphotericin-B, Nystatin, Natamycin, Griseofulvin.<br>**Synthetic Antifungal agents:** Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconozole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.<br>**Anti-protozoal Agents:** Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.<br>**Anthelmintics:** Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.<br>**Sulphonamides and Sulfones**<br>Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxaole*, Sulphadiazine, Mefenide acetate, Sulfasalazine<br>**Folate reductase inhibitors:** Trimethoprim*, Cotrimoxazole<br>**Sulfones:** Dapsone* | 08 | CO1<br>CO2<br>CO3<br>CO4 |
| [5] | **Introduction to Drug Design**<br>Various approaches used in drug design.<br>Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammet's electronic parameter, Tafts steric parameter and Hansch analysis.<br>**Pharmacophore modeling and docking techniques**.<br>**Combinatorial Chemistry:** Concept and applications chemistry: solid phase and solution phase synthesis. | 07 | CO5 |

## C. TEXT BOOKS


1. Alagarsamy, V. Textbook of Medicinal Chemistry, Volume I and Volume II, 3rd ed.; CBS Publishers, India, 2016
2. Kadam, S.S., Mahadik, K.R., Bothara, K.G. Principles of Medicinal Chemistry, Volume I and II, 20th ed.; Nirali Prakashan, India, 2010


## D. REFERENCE BOOKS


1. Hansch, C., Semmes, P.G., Taylor, J.B. Comprehensive Medicinal Chemistry, Volume I to VI, 1st ed.; Elsevier, India, 2005
2. Abraham, D.J. Burger's Medicinal Chemistry and Drug Discovery, Volume I to VI, 6th ed.; Wiley-Interscience, New Jersey, 2003
3. Lendnicer, D., Mitscher, L.A. The Organic Chemistry of Drug Synthesis, Volume I to VI, Wiley-Interscience, New Jersey, 2008
4. Johnson, D.S., Li, J.J. Art of Drug Synthesis, 1st ed,; Wiley-Interscience, New Jersey, 2007
5. Patrick, G.L. An Introduction to Medicinal Chemistry, 3rd ed.; Oxford University Press, Oxford, 2006
6. Silverman, R.B. The Organic Chemistry of Drug Design and Drug Action, 2nd ed,; Academic Press, Burlington, 2004
7. Lemke, T.L., Williams, D.A. FOYE'S Principles of Medicinal Chemistry, 7th ed.; Lippincott Williams & Wilkins, Baltimore, 2013
8. Baele, J.M., Block J. H. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th ed.; Lippincott Williams & Wilkins; Baltimore, 2011
9. Smith, J.H., Williams, H. Smith and Williamson's Introduction to the Principles of Drug Design and Action, 3rd ed; CRC Press, The Netherlands, 2005
10. Vardanyan, R., Hruby, V. Synthesis of Essential Drugs, Volume I & II, 1st ed.; Elsevier, The Netherlands, 2006

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Remember | To describe classification, chemistry and chemical degradation of various classes of drugs. |
| CO2 | Analyse and understand | To summarize structure activity relationship and development of different classes of drugs. |
| CO3 | Apply, Create | To report synthetic protocol of selected drugs. |
| CO4 | Understand, remember | To summarize mechanism of action, uses and metabolic pathways/metabolism various some important drugs. |
| CO5 | Understand, Remember | Understand the fundamental concepts of prodrugs, combinatorial chemistry and drug design. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 0 | 2 | 2 | 0 | - | - | - | - | 0 | 3 | 2 | 2 | 3 | 2 | 1 |
| **CO2** | 3 | 3 | 3 | 2 | 3 | - | - | - | - | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| **CO3** | 3 | 0 | 2 | 1 | 0 | - | - | - | - | 0 | 3 | 2 | 2 | 3 | 1 | 1 |
| **CO4** | 3 | 0 | 2 | 1 | 0 | - | - | - | - | 0 | 3 | 2 | 1 | 2 | 1 | 1 |
| **CO5** | 3 | 0 | 2 | 1 | 0 | - | - | - | - | 0 | 3 | 2 | 2 | 3 | 1 | 1 |
| | | | | | | | | | | | | | | | | |
| **Avg** | 2.8 | 0.6 | 2.2 | 1.4 | 0.6 | - | - | - | - | 0.6 | 2.8 | 2 | 2 | 2.8 | 1.4 | 1.4 |

## B.PHARM. SEMESTER – VI (BPH)
## SUBJECT: PHARMACOLOGY-III–THEORY (BP602T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications)of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and Chrono pharmacology.

**Objectives:** Upon completion of this course the student should be able to:

- Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases.
- Understand the resistance mechanism of drug action in the treatment of different infectious diseases.
- Select the drug, its necessity, frequency, duration, prophylaxis and test for cure of the treatment of infectious diseases.
- Appreciate correlation of pharmacology with related medical sciences and chrono-pharmacology.
- Comprehend the principles of toxicology and treatment of various poisonings.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Pharmacology of drugs acting on Respiratory system**<br>a.Anti-asthmatic drugs<br>b.Drugs used in the management of COPD<br>c.Expectorants and antitussives<br>d.Nasal decongestants<br>e.Respiratory stimulants<br>**Pharmacology of drugs acting on the Gastrointestinal Tract**<br>a. Antiulcer agents.<br>b. Drugs for constipation and diarrhoea.<br>c. Appetite stimulants and suppressants.<br>d. Digestants and carminatives.<br>e. Emetics and anti-emetics. | 10 | CO1, CO3, CO5. |
| [2] | **Chemotherapy**<br>a. General principles of chemotherapy.<br>b. Sulphonamides and cotrimoxazole.<br>c. Antibiotics- Penicillin's, cephalosporin's, chloramphenicol, macrolides, quinolones and fluoroquinolones, tetracycline and aminoglycosides | 10 | CO1, CO2, CO3, CO4. |
| [3] | **Chemotherapy**<br>a. Anti-tubercular agents<br>b. Anti-leprotic agents<br>c. Anti-fungal agents<br>d. Antiviral drugs<br>e. Anthelmintics | 10 | CO1, CO2, CO3, CO4. |

| | | | |
|---|---|---|---|
| | f. Antimalarial drugs<br>g. Anti-amoebic agents | | |
| [4] | **Chemotherapy**<br>Urinary tract infections and sexually transmitted diseases.<br>Chemotherapy of malignancy.<br>**Immunopharmacology**<br>a.Immunostimulants<br>b. Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilar. | 08 | CO2, CO3, CO4. |
| [5] | **Principles of toxicology**<br>a. Definition and basic knowledge of acute, subacute and chronic toxicity.<br>b.Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity<br>c. General principles of treatment of poisoning.<br>d.Clinical symptoms and management of barbiturates, morphine, organophosphosphorus compound and lead, mercury and arsenic poisoning.<br>**Chronopharmacology**<br>a.Definition of rhythm and cycles.<br>b.Biological clock and their significance leading to chronotherapy. | 07 | CO1, CO4, CO5. |

## C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

## D. REFERENCE BOOKS


1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; Mcgraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; KnollmannB. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; Mcgraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's.*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.
10. N Udupa; Gupta, P. D. *Concepts in Chronopharmacology*; Shyam Prakashan: Jaipur, 2009.


## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, Apply and Analyse | Understand the mechanism of drug action and its relevance in the treatment of different respiratory and GIT diseases. |
| CO2 | Understand, Evaluate and Apply | Understand the mechanism and resistance mechanism of drug action in the treatment of different infectious diseases. |
| CO3 | Remember, Evaluate, Apply and Create | Select the drug, its necessity, frequency, duration, prophylaxis and test for cure of the treatment of infectious diseases. |
| CO4 | Understand, Evaluate and analyse | Comprehend the principles of toxicology and treatment of various poisonings, over usage of antibiotics and avoid excessive and unnecessary usages of antibiotics. |
| CO5 | Understand, Remember and Apply | Appreciate correlation of pharmacology with related its appropriate uses and how the drugs affect Chronopharmacology. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | 3 | 3 | 3 | 2 | 3 | 1 | 3 | 1 | 3 | 3 | - | 3 | 3 | 3 |
| CO2 | 3 | - | 3 | 3 | 3 | 1 | 3 | 1 | 3 | 3 | 2 | 3 | - | 3 | 3 | 3 |
| CO3 | 3 | 1 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | - | 3 | 3 | 3 |
| CO4 | 3 | 1 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | - | 3 | 3 | 3 |
| CO5 | 3 | 1 | 3 | 3 | 3 | 2 | 3 | 1 | 3 | 1 | 3 | 3 | - | 3 | 3 | 3 |
| Avg | 3 | 0.6 | 3 | 3 | 2.8 | 1.6 | 3 | 1.6 | 3 | 2.2 | 2.6 | 3 | - | 3 | 3 | 3 |

## B.PHARM. SEMESTER – VI (BPH)
## SUBJECT: HERBAL DRUG TECHNOLOGY–THEORY (BP603T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing
Practices (GMP), patenting and regulatory issues of herbal drugs
**Objectives:** Upon completion of this course the student should be able to:

- Understand raw material as source of herbal drugs from cultivation to herbal drug product
- Know the WHO and ICH guidelines for evaluation of herbal drugs
- Know the herbal cosmetics, natural sweeteners, nutraceuticals
- Appreciate patenting of herbal drugs, GMP.

## B. COURSE CONTENT

| NO | TOPIC | L(hrs) | COs |
|---|---|---|---|
| [1] | **Herbs as raw materials**<br>Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation.<br>Source of Herbs,<br>Selection, identification and authentication of herbal materials<br>Processing of herbal raw material<br>**Biodynamic Agriculture**<br>Good agricultural practices in cultivation of medicinal plants including Organic farming.<br>Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides.<br>**Indian Systems of Medicine**<br>a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy<br>b) Preparation and standardization of Ayurvedic formulations vizAristas and Asavas, Ghutika,Churna, Lehya and Bhasma. | 11 | CO1<br>CO5 |
| [2] | **Nutraceuticals**<br>General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases.<br>Study of following herbs as health food: Alfalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina<br>**Herbal-Drug and Herb-Food Interactions:** General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra. | 07 | CO2 |
| [3] | **Herbal Cosmetics**<br>Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products.<br>**Herbal excipients:** | 10 | CO3<br>CO4 |

| | | | |
|---|---|---|---|
| | Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes.<br>**Herbal formulations :**<br>Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes | | |
| **[4]** | **Evaluation of Drugs** WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs.<br>**Patenting and Regulatory requirements of natural products:**<br>a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy<br>b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem.<br>**Regulatory Issues** - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs. | 10 | CO4 |
| **[5]** | **General Introduction to Herbal Industry**<br>Herbal drugs industry: Present scope and future prospects.<br>A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India.<br>**Schedule T–Good Manufacturing Practice of Indian systems of medicine**<br>Components of GMP (Schedule–T) and its objectives, Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records. | 07 | CO3<br>CO5 |

## C. TEXT BOOKS


1. Dr. Arora, P. &Dr. Arora, V., A text book of "Herbal Drug Technology" Pee Vee Books, S. Vikas & Company ( Medical Publishers) ,2019.
2. Dr. Lodhi, S., Dr. Usman, R. Md ., Dr. Deshmukh Ta., Darvekar, VM. &Dr. Kori ML., "Herbal Drug Technology", 1st Edition, NiraliPrakashan, 2019.


## D. REFERENCE BOOKS


1. Dr. Mukherjee, PK. &Dr.Verpoorte, R., "GMP for Botanicals" 1st Edition, Business Horizons Pharmaceutical Publishers, 2003.
2. Dr. Mukherjee, PK."Quality Control of Herbal Drugs: An Approach to Evaluation of botanicals" 1st Edition reprint, Elsevier Science Publication, 2017.
3. Agrawal, SS. &Paridhavi M., "Herbal Drug Technology" 2nd edition, Orient Blackswan , 2012.
4. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry" , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
5. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
6. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
7. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
8. Dr. Shinde, VM. & Mrs. Bodas-yadav, KS., "Herbal Drug Technology", 2nd edition, Nirali Prakashan, 2020.
9. Dr. Tiwari V., "Herbal Drug Technology", 1st edition, Nirali Prakashan, 2020.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Remember | Describe concept of raw material as source of herbal drugs from cultivation for herbal drug production. |
| CO2 | Remember, Apply and Analyse | Concept and importance of Nutraceuticals, Herb-food and Herb- drug interaction. |
| CO3 | Understand, Apply, and Evaluate | Explain the concept of Herbal Industry, Herbal excipients, Herbal cosmetics and Formulation. |
| CO4 | Remember, Evaluate and Analyse | Application of WHO and ICH guidelines for raw material and finish products, Patenting and Regulatory requirements of Herbal drug and formulations. |
| CO5 | Remember, Apply, and Evaluate | Detail description and Good manufacturing Practice of Indian system of medicine. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | - | 2 | 2 | 1 | 2 | 1 | 3 | 3 | 2 | 2 | - | 1 |
| CO2 | 3 | 2 | 2 | 2 | - | 2 | 3 | 1 | 2 | 1 | 3 | 3 | 2 | 2 | 3 | 1 |
| CO3 | 3 | 2 | 2 | 2 | - | 2 | 2 | 1 | 3 | 1 | 3 | 3 | 2 | 2 | - | 1 |
| CO4 | 3 | 2 | 2 | 2 | - | 2 | 3 | 1 | 3 | 1 | 3 | 3 | 2 | 2 | 3 | 1 |
| CO5 | 3 | 2 | 2 | 2 | - | 2 | 2 | 1 | 2 | 1 | 3 | 3 | 2 | 2 | 3 | 1 |
| | | | | | | | | | | | | | | | | |
| Avg | 3 | 2 | 2 | 2 | - | 2 | 2.4 | 1 | 2.4 | 1 | 3 | 3 | 2 | 2 | 1.8 | 1 |

## B.PHARM. SEMESTER – VI (BPH)

## SUBJECT: BIOPHARMACEUTICS AND PHARMACOKINETICS-THEORY (BP604T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** This subject is designed to impart knowledge and skills of Biopharmaceutics and pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arised therein.

**Objectives:** Upon completion of the course student shall be able to:

1. Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
2. Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
3. To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
4. Understand various pharmacokinetic parameters, their significance & applications.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Introduction to Biopharmaceutics**<br>**Absorption**; Mechanisms of drug absorption through GIT, factors influencing drug absorption though GIT, absorption of drug from Non per oral extra-vascular routes.<br>**Distribution** Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs | 10 | CO1<br>CO2 |
| [2] | **Elimination:** Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non renal routes of drug excretion of drugs<br>**Bioavailability and Bioequivalence:** Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, *in-vitro* drug dissolution models, *in-vitro-in-vivo* correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs. | 10 | CO1<br>CO2 |
| [3] | **Pharmacokinetics:** Definition and introduction to Pharmacokinetics, Compartment models, Non compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - KE ,t1/2,Vd,AUC,Ka, Clt and CLR- definitions methods of eliminations, understanding of their significance and application. | 08 | CO3 |
| [4] | **Multicompartment models:** Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and mainetnance doses and their significance in clinical settings. | 8 | CO4 |
| [5] | **Nonlinear Pharmacokinetics:**<br>a. Introduction, b. Factors causing Non-linearity.<br>c. Michaelis-menton method of estimating parameters, Explanation with | 7 | CO5 |

| | | | |
|---|---|---|---|
| | example of drugs. | | |

## C. TEXT BOOKS

1. Brahankar, D. M.; Jaiswal, S. B. *Biopharmaceutics and Pharmacokinetics : A Treatise*; Vallabh Prakashan: Delhi, 2014.

## D. REFERENCE BOOKS


1. Abdou, H. M. Dissolution, Bioavailability and Bioequivalence; Mack Publishing Company: Easton, 1989.
2. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics; Lea & Febiger: Philadelphia, 1984.
3. Gibaldi, M.; Perrier, D. Pharmacokinetics; Infroma Healthcare: New York, 2007.
4. Notari, R. E. Biopharmaceutics and Pharmacokinetics : An Introduction; M. Dekker: New York, 1975.
5. Notari, R. E. Biopharmaceutics and Clinical Pharmacokinetics : An Introduction; M. Dekker: New York, 1987.
6. Remington, J. P.; Gennaro, A. R. Remington's Pharmaceutical Sciences; Mack Pub. Co: Easton, Pa., 1990.
7. Rowland, M.; Tozer, T. N. Clinical Pharmacokinetics and Pharmacodynamics : Concepts and Applications; Wolters Kluwer-Lippincott William & Wilkins: Philadelphia, 2011.
8. Shargel, L.; Yu, A. B. C. Applied Biopharmaceutics & Pharmacokinetics; Mcgraw-Hill Education: Singapore, 2016.
9. Gibaldi M and Prescott L, Hand Book of Clinical Pharmacokinetics, ADIS Health Science Press, 1989
10. Swarbrick, Biopharmaceutics, Lea & Febiger,U.S.,1971


## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember and Understand | Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance. |
| CO2 | Understand and Apply | To understand the concepts of bioavailability and bioequivalence of drug products and their significance and IVIVC co-relation for different dosage forms as well as distribution and elimination process. |
| CO3 | Understand | To understand and apply plasma drug concentration-time data to calculate the pharmacokinetic parameters for one compartment modeling |
| CO4 | Understand and Remember | To understand various pharmacokinetic parameters and their significance for multicompartment modeling. |
| CO5 | Apply and evaluate | To understand various pharmacokinetic parameters and their significance for Nonlinear kinetics. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2** | 3 | 2 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO3** | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO4** | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 3 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 1 | 2 |
| **Avg** | 3 | 2.2 | 2.6 | 3 | 1.6 | 1.4 | 1.8 | 2.2 | 1.6 | 1.6 | 2.6 | 3 | 2.8 | 2.8 | 1.8 | 2 |

## B.PHARM. SEMESTER – VI (BPH)
## SUBJECT: PHARMACEUTICAL BIOTECHNOLOGY-THEORY (BP605T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: Course enables the student to learn biotechnology, long promise to revolutionize the biological sciences and technology. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. Biotechnology has already produced transgenic crops and animals and the future promises a lot more. It is basically a research-based subject.
**Objectives:** Upon completion of the course the student shall be able to understand Enzymes, Genetic engineering and fermentation technology and importance of biotechnology in industry.

## B. COURSE CONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.<br>b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.<br>c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.<br>d) Brief introduction to Protein Engineering.<br>e) Use of microbes in industry. Production of Enzymes- General consideration<br>Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.<br>f) Basic principles of genetic engineering. | **10** | CO1 |
| [2] | a) Study of cloning vectors, restriction endonucleases and DNA ligase.<br>b) Recombinant DNA technology. Application of genetic engineering in medicine.<br>c) Application of r DNA technology and genetic engineering in the production of: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones- Insulin. d) Brief introduction to PCR | **10** | CO2<br>CO3 |
| [3] | Types of immunity- humoral immunity, cellular immunity<br>a) Structure of Immunoglobulins<br>b) Structure and Function of MHC<br>c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.<br>d) General method of the preparation of bacterial vaccines, toxoids, viral vaccines, antitoxins, serum-immune blood derivatives and other products relative to immunity.<br>e) Storage conditions and stability of official vaccines<br>f) Hybridoma technology- Production, Purification and Applications | **10** | CO5 |
| [4] | a) Immunoblotting techniques- ELISA, Western blotting, Southern blotting.<br>b) Genetic organization of Eukaryotes and Prokaryotes | **08** | CO2<br>CO5 |

| | | | |
|---|---|---|---|
| | c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.<br>d) Introduction to Microbial biotransformation and applications.<br>**e)** Mutation: Types of mutation/mutants. | | |
| **[5]** | a) Fermentation methods and general requirements, study of media, equipment, sterilization methods, aeration process, stirring.<br>b) Large scale production fermenter design and its various controls.<br>c) Study of the production of - penicillin, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,<br>d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma substitutes. | **07** | CO4 |

## C. TEXT BOOKS

1. Primrose, S. B. *Molecular Biotechnology*; Blackwell Scientific Publications: Oxford ; Boston, 2001.
2. Stanbury, P. F.; Whitaker, A.; Hall, S. J. *Principles of Fermentation Technology*; 2017.

## D. REFERENCE BOOKS

1. Glick, B. R.; Patten, C. L. *Molecular Biotechnology: Principles and Applications of Recombinant DNA*; Asm Press: Washington, Dc, 2017.
2. Kindt, T. J.; Goldsby, R. A.; Anne, B. *Kuby Immunology*; W.H. Freeman and Company: New York, 2007.
3. Goding, J. W. *Monoclonal Antibodies: Principles and Practice: Production and Application of Monoclonal Antibodies in Cell Biology, Biochemistry and Immunology.*; Academic Press: London, 1996.
4. Walker, J. M.; Gingold, E. B. *Molecular Biology and Biotechnology*; Royal Society of Chemistry: London, 1993.
5. Zaborsky, O. R. *Immobilized Enzymes*; Krieger: Malabar, Fla., 1984.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Remember and Understand | To Understand the importance of Immobilized enzymes in Pharmaceutical Industries. |
| **CO2** | Remember and Understand | To learn genetic engineering applications in relation to production of pharmaceuticals |
| **CO3** | Understand and Apply | To learn Importance of Monoclonal antibodies in Industries |
| **CO4** | Understand and Remember | To learn the use of microorganisms in fermentation technology |
| **CO5** | Understand | To learn antigen-antibody reaction and immunity of Human system |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | – | 1 | 3 | – | - | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO2** | 2 | – | 2 | 3 | – | 1 | 1 | 1 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO3** | 2 | – | 2 | 3 | – | - | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 2 | – | 2 | 3 | – | 2 | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO5** | 2 | – | 2 | 2 | – | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 3 | 1 | 1 |
| **Avg** | 2 | – | 1.8 | 2.8 | – | 1 | 1.2 | 1 | 1.6 | 2.8 | 2.8 | 2.4 | 2.8 | 3 | 2.2 | 2.6 |

## B.PHARM. SEMESTER – VI (BPH)
## SUBJECT: INSTRUMENTAL METHODS OF ANALYSIS - THEORY (BP606T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

**Objectives:** Upon completion of the course student shall be able to:

1. understand the cGMP aspects in a pharmaceutical industry
2. appreciate the importance of documentation
3. understand the scope of quality certifications applicable to pharmaceutical industries
4. understand the responsibilities of QA & QC departments

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Quality Assurance and Quality Management concepts:** Definition and concept of Quality control, Quality assurance and GMP<br>**Total Quality Management (TQM):** Definition, elements, philosophies<br>**ICH Guidelines**: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines<br>**Quality by design (QbD)**: Definition, overview, elements of QbD program, tools<br>**ISO 9000 & ISO14000**: Overview, Benefits, Elements, steps for registration<br>**NABL accreditation** : Principles and procedures | 10 | CO1<br>CO3 |
| [2] | **Organization and personnel:** Personnel responsibilities, training, hygiene and personal records. **Premises:** Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.<br>**Equipments and raw materials:** Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials. | 10 | CO1<br>CO3<br>CO4 |
| [3] | **Quality Control:** Quality control test for containers, rubber closures and secondary packing materials.<br>**Good Laboratory Practices:** General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities | 10 | CO3<br>CO4 |
| [4] | **Complaints:** Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.<br>**Document maintenance in pharmaceutical industry:** Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records. | 08 | CO2 |

| | | | |
|---|---|---|---|
| [5] | **Calibration and Validation:** Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.<br>**Warehousing:** Good warehousing practice, materials management | 07 | CO5 |

## C. TEXT BOOKS


1. P P Sharma. *How to Practice GMPs*, 6th ed.; vandana publications Pvt. Ltd.: Delhi, 2010.
2. Hirsch, A. F. *Good Laboratory Practice Regulations*; M. Dekker: New York ; Basel, 1989.


## D. REFERENCE BOOKS


1. Weinberg, S. *Good Laboratory Practice Regulations*; M. Dekker: New York, 1995.
2. World Health Organization. *Quality Assurance of Pharmaceuticals. 2 : A Compendium of Guidelines and Related Materials*; 1999.
3. World Health Organization. Pharmaceuticals Programme. The International pharmacopoeia = Pharmacopoea internationalis. Vol. 4, Tests, methods and general requirements : quality specifications for pharmaceutical substances, excipients and dosage forms
4. ICH Official web site : ICH http://www.ich.org/.
5. ISO. ISO 14000 Environmental management https://www.iso.org/iso-14001-environmental-management.html.
6. Ghosh S K; Maitra K. *A Guide to Total Quality Management*, 4th ed.; Oxford Publishing House, 2005.
7. S K Ghosh. *Introduction to ISO 9000 and Total Quality Management*, 4th ed.; Oxford Publishing House, 2007.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand Remember and Evaluate | To understand the cGMP and ICH aspects in a pharmaceutical industry |
| CO2 | Understand Apply and Evaluate | To understand and appreciate the importance of documentation |
| CO3 | Understand Remember and Evaluate | To understand the scope of quality certifications applicable to pharmaceutical industries |
| CO4 | Understand Remember and Evaluate | To understand the responsibilities of QA & QC departments |
| CO5 | Understand Apply and Evaluate | To learn the aspects of calibration, validation, Material management |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 1 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 |
| CO2 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 2 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 2 |
| Avg | 3 | 2.4 | 2.4 | 2.4 | 1 | 2.8 | 2.6 | 2 | 2 | 1.8 | 2.6 | 3 | 3 | 2.2 | 2.4 | 2.8 |

## B.PHARM. SEMESTER – VI (BPH)
## SUBJECT: MEDICINAL CHEMISTRY III -PRACTICAL (BP607P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | - | 05 | 10 | 50 |

## A. COURSE OVERVIEW

Medicinal Chemistry III practical subject imparts practical knowledge regarding synthesis and analysis of drugs by various methods via experiments in laboratory. The subject also focuses on chemical structure, reaction and mechanism drawing experiment using various offline and online tools. Experiments involving prediction of various physicochemical properties-drug likeness properties would help to understand important aspect of drug design.

**Objectives**: Upon completion of the course student shall be able to

1. Use ChemDraw for chemical structure and reaction drawing
2. Synthesize and purify organic compounds
3. Perform analysis of drugs using various analytical methods

## B. COURSE CONTENT

| NO | TOPIC | P (hrs) | COs |
|---|---|---|---|
| [1] | **Preparation of drugs and intermediates**<br>1 Sulphanilamide<br>2 7-Hydroxy, 4-methyl coumarin<br>3 Chlorobutanol<br>4 Triphenyl imidazole<br>5 Tolbutamide<br>6 Hexamine<br>**Assay of drugs**<br>1 Isonicotinic acid hydrazide<br>2 Chloroquine<br>3 Metronidazole<br>4 Dapsone<br>5 Chlorpheniramine maleate<br>6 Benzyl penicillin<br><br>**Preparation of medicinally important compounds or intermediates by Microwave irradiation technique**<br><br>**Drawing structures and reactions using chem draw**<br><br>**Determination of physicochemical properties** such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinski's RO5) | 60 hrs | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. Kar, A. Advanced Practical Medicinal Chemistry, 3rd ed.; New Age International Publishers, India, 2020
2. Vogel, A.I., Tatchell, A.R., Furniss, B.S., Smith, P.W.G. Text book of practical organic chemistry, 5th ed.; Longman Scientific and Technical; New York, 2011

## C. REFERENCE BOOKS

1. Lendnicer, D., Mitscher, L.A. The Organic Chemistry of Drug Synthesis, Volume I to VI, Wiley-Interscience, New Jersey, 2008
2. Mann, F.G., Saunders, B.G., Practical Organic Chemistry, 4th ed.; Pearson, India, 2009

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Apply and evaluate | To assess the drug-likeness properties of drugs using various online tools |
| CO2 | Understand and apply | To draw chemical structure, reaction and mechanism drawing using offline and online tools |
| CO3 | Apply | To synthesize some drugs and intermediates by conventional synthesis |
| CO4 | Apply | To perform synthesis of selected drugs by microwave assisted organic synthesis technique |
| CO5 | Apply and evaluate | To carry out analysis of various drugs |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 0 | 2 | 3 | 1 | - | - | - | - | 0 | 3 | 2 | 2 | 3 | 2 | 1 |
| CO2 | 2 | 1 | 1 | 3 | 0 | - | - | - | - | 0 | 3 | 1 | 2 | 1 | 1 | 1 |
| CO3 | 3 | 2 | 3 | 3 | 1 | - | - | - | - | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 1 | - | - | - | - | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 1 | - | - | - | - | 0 | 3 | 3 | 3 | 2 | 2 | 1 |
| | | | | | | | | | | | | | | | | |
| Avg | 2.8 | 1.4 | 2.4 | 3 | 0.8 | - | - | - | - | 1.2 | 3 | 2.4 | 2.6 | 2 | 1.8 | 1.8 |

## B.PHARM. SEMESTER – VI (BPH)
## SUBJECT:PHARMACOLOGY-III–PRACTICAL(BP608P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope:**This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and Chrono pharmacology.

**Objectives:**Upon completion of this course the student should be able to:

- Evaluate different types of toxicity studies.
- Apply different types of statistical analysis in different pharmacological experiments.
- Analyse and evaluate various receptor actions using isolated tissue preparation.
- Create the observation data and correlate them using statistical analysis.
- To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

## B. COURSE CONTENT

| NO | TOPIC | P (Hrs) | COs |
|---|---|---|---|
| [1] | 1) Dose calculation in pharmacological experiments.<br>2) Anti-allergic activitybymast-cellstabilizationassay.<br>3) Studyofanti-ulceractivityofadrugusingpylorusligand (SHAY) ratmodel and NSAIDSinduced ulcermodel.<br>4) Studyofeffectofdrugsongastrointestinal motility.<br>5) Effectofagonistandantagonists on guineapig ileum.<br>6) Estimation ofserum biochemical parametersbyusingsemi-autoanalyser.<br>7) Effectof salinepurgativeonfrogintestine.<br>8) Insulin hypoglycaemic effect in rabbit.<br>9) Test forpyrogens (rabbit method).<br>10) Determination of acuteoral toxicity (LD50) ofadrugfrom agivendata.<br>11) Determination of acuteskin irritation / corrosion ofatest substance.<br>12) Determination of acuteeyeirritation /corrosionof atest substance.<br>13) Calculation ofpharmacokinetic parametersfromagivendata.<br>14) Biostatistics methods in experimental pharmacology (student's t test,ANOVA)<br>15) Biostatistics methods inexperimental pharmacology(Chi squaretest, Wilcoxon Signed Rank test) | **60** | CO1, CO2, CO3, CO4, CO5. |

## C. TEXT BOOKS


1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

## D. REFERENCE BOOKS


1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; Mcgraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; KnollmannB. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; Mcgraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's.*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.
10. N Udupa; Gupta, P. D. *Concepts in Chronopharmacology*; Shyam Prakashan: Jaipur, 2009.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember and Evaluate. | Evaluate different types of toxicity studies. |
| CO2 | Apply and Analyse | Apply different types of statistical analysis in different pharmacological experiments. |
| CO3 | Analyse an Evaluate. | Analyse and evaluate various receptor actions using isolated tissue preparation. |
| CO4 | Create and Correlate | Create the observation data and correlate them using statistical analysis. |
| CO5 | Evaluate and analyse | To evaluate the drugs on different organs/tissues from the laboratory animals by invivo/invitro analysis. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |
| Avg | 3 | 2.4 | 3 | 3 | 3 | 3 | 2.4 | 3 | 3 | 2.4 | 2.2 | 3 | 2.6 | 3 | 2.8 | 3 |

## B.PHARM. SEMESTER – VI (BPH)
## SUBJECT: HERBAL DRUG TECHNOLOGY - PRACTICAL (BP609P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 05 | - | 50 |

## A. COURSE OVERVIEW

**Scope**: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing
Practices (GMP), patenting and regulatory issues of herbal drugs
**Objectives:** Upon completion of this course the student should be able to:

- Understand raw material as source of herbal drugs from cultivation to herbal drug product
- Know the WHO and ICH guidelines for evaluation of herbal drugs
- Know the herbal cosmetics, natural sweeteners, nutraceuticals
- Appreciate patenting of herbal drugs, GMP.

## B. COURSE CONTENT

| NO | TOPIC | P(hrs) | COs |
|---|---|---|---|
| | 1. To perform preliminary phytochemical screening of crudedrugs.<br>2. Determination of the alcohol content of Asava and Arista<br>3. Evaluation of excipients of natural origin<br>4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation.<br>5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeia requirements.<br>6. Monograph analysis of herbal drugs from recent Pharmacopoeias<br>7. Determination of Aldehyde content.<br>8. Determination of Phenol content<br>9. Determination of total alkaloids. | 60 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Dr. Usman, R. Md., Darvhekar, VM., Dr.Akhila, S. &Dr. Kumar, V., A practical Book of "Herbal Drug Technology" 1st edition, NiraliPrakashan, 2019.
2. Dr. Lodhi, S. A practical Book fo "Herbal Drug Technology" Pee Vee Books, S. Vikas & Company ( Medical Publishers) ,2020.
3.


## D. REFERENCE BOOKS


1. Dr.Khadabadi, SS., Dr.Deore, SL. & Mr. Baviskar, BA., "Experimental Phytopharmacognosy" A comprehensive Guide, 1st edition, NiraliPrakashan, 2011.
2. Dr. Mukherjee, PK. &Dr.Verpoorte, R., "GMP for Botanicals" 1st Edition, Business Horizons Pharmaceutical Publishers, 2003.
3. Dr. Mukherjee, PK."Quality Control of Herbal Drugs: An Approach to Evaluation of botanicals" 1st Edition reprint, Elsevier Science Publication, 2017.

4. Agrawal, SS. &Paridhavi M., "Herbal Drug Technology" 2nd edition, Orient Blackswan , 2012.
5. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry" , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
6. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
7. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
8. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Analyse | To Analyse Natural excipients. |
| CO2 | Create, Remember, Evaluate | To Prepare and standardise herbal Products, herbal cosmetics and Ayurvedic formulations. |
| CO3 | Understand, Evaluate and Apply | To learn application of phytochemical screening of crude drugs. |
| CO4 | Remember, Apply and Analysis | To study Monograph Analysis of herbal drugs as per the Pharmacopoeial standard. |
| CO5 | Understand, Apply and Analysis | To perform Quantitative analysis of phytoconstituents present in crude drugs. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | - | 2 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | - |
| CO2 | 3 | 2 | 2 | 3 | - | 2 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 1 | - |
| CO3 | 3 | 2 | 2 | 3 | - | 2 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 1 | - |
| CO4 | 3 | 2 | 2 | 3 | - | 2 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | - |
| CO5 | 3 | 2 | 2 | 3 | - | 2 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | - |
| | | | | | | | | | | | | | | | | |
| Avg | 3 | 2 | 2 | 3 | - | 2 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 1.6 | - |

## B.PHARM. SEMESTER – VII (BPH)
## SUBJECT: INSTRUMENTAL METHODS OF ANALYSIS - THEORY (BP701T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

**Objectives:** Upon completion of the course the student shall be able to
1. Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
2. Understand the chromatographic separation and analysis of drugs.
3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **UV Visible spectroscopy**<br>Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Applications - Spectrophotometric titrations, Single component and multi component analysis<br>**Fluorimetry**<br>Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications | 10 | CO1<br>CO2<br>CO5 |
| [2] | **IR spectroscopy**<br>Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations<br>Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications<br>**Flame Photometry**-Principle, interferences, instrumentation and applications<br>**Atomic absorption spectroscopy**- Principle, interferences, instrumentation and applications<br>**Nepheloturbidometry**- Principle, instrumentation and applications | 10 | CO1<br>CO2<br>CO5 |

| | | | |
|---|---|---|---|
| [3] | **Introduction to chromatography**<br>**Adsorption and partition column chromatography-**Methodology, advantages, disadvantages and applications.<br>**Thin layer chromatography-** Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications.<br>**Paper chromatography-**Introduction, methodology, development techniques, advantages, disadvantages and applications<br>**Electrophoresis**– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications | 10 | CO3<br>CO4<br>CO5 |
| [4] | **Gas chromatography** - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications<br>**High performance liquid chromatography (HPLC)-**Introduction, theory, instrumentation, advantages and applications. | 08 | CO3<br>CO4<br>CO5 |
| [5] | **Ion exchange chromatography-** Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications<br>**Gel chromatography-** Introduction, theory, instrumentation and applications<br>**Affinity chromatography-** Introduction, theory, instrumentation and applications | 07 | CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis.*; Pearson: New Delhi, 2009.
2. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..


## D. REFERENCE BOOKS


1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds.*; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distributors: New Delhi, 2005.
8. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
9. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.
10. Garratt, D. C. *The Quantitative Analysis of Drugs : Assisted by L. Brealey Etc.*; Chapman & Hall: London, 1964.
11. Finar, I. L. *Organic Chemistry.*; Pearson Education, (9Th Impression: Delhi, 2011.
12. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand Apply and Evaluate | To understand the interaction of matter with electromagnetic radiations |
| CO2 | Understand Apply and Evaluate | To apply the fundamentals of spectroscopy in drug analysis |
| CO3 | Understand | To understand the chromatographic separation fundamentals |
| CO4 | Understand Apply and Evaluate | To apply the fundamentals of various chromatographic techniques in drug analysis |
| CO5 | Understand Apply and Evaluate | To learn quantitative & qualitative analysis of drugs using various analytical instruments. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 2 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 2 | 1 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| Avg | 3 | 2.6 | 2.6 | 2.6 | 1 | 2.6 | 1 | 2 | 2 | 1.6 | 2.6 | 3 | 3 | 3 | 2.6 | 1.6 |

## B.PHARM. SEMESTER – VII (BPH)
## SUBJECT:INDUSTRIAL PHARMACY II -THEORY (BP702T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory to market

**Objectives:** Upon completion of the course the student shall be able to

- Know the process of pilot plant and scale up of pharmaceutical dosage forms
- Understand the process of technology transfer from lab scale to commercial batch
- Know different Laws and Acts that regulate pharmaceutical industry
- Understand the approval process and regulatory requirements for drug products

## B. COURSE CONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | **Pilot plant scale up techniques:** General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology | **10** | CO1<br>CO2 |
| [2] | **Technology development and transfer:** WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues | **10** | CO2 |
| [3] | **Regulatory affairs:** Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals<br>**Regulatory requirements for drug approval:** Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies. | **10** | CO3<br>CO4<br>CO5 |
| [4] | **Quality management systems:** Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP | **08** | CO5<br>CO3 |
| [5] | **Indian Regulatory Requirements:** Central Drug Standard Control | **07** | CO3 |

| | | | |
|---|---|---|---|
| | Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs. | | CO4<br>CO5 |

## C. TEXT BOOKS

1. B Nagarani. Industrial pharmacy-II. Blue Rose Publishers, New Delhi2021.

## D. REFERENCE BOOKS

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http,//en.wikipedia.org/wiki/Regulatory_ Affairs.
2. International Regulatory Affairs Updates, 2005. available athttp://www.iraup.com/about.php
3. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guidefor Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought by learning plus, inc. available athttp.//www.cgmp.com/ra.htm.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and apply | Understand and apply process of pilot plant and scale up of pharmaceutical dosage forms |
| CO2 | Understand and remember | Understand and remember process of technology transfer from lab scale to commercial batch |
| CO3 | Remember, Understand | Remember and apply different Laws and Acts that regulate pharmaceutical industry |
| CO4 | Understand, Remember and apply | Understand, Remember and apply approval process and regulatory requirements for drug products |
| CO5 | Understand and Remember | Understand, apply and evaluate various aspects of quality and quality management |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 0 | 3 | 3 | 3 | 1 | 1 | 1 |
| CO2 | 3 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 1 | 2 |
| CO3 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 3 | 1 | 2 | 2 |
| CO4 | 3 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 0 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 3 | 2 | 3 | 3 |
| Avg | 3 | 1.6 | 1.4 | 1 | 1.4 | 2 | 1.4 | 2 | 1.8 | 0.6 | 2.2 | 3 | 3 | 2 | 2 | 2.2 |

## B. PHARM. SEMESTER – VII
## (BPH)SUBJECT:PHARMACYPRACTICE-THEORY(BP703T)

| TeachingScheme(Hours/Week) | | | | Credits | ExaminationScheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSEOVERVIEW

**Scope:** In the changing scenario of pharmacy practice in India, for successful practice of HospitalPharmacy, the students are required to learn various skills like drug distribution, drug information,andtherapeuticdrugmonitoringforimprovedpatientcare.Incommunitypharmacy,students willbelearning various skills such as dispensing of drugs, responding to minor ailments by providingsuitablesafemedication,patientcounselling forimprovedpatientcareinthecommunityset up.

**Objectives:**Uponcompletionofthecoursethestudentshallbeableto

- knowvariousdrugdistributionmethods inahospital
- appreciatethepharmacystoresmanagement andinventorycontrol
- monitordrugtherapyof patientthroughmedicationchartreviewand clinicalreview
- obtainmedicationhistoryinterviewandcounselthepatients
- identifydrugrelatedproblems
- detectand assessadversedrugreactions
- interpretselectedlaboratoryresults(asmonitoringparametersintherapeutics)ofspecificdiseas estates
- knowpharmaceuticalcareservices
- dopatientcounsellingincommunitypharmacy
- appreciatetheconceptof Rationaldrugtherapy

## B. COURSECONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | **a) Hospitalandit'sorganization**<br>Definition, Classification of hospital- Primary,Secondary and Tertiaryhospitals,Classificationbasedonclinicalandnon-clinicalbasis,Organization Structure of a Hospital, and Medical staffs involved in thehospitaland theirfunctions.<br>**b) Hospitalpharmacyand itsorganization**<br>Definition,functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.<br>**c) Adversedrug reaction**<br>Classifications-<br>Excessivepharmacologicaleffects,secondarypharmacological effects, idiosyncrasy, allergic drug reactions, geneticallydetermined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction-beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.<br>**d) CommunityPharmacy**<br>Organization and structure of retail and wholesale drug store, types anddesign, Legal requirements for establishment and maintenance of a drugstore, Dispensing of proprietary products, maintenance of records of | 10 | CO1, CO2, CO3. |

| | | | |
|---|---|---|---|
| | retailandwholesaledrugstore. | | |

| | | | |
|---|---|---|---|
| [2] | **a) Drugdistribution systemin ahospital**<br>Dispensingofdrugstoinpatients,typesofdrugdistributionsystems,charging policy and labelling, Dispensing of drugs to ambulatory patients,andDispensingofcontrolled drugs.<br>**b) Hospitalformulary**<br>Definition,contentsofhospitalformulary,Differentiationofhospitalformulary andDruglist,preparationandrevision,andadditionanddeletionofdrugfrom hospital formulary.<br>**c) Therapeuticdrugmonitoring**<br>NeedforTherapeuticDrugMonitoring,FactorstobeconsideredduringtheTherapeutic Drug Monitoring, and Indian scenario for Therapeutic DrugMonitoring.<br>**d) Medicationadherence**<br>Causes of medication non-adherence, pharmacist role in the medicationadherence,and monitoringofpatientmedication adherence.<br>**e) Patientmedicationhistoryinterview**<br>Need for the patient medication history interview, medication interviewforms.<br>**f) Communitypharmacymanagement**<br>Financial,materials,staff,andinfrastructurerequirements. | **10** | CO1, CO2, CO3, CO5. |
| [3] | **a) Pharmacyandtherapeuticcommittee**<br>Organization,functions,Policiesofthepharmacyandtherapeuticcommitteeinincludingdrugsintoformulary,inpatientandoutpatientprescription,automaticstoporder,andemergencydruglistpreparation.<br>**b) Druginformationservices**<br>DrugandPoisoninformationcentre,Sourcesofdruginformation,Computerisedservices,andstorageandretrievalofinformation.<br>**c) Patientcounselling**<br>Definitionofpatientcounselling;stepsinvolvedinpatientcounselling,andSpecialcases that requirethepharmacist<br>**d) Education and trainingprogramin thehospital**<br>Role of pharmacist in the education and training program, Internal andexternal training program, Services to the nursing homes/clinics, Code ofethicsforcommunitypharmacy,andRoleofpharmacistintheinterdepartmental communicationand communityhealtheducation.<br>**e) Prescribed medicationorderandcommunicationskills**<br>Prescribedmedicationorder-interpretationandlegalrequirements,Communicationskills-communicationwithprescribersandpatients. | **10** | CO1 CO2 CO3, CO4. |
| [4] | **a) Budgetpreparationandimplementation**<br>Budgetpreparationandimplementation<br>**b) ClinicalPharmacy**<br>IntroductiontoClinicalPharmacy,Conceptofclinicalpharmacy,functionsandresponsibilitiesofclinicalpharmacist,Drugtherapymonitoring-medication chart review, clinical review, pharmacist intervention, Wardround participation, Medication history and Pharmaceutical care. Dosingpatternand drugtherapybasedon Pharmacokinetic&diseasepattern.<br>**c) Overthecounter (OTC)sales**<br>Introductionandsaleofoverthecounter,andRationaluseofcommonoverthecountermedications. | **8** | CO2, CO4, CO5. |
| [5] | **a)Drugstore managementand inventorycontrol**<br>Organisationofdrugstore,typesofmaterialsstockedandstorageconditions,Purchaseandinventorycontrol:principles,purchaseprocedure, | **7** | CO1, CO4, CO5. |

| | | | |
|---|---|---|---|
| | purchaseorder,procurementandstocking,Economicorderquantity,Reorder quantity level, and Methods used for the analysis of the drugexpenditure<br>**b) Investigationaluseofdrugs**<br>Description, principals involved, classification, control, identification, roleofhospital pharmacist, advisorycommittee.<br>**c) InterpretationofClinicalLaboratoryTests**<br>Bloodchemistry,hematology,andurinalysis | | |

## C. TEXTBOOKS


1. TipnisBajaj.HospitalPharmacy,1sted.Maharashtra:CareerPublications;2008.
2. MerchantS.H.andDr.J.S.Quadry.*Atextbookofhospitalpharmacy*,4thed.Ahmadabad:B.S.ShahPrakakshan; 2001.


## D. REFERENCEBOOKS&JOURNALS


1. ParthasarathiG,KarinNyfort-Hansen, MilapCNahata.*A textbookofClinical PharmacyPractice-essentialconceptsandskills,*1sted.Chennai:Orient LongmanPrivateLimited;2004.
2. WilliamE.Hassan.*Hospitalpharmacy*,5thed.Philadelphia:Lea&Febiger;1986.
3. TipnisBajaj.*HospitalPharmacy*,1sted.Maharashtra:CareerPublications;2008.
4. ScottLT.*Basicskillsininterpretinglaboratorydata*,4thed.AmericanSocietyofHealthSystemPharmacistsInc; 2009.
5. ParmarN.S.*HealthEducationandCommunityPharmacy,*18thed.India:CBSPublishers&Distributers;2008.


**JOURNALS**


1. Therapeutic drug monitoring. ISSN: 0163-4356(https://journals.lww.com/drug-monitoring/pages/default.aspx)
2. Journalofpharmacypractice.ISSN:0974-8326(https://ijopp.org/)
3. American journal of health system pharmacy. ISSN: 1535-2900 (online)(https://academic.oup.com/ajhp)
4. Pharmacytimes(Monthlymagazine)(https://www.pharmacytimes.com/)

## E. COURSEOUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understan, Remember and Analyse | Tounderstandthestructureofhealthcaresystemlikehospitalandcommunityp harmacyand analyzeadversedrugreactions |
| CO2 | Remember, Understand and Evaluate | Togetknowledgeofvariousprocedurescarriedoutinthehospitalandpharmacy and management ofthepharmacy |
| CO3 | Understand and remember | Toknowvariouscommitteesandtrainingprogramsinthehospitalsandunderst andabout communication skills |
| CO4 | Understand and Remember | Tounderstandbasicclinicalpharmacypracticeandtoknowaboutfinancialman agement |
| CO5 | Understand and evaluate | Tounderstandthemanagementalpracticesofthedrugstoreandknowaboutinte rpretation ofvarious biochemicallaboratorytests |

## F. COURSEMATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 3 | 1 | 3 | 1 | 2 | 3 | 2 | 1 | 3 | 3 | 3 | 1 | 3 |
| CO2 | 3 | 1 | 1 | 3 | 3 | 3 | 1 | 2 | 3 | 1 | 2 | 3 | 2 | 1 | 1 | 3 |
| CO3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 1 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 |
| Avg | 3 | 2.2 | 2.2 | 2.6 | 2.6 | 3 | 2.2 | 2.6 | 3 | 1.6 | 2.4 | 3 | 2.6 | 2.2 | 2.2 | 2.6 |

## B.PHARM. SEMESTER – VII (BPH)
## SUBJECT: NOVEL DRUG DELIVERY SYSTEMS -THEORY (BP704T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject is designed to impart basic knowledge on the area of novel drug delivery systems.

**Objectives:** Upon completion of the course student shall be able

1. To understand various approaches for development of novel drug delivery systems.
2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Controlled drug delivery systems:** Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations<br>**Polymers:** Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems. | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [2] | **Microencapsulation:** Definition, advantages and disadvantages, microspheres/microcapsules, microparticles, methods of microencapsulation, applications<br>**Mucosal Drug Delivery system:** Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems<br>**Implantable Drug Delivery Systems**: Introduction, advantages and disadvantages, concept of implants and osmotic pump | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [3] | **Transdermal Drug Delivery Systems:** Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches<br>**Gastroretentive drug delivery systems:** Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications<br>**Nasopulmonary drug delivery system:** Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers | 10 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [4] | **Targeted drug Delivery:** Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications | 08 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [5] | **Ocular Drug Delivery Systems:** Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts<br>**Intrauterine Drug Delivery Systems:** Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications | 07 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. Jain, N. K. *Controlled and Novel Drug Delivery*; CBS Publishers & Distributors: New Delhi, India, 1997.

## D. REFERENCE BOOKS

1. Chien, Y. W. *Novel Drug Delivery Systems, Second Edition*, 2nd ed.; CRC Press: Boca Raton, FL, 1991.
2. Robinson, J. R.; Lee, V. H. *Controlled Drug Delivery Systems*; Marcel Dekker, Inc: New York, 1992.
3. *Encyclopedia of Controlled Drug Delivery, 2 Volume Set*; Mathiowitz, E., Ed.; John Wiley & Sons: Nashville, TN, 1999.
4. Vyas, S. P.; Khar, R. K. *Controlled Drug Delivery -Concepts and Advances,*; Vallabh Prakashan: New Delhi, 2002.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | A good understanding of fundamentals of controlled & novel drug delivery systems |
| CO2 | Understand | To understand concepts and rationale behind novel and controlled drug delivery systems. |
| CO3 | learn | To get acquainted with approaches, formulations, technologies, and systems of New Drug Delivery Systems |
| CO4 | Understand and Remember | Explain the principles and technology used in the design of novel and controlled release drug delivery systems |
| CO5 | Analyse | Learn Aspects related to formulation and evaluation of various novel drug delivery systems |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO2 | 3 | 2 | 2 | 3 | 1 | 2 | 1 | 2 | 3 | 2 | 1 | 2 | 3 | 3 | 3 | 1 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 3 | 3 | 1 |
| Avg | 3 | 2.6 | 2.6 | 2.6 | 1 | 2 | 1.2 | 2 | 2.6 | 2.2 | 1.6 | 2.4 | 3 | 3 | 2.8 | 1.6 |

## B.PHARM. SEMESTER – VII (BPH)
## SUBJECT: INSTRUMENTAL METHODS OF ANALYSIS - PRACTICAL(BP705P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | | Total |
| - | - | 4 | 4 | 2 | 35 | 10 | 5 | | 50 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

**Objectives:**Upon completion of the course the student shall be able to

- Understand spectroscopy and chromatographic techniques and their applications in drug analysis
- Perform quantitative & qualitative analysis of drugs using various analytical instruments.

## B. COURSE CONTENT

| NO | TOPIC | P(Hrs) | COs |
|---|---|---|---|
| [1] | Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds<br>Estimation of dextrose by colorimetry<br>Estimation of sulfanilamide by colorimetry<br>Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy<br>Assay of paracetamol by UV- Spectrophotometry<br>Estimation of quinine sulfate by fluorimetry<br>Study of quenching of fluorescence | **30** | CO1<br>CO2<br>CO5 |
| [2] | Determination of sodium by flame photometry<br>Determination of potassium by flame photometry<br>Determination of chlorides and sulphates by nephelo turbidometry<br>Separation of amino acids by paper chromatography<br>Separation of sugars by thin layer chromatography<br>Separation of plant pigments by column chromatography<br>Demonstration experiment on HPLC<br>Demonstration experiment on Gas Chromatography | **30** | CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. *Practical book of instrumental methods of analysis – Final Year BPharm – Semester 7*, first.; Abhishek Tiwari, Ed.; NiraliPrakashan, 2020.
2. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.


## D. REFERENCE BOOKS


1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds.*; New Age International Pvt, 2016.

3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers &Distritutors: New Delhi, 2005.
8. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
9. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.
10. Garratt, D. C. *The Quantitative Analysis of Drugs : Assisted by L. Brealey Etc.*; Chapman & Hall: London, 1964.
11. Finar, I. L. *Organic Chemistry.*; Pearson Education, (9Th Impression: Delhi, 2011.
12. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982.
13. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis.*; Pearson: New Delhi, 2009.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remember | To understand the fundamentals of spectroscopy in drug analysis |
| CO2 | Understand Apply and Evaluate | To apply the fundamentals of spectroscopy in qualitative and quantitative drug analysis |
| CO3 | Understand andremeber | To understand the fundamentals of chromatography in drug analysis |
| CO4 | Understand Apply and Evaluate | To apply the fundamentals of chromatography in qualitative and quantitative drug analysis |
| CO5 | Understand Apply and Evaluate | To understand working and handling of various analytical instruments. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | 1 | 1 | - | 1 | - | 1 | - | - | 3 | 3 | 3 | 1 | 1 | - |
| CO2 | 3 | 3 | 3 | 2 | - | 2 | 1 | 1 | 2 | - | 3 | 3 | 3 | 2 | 2 | 1 |
| CO3 | 3 | - | 1 | 1 | - | 1 | - | 1 | - | - | 3 | 3 | 3 | 1 | 1 | - |
| CO4 | 3 | 3 | 3 | 2 | - | 2 | 1 | 1 | 2 | - | 3 | 3 | 3 | 2 | 2 | 1 |
| CO5 | 3 | 3 | - | - | - | 2 | 1 | 1 | 1 | - | 3 | 3 | 3 | 2 | 2 | 1 |
| Avg | 3 | 1.8 | 1.6 | 1.2 | - | 1.6 | 0.6 | 1 | 1 | - | 3 | 3 | 3 | 1.6 | 1.6 | 0.6 |

## B.PHARM. SEMESTER – VII (BPH)
## SUBJECT:PRACTICE SCHOOL(BP706PS)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | | Total |
| - | - | 12 | 6 | 6 | 125 | - | 25 | | 150 |

## A. COURSE OVERVIEW

In the VII semester, every candidate shall undergo practice school for a period of 150 hours evenly distributed throughout the semester. The student shall opt any one of the domains for practice school declared by the program committee from time to time.
At the end of the practice school, every student shall submit a printed report (in triplicate) on the practice school he/she attended (not more than 25 pages). Along with the exams of semester VII, the report submitted by the student, knowledge and skills acquired by the student through practice school shall be evaluated by the subject experts at collegeLeveland grade point shall be awarded.

## B.PHARM. SEMESTER – VIII (BPH)
## SUBJECT:BIOSTATISTICS AND RESEARCH METHODOLOGY-THEORY (BP801T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non-Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analysing the statistical data using Excel.

**Objectives:** Upon completion of the course the student shall be able to

- Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)
- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems.

## B. COURSE CONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | **Introduction:** Statistics, Biostatistics, Frequency distribution<br>**Measures of central tendency:** Mean, Median, Mode- Pharmaceutical examples Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems<br>**Correlation:** Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples | **10** | CO1<br>CO2 |
| [2] | **Regression:** Curve fitting by the method of least squares, fitting the lines y= a + bx and x<br>= a + by, Multiple regression, standard error of regression– Pharmaceutical Examples<br>**Probability:**Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems<br>Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples<br>**Parametric test:** t-test (Sample, Pooled or Unpaired and Paired), ANOVA, (One way and Two way), Least Significance difference | **10** | CO1<br>CO2<br>CO4 |
| [3] | **Non-Parametric tests:** Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test.<br>**Introduction to Research:** Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism<br>**Graphs:** Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph<br>**Designing the methodology:** Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases. | **10** | CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [4] | Blocking and confounding system for Two-level factorials<br>**Regression Modeling:** Hypothesis testing in Simple and Multiple regressionmodels.<br>**Introduction to Practical components of Industrial and Clinical Trials Problems:** Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach | **08** | CO2<br>CO3<br>CO5 |
| [5] | **Design and Analysis of experiments:**<br>**Factorial Design:** Definition, $2^2$, $2^3$design. Advantage of factorial design<br>**Response Surface methodology:** Central composite design, Historical design, Optimization Techniques | **07** | CO4<br>CO2 |

## C. TEXT BOOKS

1. Bolton, Stanford. Pharmaceutical statistics: Practical and clinical applications; 2nd Ed; Marcel Dekker Inc: New York, 1997
2. Panneerselvam, R.Design and Analysis of Experiments; PHI: India, 2012

## D. REFERENCE BOOKS

1. Gupta, SC.Fundamentals of Statistics;7th Ed; Himalaya Publishing House: India, 2018
2. Montgomery, DC. Design and Analysis of Experiments;10th Ed (student edition); John Wiley & Sons, 2019

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and apply | To understand statistical techniques and apply to solve statistical problem |
| CO2 | Remember, Understand and Apply, Evaluate | To understand various hypothesis testing techniques and application to pharmaceutical experimental design techniques. |
| CO3 | Understand | To learn research methodology and Study Designsfor pharmaceutical experiments |
| CO4 | Understand and remember, Evaluate | To understand research designs, control strategy, optimization and design of experiments (DoE) for pharmaceutical experiments. |
| CO5 | Understand and apply | To understand non parametric methods and regression models for hypothesis testing. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 3 | 3 | 1 | 1 | 2 | 2 | 1 | 0 | 3 | 3 | 3 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 3 | 3 | 1 | 2 | 2 | 2 | 1 | 0 | 3 | 3 | 3 | 2 | 1 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 1 | 2 | 3 | 2 | 3 | 0 | 3 | 3 | 3 | 2 | 3 | 2 |
| CO4 | 3 | 1 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 0 | 3 | 3 | 3 | 2 | 2 | 2 |
| CO5 | 3 | 1 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 0 | 3 | 3 | 3 | 2 | 1 | 2 |
| Avg | 3 | 1.4 | 3 | 3 | 1 | 1.8 | 2 | 2 | 2 | 0 | 3 | 3 | 3 | 2 | 2 | 2 |

## B.PHARM. SEMESTER – VIII (BPH)
## SUBJECT: SOCIAL AND PREVENTIVE PHARMACY (BP802T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

**Objectives:** After the successful completion of this course, the student shall be able to:

- Acquire high consciousness/realization of current issues related to health andPharmaceutical problems within the country and worldwide.
- Have a critical way of thinking based on current healthcare development.
- Evaluate alternative ways of solving problems related to health and pharmaceutical issues.

## B. COURSE CONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | a. Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.<br>b. Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention.<br>c. Sociology and health: Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health<br>d. Hygiene and health: personal hygiene and health care; avoidable habits | **10** | CO1<br>CO2 |
| [2] | **Preventive medicine:**<br>General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chikungunya, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse | **10** | CO2 |
| [3] | **National health programs, its objectives, functioning and outcome of the following:**<br>HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme. | **10** | CO3<br>CO4<br>CO5 |
| [4] | National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program | **08** | CO3<br>CO4<br>CO5 |
| [5] | Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education inschool. | **07** | CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. Prabhakara, G. N. Short Textbook of Preventive and Social Medicine; Jaypee Brothers Medical Publishers: Bengaluru ; St. Louis (USA), 2010.
2. Rabindra, R.; Jaypee Brothers (Jaypeedigital. Mahajan & Gupta Textbook of Preventive and Social Medicine; Jaypee Brothers Medical Publisher (P) Ltd, 2013.

## D. REFERENCE BOOKS& JOURNAL

1. Jain, V. Review of Preventive and Social Medicine (Including Biostatistics); 6thEdn. Jaypee Publication, New Delhi, 2014.
2. Lalita, H. D.; Dhananjaya, H. A. Essentials of Community Medicine—A Practical Approach; 2ndEdn. Jaypee Publications, New Delhi, 2012.
3. Park, K. Park's Textbook of Preventive and Social Medicine; 21stEdn. Bhanot Publishers: India, 2015.
4. Adepu, R. Community Pharmacy Practice; PharmaMed Press/BSP Books, Telangana, India, 2022.

**JOURNAL:**

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland (https://www.sciencedirect.com/journal/research-in-social-and-administrative-pharmacy)

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Analyse | To understand basic concept of health and effect of various social, mental and hygienic aspects on health |
| CO2 | Remember, Understand and Evaluate | To get knowledge of various communicable and non-communicable diseases and its preventive measures |
| CO3 | Understand Apply and Evaluate | To get knowledge about various state and central government health programs on various health problems |
| CO4 | Understand and remember | To know government efforts on various critical health issues |
| CO5 | Understand and remember | To know about health infrastructure and role of government in the development of infrastructure as well as importance of hygine |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 2 | 3 |
| CO4 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 3 | 2 | 2 | 3 |
| CO5 | 3 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 3 |
| Avg | 2.6 | 1 | 2.4 | 1.8 | 3 | 3 | 3 | 3 | 3 | 1.8 | 2.4 | 2.2 | 3 | 2.4 | 2.4 | 3 |

## B.PHARM. SEMESTER – VIII (BPH)
## SUBJECT:PHARMA MARKETING MANAGEMENT (Theory) (BP803ET)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.

**Objectives:** The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

## B. COURSE CONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | **Marketing:**<br>Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior.<br>**Pharmaceutical market:**<br>Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation&targeting. Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist. Analyzing the Market; Role of market research. | **10** | CO1 |
| [2] | **Product decision:**<br>Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry. | **08** | CO2 |
| [3] | **Promotion:**<br>Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products. | **07** | CO3 |
| [4] | **Pharmaceutical marketing channels:**<br>Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.<br>**Professional sales representative (PSR):**<br>Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR. | **10** | CO4 |
| [5] | **Pricing:**<br>Meaning, importance, objectives, determinants of price; pricing methods | **10** | CO5 |

| | | | |
|---|---|---|---|
| | and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority).<br>**Emerging concepts in marketing:**<br>Vertical & Horizontal Marketing; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing. | | |

## C. TEXT BOOKS:

1. Patil, PA. &Thakare, HN., "Text book of Pharmaceutical marketing management" 1st edition, White Falcon Publishing, 2020.
2. Dr. Bhambere, DS., Dr. Ahirrao, SP., Dr. Kankate, RS. & Dr. Laddha UD., "Pharma Marketing Management", 1st edition, Bhumi Publishing 2021.

## D. REFERENCE BOOKS:

1. Walker, OC., Boy, H.& Larreche, JC., "Marketing Strategy- Planning and Implementation", 1st edition, Tata MC GrawHill Education, New Delhi., 1999.
2. Grewal,D., & Levy, M.,"Marketing", Indian Edition, Tata MC Graw Hill India. 2017.
3. Kumar A. &Meenakshi N."Marketing Management", 3rd edition, Vikas Publishing House Pvt. Ltd., India., 2017.
4. Saxena, R., "Marketing Management", 6th edition, Tata MC Graw-Hill, 2019.
5. Ramaswamy, US &Nanakamari, S., "Marketing Managemnt" 5th edition, MC Graw Hill Education, New Delhi, 2017.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Analyse | Describe the concept of pharmaceutical marketing in research area. |
| CO2 | Create and Apply | Create and apply the idea of new product development in pharmaceutical Industry. |
| CO3 | Understand, Remember and Analyse | Discuss the components of promotion of pharmaceutical products. |
| CO4 | Remember, apply , understand and Evaluate | Explain pharmaceutical marketing channels. To evaluate the responsibility of professional sales representative. |
| CO5 | Identify, Apply & Evaluate | Discuss responsibilities of pricing authorities in India. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 3 | 2 | - | 2 | 2 | - | 2 | 3 | 3 | 2 | 3 | - |
| CO2 | 3 | 2 | 2 | 2 | - | 2 | - | 2 | 2 | - | 2 | 3 | 3 | 2 | 2 | - |
| CO3 | 3 | 2 | 2 | 2 | 3 | 2 | - | 2 | 2 | - | 2 | 3 | 3 | 2 | 3 | - |
| CO4 | 3 | 2 | 2 | 2 | 3 | 2 | - | 2 | 2 | - | 2 | 3 | 3 | 2 | 3 | - |
| CO5 | 3 | 2 | 2 | 2 | - | 2 | - | 2 | 2 | - | 2 | 3 | 3 | 2 | 2 | - |
| Avg | 3 | 2 | 2 | 2 | 1.8 | 2 | - | 2 | 2 | - | 2 | 3 | 3 | 2 | 2.6 | - |

## B.PHARM. SEMESTER – VIII (BPH)
## SUBJECT: PHARMACEUTICAL REGULATORY SCIENCE - THEORY(BP804T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.

**Objectives:**Upon completion of the subject student shall be able to;

- Know about the process of drug discovery and development
- Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
- Know the regulatory approval process and their registration in Indian and international markets

## B. COURSE CONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | **New Drug Discovery and development**<br>Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development. | **10** | CO1 |
| [2] | **Regulatory Approval Process**<br>Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA.<br>**Regulatory authorities and agencies**<br>Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications) | **10** | CO2<br>CO3<br>CO4 |
| [3] | **Registration of Indian drug product in overseas market**<br>Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD)research. | **10** | CO3 |
| [4] | **Clinical trials**<br>Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials | **08** | CO5 |
| [5] | **Regulatory Concepts**<br>Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book | **07** | CO5 |

## C. TEXT BOOKS

1. Itkar, S.; Vyawahare, N. S. *Drug Regulatory Affaira*, Kindle.; NiraliPrakashan, 2019.
2. Berry, I. R.; Martin, R. P. *The Pharmaceutical Regulatory Process*; Informa Healthcare: New York, 2008.

## D. REFERENCE BOOKS

1. Guarino, R. A. *New Drug Approval Process*; Informa Healthcare, Cop: New York, 2009.
2. Weinberg, S. *Guidebook for Drug Regulatory Submissions*; Wiley: Hoboken, N.J., 2009.
3. Pisano, D. J. *FDA Regulatory Affairs : A Guide for Prescription Drugs, Medical Devices, and Biologics*; Informa Healthcare Usa: New York, 2008.
4. Kanfer, I.; Shargel, L. *Generic Drug Product Development : Solid Oral Dosage Forms*; Marcel Dekker: New York, 2005.
5. Rozovsky, F. A.; Adams, R. K. *Clinical Trials and Human Research : A Practical Guide to Regulatory Compliance*; Jossey-Bass: San Francisco, 2003.
6. Gallin, J. I.; Ognibene, F. P.; Laura Lee Johnson. *Principles and Practice of Clinical Research*; Elsevier/Academic Press: London ; San Diego, Ca, 2018.
7. Ng, R. *Drugs : From Discovery to Approval*; Wiley-Blackwell: Chichester, 2009.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | To understand the process of drug discovery and development |
| CO2 | Understand and remember | To understand the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals |
| CO3 | Understand and remember | To understand the regulatory approval process and their registration in international markets |
| CO4 | Understand and remember | To understand the regulatory approval process and their registration in Indian markets |
| CO5 | Understand remember and Apply | To Understand the regulatory concepts and clinical trial aspects |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | - | 3 | 3 | 3 | 2 | 3 | 3 |
| CO2 | 3 | - | - | - | - | 1 | 2 | 3 | 2 | - | 3 | 3 | 3 | 1 | 2 | 2 |
| CO3 | 3 | - | - | 1 | - | 1 | 2 | 3 | 2 | - | 3 | 3 | 3 | 1 | 2 | 2 |
| CO4 | 3 | - | - | 1 | - | 1 | 2 | 3 | 2 | - | 3 | 3 | 3 | 1 | 2 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | - | 3 | 3 | 3 | 2 | 3 | 3 |
| Avg | 3 | 0.8 | 0.8 | 1.2 | 0.4 | 1.4 | 2 | 3 | 2.4 | - | 3 | 3 | 3 | 1.4 | 2.4 | 2.4 |

## B.PHARM. SEMESTER – VIII (BPH)
## SUBJECT: PHARMACOVIGILANCE (BP805ET)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions. The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

**Objectives:**At completion of this paper it is expected that students will be able to (know, do, andappreciate):

- Why drug safety monitoring is important?
- History and development of pharmacovigilance
- National and international scenario of pharmacovigilance
- Dictionaries, coding and terminologies used in pharmacovigilance
- Detection of new adverse drug reactions and their assessment
- International standards for classification of diseases and drugs
- Adverse drug reaction reporting systems and communication in pharmacovigilance
- Methods to generate safety data during pre-clinical, clinical and post approval phases of drugs' life cycle
- Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation
- Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India
- ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning
- CIOMS requirements for ADR reporting
- Writing case narratives of adverse events and their quality.

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | **Introduction to Pharmacovigilance**<br>• History and development of Pharmacovigilance<br>• Importance of safety monitoring of Medicine<br>• WHO international drug monitoring programme<br>• Pharmacovigilance Program of India(PvPI)<br>**Introduction to adverse drug reactions**<br>• Definitions and classification of ADRs<br>• Detection and reporting<br>• Methods in Causality assessment<br>• Severity and seriousness assessment<br>• Predictability and preventability assessment<br>• Management of adverse drug reactions<br>**Basic terminologies used in pharmacovigilance** | **10** | CO1<br>CO2 |

| | | | |
|---|---|---|---|
| | • Terminologies of adverse medication related events<br>• Regulatory terminologies | | |
| [2] | **Drug and disease classification**<br>• Anatomical, therapeutic and chemical classification of drugs<br>• International classification of diseases<br>• Daily defined doses<br>• International Non-proprietary Names for drugs<br>**Drug dictionaries and coding in pharmacovigilance**<br>• WHO adverse reaction terminologies<br>• MedDRA and Standardised MedDRA queries<br>• WHO drug dictionary<br>• Eudravigilance medicinal product dictionary<br>**Information resources in pharmacovigilance**<br>• Basic drug information resources<br>• Specialised resources for ADRs<br>**Establishing pharmacovigilance programme**<br>• Establishing in a hospital<br>• Establishment & operation of drug safety department in industry<br>• Contract Research Organisations (CROs)<br>• Establishing a national programme | **10** | CO2 |
| [3] | **Vaccine safety surveillance**<br>• Vaccine Pharmacovigilance<br>• Vaccination failure<br>• Adverse events following immunization<br>**Pharmacovigilance methods**<br>• Passive surveillance – Spontaneous reports and case series<br>• Stimulated reporting<br>• Active surveillance – Sentinel sites, drug event monitoring and registries<br>• Comparative observational studies – Cross sectional study, case control study and cohort study<br>• Targeted clinical investigations<br>**Communication in pharmacovigilance**<br>• Effective communication in Pharmacovigilance<br>• Communication in Drug Safety Crisis management<br>• Communicating with Regulatory Agencies, Business Partners, Healthcare facilities &Media | **10** | CO2<br>CO3 |
| [4] | **Safety data generation**<br>• Pre-clinical phase<br>• Clinical phase<br>• Post approval phase (PMS)<br>**ICH Guidelines for Pharmacovigilance**<br>• Organization and objectives of ICH<br>• Expedited reporting<br>• Individual case safety reports<br>• Periodic safety update reports<br>• Post approval expedited reporting<br>• Pharmacovigilance planning<br>• Good clinical practice in pharmacovigilance studies | **08** | CO4 |
| [5] | **Pharmacogenomics of adverse drug reactions** | **07** | CO5 |

| | | | |
|---|---|---|---|
| | • Genetics related ADR with example focusing PK parameters.<br>**Drug safety evaluation in special population**<br>• Paediatrics<br>• Pregnancy and lactation<br>• Geriatrics<br>**CIOMS**<br>• CIOMS Working Groups<br>• CIOMS Form<br>**CDSCO (India) and Pharmacovigilance**<br>• D&C Act and Schedule Y<br>• Differences in Indian and global pharmacovigilance requirements | | |

## C. TEXT BOOKS


1. Gupta, S. K.; India. Textbook of Pharmacovigilance; Jaypee Brothers Medical Publishers: New Delhi, 2011.
2. Mohanta, G. P.; Manna, P. K. Text book of Pharmacovigilance: concept and practice; PharmaMed Press: Hydrabad, India, 2016.


## D. REFERENCE BOOKS &WEBSITES


1. Cobert, B. L.; Biron, P. Practical Drug Safety from A to Z; Sudbury, Mass Jones and Bartlett, 2009.
2. Andrews, E. B.; Moore, N. Mann's Pharmacovigilance; John Wiley & Sons Inc: Chichester, West Sussex, Uk, 2014.
3. Stephens, M. D. B.; Talbot, J. C.C.; Waller, P. Stephens' Detection of New Adverse Drug Reactions; Wiley: Chichester; Hoboken, NJ, 2004.
4. Waller, P.; Harrison-Woolrych, M. An Introduction to Pharmacovigilance; Wiley Blackwell/John Wiley & Sons Inc: Chichester, West Sussex, Uk ; Hoboken, Nj, 2017.
5. Cobert, B. Cobert's Manual of Drug Safety and Pharmacovigilance; Jones And Bartlett Publishers: 1997, 2011.
6. Strom, B. L. Textbook of Pharmacoepidemiology.; Wiley-Blackwell: S.L., 2022.
7. Parthasarathi, G.; Nyfort-Hansen, K.; Nahata, M. C.; Elliott, R. A.; George, J.; Nation, R. L.; Rayner, C. R. A Text Book of Clinical Pharmacy Practice: Essential Concepts and Skills; Orient Longman Ltd: Hyderabad, 2004.
8. National Formulary of India
9. http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297
10. https://www.ich.org/
11. http://www.cioms.ch/
12. http://cdsco.nic.in/
13. http://www.who.int/vaccine_safety/en/
14. http://www.ipc.gov.in/PvPI/pv_home.html

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Analyse | To know about basic aspects of Pharmacovigilance and Adverse Drug Reactions |
| CO2 | Remember, Understand and Evaluate | To understand various terminologies related to drugs, coding and Adverse Drug Reactions and to know about organization of pharmacovigilance programs |
| CO3 | Understand Apply and Evaluate | To get knowledge about various methods and communication techniques in Pharmacovigilance |
| CO4 | Understand and remember | To know about various ICH guidelines related to Pharmacovigilance |
| CO5 | Understand and remember | To understand basics of Pharmacogenomics and to know the rules and regulations related to Pharmacovigilance in India |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| Avg | 3 | 2.6 | 2.8 | 3 | 2.4 | 3 | 2 | 3 | 3 | 2.2 | 3 | 3 | 3 | 3 | 2.6 | 2.4 |

## B.PHARM. SEMESTER – VIII (BPH)

## SUBJECT: QUALITY CONTROL AND STANDARDIZATION OF HERBALS – THEORY(BP806ET)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | -- | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines.

**Objectives:** Upon completion of the subject student shall be able to;

- know WHO guidelines for quality control of herbaldrugs
- know Quality assurance in herbal drugindustry
- know the regulatory approval process and their registration in Indianand internationalmarkets
- appreciate EU and ICH guidelines for quality control of herbaldrugs

## B. COURSE CONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms<br>WHO guidelines for quality control of herbal drugs.<br>Evaluation of commercial crude drugs intended for use | **10** | CO1 |
| [2] | **Quality assurance in herbal drug industry** of cGMP, GAP, GMP and GLP in traditional system of medicine.<br>WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACP for Medicinal Plants. | **10** | CO2 |
| [3] | EU and ICH guidelines for quality control of herbal drugs.<br>Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines | **10** | CO3<br>CO4 |
| [4] | Stability testing of herbal medicines.Application of various chromatographic techniques in standardization of herbal products.<br>Preparation of documents for new drug application and export registration<br>GMP requirements and Drugs & Cosmetics Act provisions. | **08** | CO5 |
| [5] | Regulatory requirements for herbal medicines.<br>WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias.<br>Role of chemical and biological markers in standardization of herbal products | **07** | CO4<br>CO5 |

## B. TEXT BOOKS

1. Dr. Pankaj Pradhan and Dr. Dillip Kumar Jena, "Quality Control and Standardization of Herbals", Thakur Publication PVT. LTD., Lucknow, 2021.
2. Dr. Antara Choudhury, "Quality control and standardization of herbals", Nirali Prakashan, India, 2021.

## C. REFERENCE BOOKS


1. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India,2002.
2. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p.4-8.
3. WHO Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998.
4. WHO Guidelines for the Appropriate Use ofHerbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila,1998.
5. WHOThe International Pharmacopeia, Vol. 2: Quality Specifications, 3rdedn. World Health Organization, Geneva,1981.
6. WHOQuality Control Methods for Medicinal Plant Materials. WorldHealth Organization, Geneva,1999.
7. WHOGlobal Atlas of Traditional, Complementary andAlternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva,2005.
8. WHO Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva,2004.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and evaluate | To evaluate crude drugs as per WHO guidelines. |
| CO2 | Understand and apply | Discuss Quality assurance and techniques in herbal drugindustry and herbal products. |
| CO3 | Remember and evaluate | EU and ICH guidelines for quality control of herbaldrugs and for Evaluating the Safety and Efficacy of Herbal Medicines. |
| CO4 | Understand, remember and apply | Explain Regulatory requirements for herbal medicines. |
| CO5 | Create and apply | To prepare documents for new drug application and apply GMP requirements and Drugs & Cosmetics Act provisions. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 3 | 0 | 1 | 3 | 1 | 2 | 1 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 3 | 0 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO5 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| Avg | 3 | 2 | 2 | 3 | 1 | 2 | 2.4 | 1.8 | 2 | 2 | 2.4 | 3 | 2.8 | 3 | 2.2 | 2 |

## B.PHARM. SEMESTER – VI (BPH)
## SUBJECT: COMPUTER AIDED DRUG DESIGN-THEORY (BP807ET)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

**Objectives:** Upon completion of the course, the student shall be able to understand

- Design and discovery of lead molecules
- The role of drug design in drug discovery process
- The concept of QSAR and docking
- Various strategies to develop new drug like molecules.
- The design of new drug molecules using molecular modelling software

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Introduction to Drug Discovery and Development**<br>Stages of drug discovery and development<br>**Lead discovery and Analog Based Drug Design**<br>Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation.<br>**Analog Based Drug Design:** Bioisosterism, Classification, Bioisosteric replacement. Any three case studies | 10 | CO1 |
| [2] | **Quantitative Structure Activity Relationship (QSAR)**<br>SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammet's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA | 10 | CO2 |
| [3] | **Molecular Modeling and virtual screening techniques**<br>**Virtual Screening techniques:** Drug likeness screening, Concept of pharmacophore mapping and pharmacophore-based Screening,<br>**Molecular docking**: Rigid docking, flexible docking, manual docking, Docking based screening. De novo drug design. | 10 | CO3 |
| [4] | **Informatics & Methods in drug design**<br>Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases | 08 | CO4 |
| [5] | **Molecular Modeling:** Introduction to molecular mechanics and quantum mechanics.Energy Minimization methods and Conformational Analysis, global conformational minima determination. | 07 | CO5 |

## C. TEXT BOOKS


1. Mehta, S.K., Singh, R.K. A Text Book of Computer Aided Drug Design, 1st ed.; S. Vikas and Company, India, 2018
2. Siddiqui, A.A, Kumar, H., Khisal S. Computer-Aided Drug Design. 1st ed.; CBS Publishers, India, 2019


## D. REFERENCE BOOKS


1. Hansch, C., Semmes, P.G., Taylor, J.B. Comprehensive Medicinal Chemistry, Volume I to VI, 1st ed.; Elsevier, India, 2005
2. Abraham, D.J. Burger's Medicinal Chemistry and Drug Discovery, Volume I to VI, 6th ed.; Wiley-Interscience, New Jersey, 2003
3. Patrick, G.L. An Introduction to Medicinal Chemistry, 3rd ed.; Oxford University Press, Oxford, 2006
4. Silverman, R.B. The Organic Chemistry of Drug Design and Drug Action, 2nd ed,; Academic Press, Burlington, 2004
5. Singh D.B. Computer-Aided Drug Design, 1st ed.; Springer, Singapore, 2020
6. Lemke, T.L., Williams, D.A. FOYE'S Principles of Medicinal Chemistry, 7th ed.; Lippincott Williams & Wilkins, Baltimore, 2013
7. Baele, J.M., Block J. H. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th ed.; Lippincott Williams & Wilkins; Baltimore, 2011
8. Smith, J.H., Williams, H. Smith and Williamson's Introduction to the Principles of Drug Design and Action, 3rd ed; CRC Press, The Netherlands, 2005
9. Patrick, G.L. An Introduction to Medicinal Chemistry, 3rd ed.; Oxford University Press, Oxford, 2006

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remember | To understand the process of drug discovery to development and different approaches of drug design and discovery |
| CO2 | Understand and remember | To describe importance of Quantitative Structure Activity Relationship (QSAR) and various methods of QSAR in rational drug design |
| CO3 | Understand and apply | To explain structure-based and ligand-based virtual screening approaches of drug design |
| CO4 | Understand and remember | To discuss principles of bioinformatics and cheminformatics and their role in drug design and discovery |
| CO5 | Understand and remember | To understand role of molecular modelling techniques in computer-aided drug design |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | 0 | 3 | - | - | - | - | - | - | 3 | 2 | 3 | 3 | 1 | - |
| CO2 | 3 | - | 0 | 3 | - | - | - | - | - | - | 3 | 2 | 3 | 3 | 1 | - |
| CO3 | 3 | - | 2 | 3 | - | - | - | - | - | - | 3 | 2 | 3 | 3 | 1 | - |
| CO4 | 3 | - | 2 | 3 | - | - | - | - | - | - | 3 | 2 | 3 | 3 | 1 | - |
| CO5 | 3 | - | 1 | 3 | - | - | - | - | - | - | 3 | 2 | 3 | 3 | 1 | - |
| | | | | | | | | | | | | | | | | |
| Avg | 3 | - | 1 | 3 | - | - | - | - | - | - | 3 | 2 | 3 | 3 | 1 | - |

## B.PHARM. SEMESTER – VIII (BPH)
## SUBJECT: CELL AND MOLECULAR BIOLOGGY (B808ET)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | --- | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**:Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function.This is done both on a microscopic and molecular level. Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organisms such as humans, plants, and sponges

**Objectives:** Upon completion of the course the student shall be able to

- Summarize cell and molecular biology history.
- Summarize cellular functioning and composition.
- Describe the chemical foundations of cell biology.
- Summarize the DNA properties of cell biology.
- Describe protein structure and function.
- Describe cellular membrane structure and function.
- Describe basic molecular genetic mechanisms.
- Summarize the Cell Cycle

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | a) Cell And Molecular Biology: Definitions Theory and Basics and Applications.<br>b) Cell And Molecular Biology: History and Summation.<br>c) Properties Of Cells and Cell Membrane.<br>d) Prokaryotic Versus Eukaryotic<br>e) Cellular Reproduction<br>f) Chemical Foundations – An Introduction and Reactions (Types) | **10** | CO1 |
| [2] | a) DNA and the Flow of Molecular Information<br>b) DNA Functioning<br>c) DNA and RNA<br>d) Types of RNA<br>e) Transcription and Translation | **10** | CO2 |
| [3] | a) Proteins: Defined and Amino Acids<br>b) Protein Structure<br>c) Regularities in Protein Pathways<br>d) Cellular Processes<br>e) Positive Control and significance of Protein Synthesis | **10** | CO1<br>CO2<br>CO3 |
| [4] | a) Science of Genetics<br>b) Transgenics and Genomic Analysis<br>c) Cell Cycle analysis<br>d) Mitosis and Meiosis<br>e) Cellular Activities and Checkpoints | **08** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [5] | a) Cell Signals: Introduction<br>b) Receptors for Cell Signals<br>c) Signalling Pathways: Overview<br>d) Misregulation of Signalling Pathways<br>e) Protein-Kinases: Functioning | **07** | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. Cooper, J. W.; Gunn, C.; Sidney James Carter. Cooper and Gunn's Tutorial Pharmacy; Cbs Publishers: Editorial: New Delhi, 2005.
2. Hondermarck, H. Proteomics : Biomedical and Pharmaceutical Applications; Kluwer Academic Publishers: Dordrecht ; Boston, 2004.

## D. REFERENCE BOOKS

1. Pelczar, M. J.; Chan, E. C. S.; Kreig, N. R. Laboratory Exercises in Microbiology; Mcgraw-Hill: New York, 1986.
3. Glick, B. R.; Thompson, J. E. Methods in Plant Molecular Biology and Biotechnology; Crc Press: Boca Raton, 1993.
4. Samuel Cate Prescott; Dunn, C. G.; Reed, G. Industrial Microbiology; Macmillan: New York, 1982.
5. Rose, A. H. Industrial Microbiology; Butterworths: London, 1961.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand and remember | To know about the basics of cell, types of cells its basic functions, the structure and all the details |
| **CO2** | Remember, Understand and Apply | To get knowledge about DNA, RNA, Structure, function, translation and transcription |
| **CO3** | Understand Apply and Evaluate and remember | To understand about the protein structure, its synthesis and its regulations |
| **CO4** | Understand | To get knowledge about genomics, genomics analysis, cell cycle analysis, mitosis and Meiosis |
| **CO5** | Remember | To understand about cell signals, receptors for cell signals its functioning and misregulation |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 2 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO2** | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| **Avg** | 2.6 | 1.8 | 2.4 | 3 | 1.8 | 3 | 2.4 | 3 | 3 | 2.4 | 2.2 | 2.2 | 3 | 3 | 3 | 2.6 |

## B.PHARM. SEMESTER – VIII (BPH)
## SUBJECT: COSMETIC SCIENCE- THEORY (BP809ET)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**
This course is designed to impart knowledge and skills necessary for the fundamental need for cosmetic and cosmeceutical products.
**Objectives**
Upon completion of the course, the students shall be able to understand

- Key ingredients used in cosmetics and cosmeceuticals.
- Key building blocks for various formulations.
- Current technologies in the market
- Various key ingredients and basic science to develop cosmetics and cosmeceuticals
- Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | Classification of cosmetic and cosmeceutical products, Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs<br>**Cosmetic excipients:** Surfactants, rheologymodifiers, humectants, emollients, preservatives. Classification and application<br>**Skin:** Basic structure and function of skin.<br>**Hair:** Basic structure of hair. Hair growth cycle.<br>**Oral Cavity:** Common problem associated with teeth and gums. | **10** | CO1<br>CO2<br>CO3 |
| [2] | **Principles of formulation and building blocks of skin care products:**<br>Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmecuticals.<br>**Antiperspants& deodorants**- Actives & mechanism of action.<br>**Principles of formulation and building blocks of Hair care products:**<br>Conditioning shampoo, Hair conditioner,anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phylenediamine based hair dye.<br>Principles of formulation and building blocks of oral care products:<br>Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash. | **10** | CO1<br>CO2<br>CO3<br>CO4 |
| [3] | Sun protection, Classification of Sunscreens and SPF.<br>**Role of herbs in cosmetics:**<br>Skin Care: Aloe and turmeric<br>Hair care: Henna and amla.<br>Oral care: Neem and clove<br>**Analytical cosmetics:** BIS specification and analytical methods for shampoo, skincream and toothpaste. | **10** | CO1<br>CO5 |
| [4] | Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing | **8** | CO5<br>CO4 |

| | | | |
|---|---|---|---|
| | properties Soaps,and syndet bars. Evolution and skin benfits. | | |
| [5] | Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis.<br>Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes<br>Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat andbodyodor. Antiperspirants and Deodorants- Actives and mechanism of action | 7 | CO4<br>CO5 |

## C. TEXT BOOKS

1. Sharma, P. P.; Vandana Publications. *Cosmetics : Formulation, Manufacturing & Quality Control*; Vandama Publications: Delhi, 2018.
2. Nanda S and Khar R, Text book of cosmelicology Tata Publishers.

## D. REFERENCE BOOKS

1. Ralph Gordon Harry; Wilkinson, J. B.; Moore, R. J. *Cosmetología de Harry*; Díaz De Santos: España, 1990.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Analyse | To uderstand and remember the key ingredients used in cosmetics and cosmeceuticals |
| CO2 | Remember | To remeber the Key building blocks for various formulations. |
| CO3 | Understand and remember | To apply current technologies in the market. |
| CO4 | Understand and Remember | To understand various key ingredients and basic science to develop cosmetics and cosmeceuticals |
| CO5 | understand and evaluate | To apply the scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 2 | - | 1 | 1 | 2 | 2 | 1 | 3 | 3 | 2 | 3 | 1 | 2 |
| CO2 | 3 | 1 | 1 | 2 | - | 1 | - | 2 | 2 | - | 2 | 3 | 2 | 1 | 1 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | - | 3 | 3 | 3 | 1 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 2 | - | - | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 1 | 2 | - | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| Avg | 3 | 1.6 | 2.2 | 2.6 | 1 | 1.2 | 0.6 | 2.2 | 2.6 | 1 | 2.6 | 3 | 2.6 | 2.2 | 2.2 | 2.2 |

## B.PHARM. SEMESTER – VIII (BPH)
## SUBJECT:PHARMACOLOGICAL SCREENINGMETHODS (BP810ET)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:**This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.
**Objectives:**Uponcompletion ofthecourse the student shall be able to

- Appreciate the applications of various commonly used laboratory animals.
- Appreciate and demonstrate the various screening methods used in pre-clinical research.
- Appreciate and demonstrate the importance of biostatistics and research methodology.
- Design and execute a research hypothesis independently.

## B. COURSE CONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | **Laboratory Animals:** Study of CPCSEA and OECD guidelines form maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia. | 8 | CO1, CO4, CO5. |
| [2] | **Preclinical screeningmodels** a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study. b. Study of screening animal models for Diuretics, nootropics, anti-Parkinson's, anti-asthmatics, Preclinical screeningmodels:forCNS activity-analgesic, antipyretic,anti-inflammatory,generalanaesthetics, sedative and hypnotics, antipsychotic,antidepressant,antiepileptic, anti-parkinsonism, Alzheimer's disease | 12 | CO2, CO3, CO4. |
| [3] | **Pre-clinical screening models:** for ANS activity, sympathomimetic, sympatholytic, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaesthetics. | 10 | CO2, CO3, CO4. |
| [4] | **Preclinical screening models:** for CVS activity-antihypertensive, diuretics, antiarrhythmic, antidyslepidemic, anti-aggregatory, coagulants,andanticoagulants Preclinical screeningmodels forotherimportantdrugslikeantiulcer, antidiabetic,anticancerandanti-asthmatics. | 10 | CO2, CO3, CO4. |
| [5] | **Research methodology and Bio-statistics** Selection of research topic, review of literature, research hypothesis and study design Pre-clinical data analysis and interpretation using Students't' test and One-way ANOVA. Graphical representation of data | 05 | CO3. |

## C. TEXT BOOKS

1. Hans Gerhard Vogel. *Drug Discovery and Evaluation: Pharmacological Assays; Including a CD-ROM*; Springer: Berlin, 2002.

## D. REFERENCE BOOKS

1. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
2. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.
3. Home: Committee for the Purpose of Control and Supervision of Experiments on Animals http://cpcsea.nic.in (accessed 2022 -04 -04).
4. Gupta, S. *Drug Screening Methods*; Sk Gupta, 2016.
5. Sundar, S.; Richard, J. *An Introduction to Biostatistics: A Manual for Students in Health Sciences*; Prentice/Hall Of India: New Delhi, 1996.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and apply | Appreciate the applications of various commonly used laboratory animals. |
| | Understand,analyse and evaluate | Understand,analyse and evaluate new and existing drugs in various screening methods used in preclinical research |
| CO3 | Apply and Remember | Apply and Remember importance of biostatistics and research methodology |
| CO4 | Create,hypothesis and apply | Design and execute a research hypothesis independently. |
| CO5 | Understand and apply | Understand and maintain guidelines of CPCSEA and OECD. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 1 | 2 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 1 | 3 | 3 | 2 | 0 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.2 | 3 | 3 | 1.4 | 2.6 | 3 | 2.4 | 1.2 | 2.8 | 3 | 3 | 2.6 | 3 | 3 | 3 |

## B.PHARM. SEMESTER – VIII (BPH)

## SUBJECT: ADVANCED INSTRUMENTATION TECHNIQUES - THEORY (BP811T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

**Objectives:** Upon completion of the course the student shall be able to

1. understand the advanced instruments used and its applications in drug analysis
2. understand the chromatographic separation and analysis of drugs.
3. understand the calibration of various analytical instruments
4. know analysis of drugs using various analytical instruments.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Nuclear Magnetic Resonance spectroscopy**<br>Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications<br>**Mass Spectrometry**- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications s | 10 | CO1<br>CO2<br>CO5 |
| [2] | **Thermal Methods of Analysis**: Principles, instrumentation and applications of ThermogravimetricAnalysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)<br>**X-Ray Diffraction Methods:** Origin of X-rays, basic aspects of crystals, X-ray<br>Crystallography, rotating crystal technique, single crystal diffraction,powder diffraction, structural elucidation and applications. | 10 | CO2<br>CO5 |
| [3] | **Calibration and validation-**as per ICH and USFDA guidelines<br>**Calibration of following Instruments**<br>Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC | 10 | CO4<br>CO5 |
| [4] | **Radio immune assay:**Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay<br>**Extraction techniques**:General principle and procedure involved in the solid phase extraction and liquid-liquid extraction | 08 | CO1<br>CO5 |
| [5] | **Hyphenated techniques**-LC-MS/MS, GC-MS/MS, HPTLC-MS. | 07 | CO1<br>CO2<br>CO3<br>CO5 |

## C. TEXT BOOKS


1. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis.*; Pearson: New Delhi, 2009.
2. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..


## D. REFERENCE BOOKS


1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds.*; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
8. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
9. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.
10. Garratt, D. C. *The Quantitative Analysis of Drugs : Assisted by L. Brealey Etc.*; Chapman & Hall: London, 1964.
11. Finar, I. L. *Organic Chemistry.*; Pearson Education, (9Th Impression: Delhi, 2011.
12. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand Apply and Evaluate | To understand the advanced instruments used and its applications in drug analysis |
| CO2 | Understand Apply and Evaluate | To apply the fundamentals of spectroscopy in drug analysis |
| CO3 | Understand Apply and Evaluate | To understand the chromatographic separation fundamentals and analysis of drugs |
| CO4 | Understand Apply and Evaluate | To understand the calibration of various analytical instruments |
| CO5 | Understand Apply and Evaluate | To learn quantitative & qualitative analysis of drugs using various analytical instruments. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 1 |
| CO4 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.4 | 2.4 | 2.4 | 1 | 2.4 | 1 | 2 | 2 | 1.6 | 2.6 | 3 | 2.8 | 2.8 | 2.8 | 1.8 |

## B.PHARM. SEMESTER – VIII (BPH)

## SUBJECT: DIETARY SUPPLEMENTS AND NUTRACEUTICALS – THEORY(BP812ET)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | -- | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:**This subject covers foundational topic that are important for understanding theneed and requirements of dietary supplements among different groups in the population.

**Objective:**This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should be able to:

- Understand the need of supplements by the different group of people tomaintain healthylife.
- Understand the outcome of deficiencies in dietarysupplements.
- Appreciate the components in dietary supplements and theapplication.
- Appreciate the regulatory and commercial aspects of dietary supplementsincluding healthclaims.

## B. COURSE CONTENT

| NO | TOPIC | L(Hrs) | COs |
|---|---|---|---|
| [1] | a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e., weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertensionetc.<br>b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community.<br>c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds | 7 | CO1<br>CO5 |
| [2] | Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following:<br>a) Carotenoids- α and β-Carotene, Lycopene, Xanthophylls, leutin<br>b) Sulfides: Diallyl sulfides, Allyltrisulfide.<br>c) Polyphenolics:Reservetrol<br>d) Flavonoids- Rutin, Naringin, Quercitin, Anthocyanidins, catechins,Flavones<br>e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lactobacillum<br>f) Phyto estrogens : Isoflavones, daidzein, Geebustin, lignans<br>g) Tocopherols<br>h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and thelike. | 15 | CO1<br>CO3 |
| [3] | a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals | 07 | CO1<br>CO2 |

| | | | |
|---|---|---|---|
| | on lipids, proteins, Carbohydrates, nucleic acids.<br>b) Dietary fibres and complex carbohydrates as functional food ingredients. | | CO3 |
| [4] | a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury,Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing.<br>b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α- Lipoic acid,melatonin, Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole.<br>c) Functional foods for chronic diseaseprevention | **10** | CO1<br>CO2<br>CO3 |
| [5] | a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals.<br>b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods.<br>c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals. | **06** | CO4<br>CO5 |

## C. TEXT BOOKS

1. Dr. Tapan Behl, Dr. Sukhbir Singh, & Dr. Neelam Sharma Dietary Supplements & Nutraceuticals, R. Narain Publishers & Distributors, Agra, 2021.

## D. REFERENCE BOOKS


1. K.T Agusti and P. Faizal, Role of dietary fibres and neutraceuticals in preventing diseases, BSPublication, 2019.
2. Cooper. K.A, Advanced Nutritional Therapies, Thomas Nelson Inc publisher, 1997.
3. Jean Carper The Food Pharmacy, Simon & Schuster publisher, UK Ltd., 2000.
4. James F. Balch and Phyllis A. Balch, Prescription for Nutritional Healing,2nd Edn., Avery Publishing Group, NY, 1997.
5. G. Gibson and C.williams Editors 2000 Functional foodsWoodheadPubl.Co.London.
6. Goldberg, I. Functional Foods, Chapman and Hall, NewYork, 1994
7. Labuza, T.P. Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf-Life Testing in Essentials of Functional Foods M.K. Sachmidl and T.P. Labuza eds. Aspen Press, 2000.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remember | Discuss the need and requirements of supplements by the different group of people tomaintain healthylife. |
| CO2 | Understand and evaluate | Describe the outcome of deficiencies in dietarysupplements and evaluate it. |
| CO3 | Remember and analyse | To analyse the components in dietary supplements and theapplication. |
| CO4 | Apply | To apply regulatory and commercial aspects of dietary supplementsincluding healthclaims. |
| CO5 | Create | Explain nutrition education. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 |
| **CO4** | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CO5** | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| **Avg** | 3 | 2.4 | 2.4 | 2 | 2 | 2 | 1.2 | 3 | 2 | 2.4 | 2.4 | 3 | 2.8 | 3 | 2.2 | 2 |

## B.PHARM. SEMESTER – VIII (BPH)
## SUBJECT:PROJECT WORK (BP813PW)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 12 | 6 | 6 | 150 | - | - | - | 150 |

## A. COURSE OVERVIEW

All the students shall undertake a project under the supervision of a teacher and submit a report. The area of the project shall directly relate any one of the elective subjects opted by the student in semester VIII. The project shall be carried out in group not exceeding 5 in number. The project report shall be submitted in triplicate (typed & bound copy not less than 25 pages).

The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of five students).

MASTER OF TECHNOLOGY

# COMPUTER ENGINEERING

# SYLLABI BOOK

**(2021 – 2022)**

Department of Computer Engineering
Faculty of Technology
Dharmsinh Desai University
Nadiad – 387 001, Gujarat, India.

http://www.ddu.ac.in

| SEM. | Sr. No. | SUBJECT | WORK LOAD | | | TOTAL | Credit | MARKS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Th | T | P | | | Th | Sess | TW | Pract | Total |
| Sem-I | 1 | Advance Compiler Techniques | 3 | 1 | 2 | **6** | **5** | 60 | 40 | 25 | 25 | **150** |
| | 2 | Advance Computer Network | 3 | 1 | 2 | **6** | **5** | 60 | 40 | 25 | 25 | **150** |
| | 3 | Machine Learning | 4 | 0 | 2 | **6** | **5** | 60 | 40 | 25 | 25 | **150** |
| | 4 | Elective – I | 3 | 1 | 2 | **6** | **5** | 60 | 40 | 25 | 25 | **150** |
| | | Digital Image Processing | | | | | | | | | | |
| | | Advanced Software Engineering | | | | | | | | | | |
| | 5 | Elective – II | 3 | 1 | 2 | **6** | **5** | 60 | 40 | 25 | 25 | **150** |
| | | Operating System Design and Implementation | | | | | | | | | | |
| | | Advanced Programming in Unix | | | | | | | | | | |
| | | Advanced Data Structure | | | | | | | | | | |
| | 6 | Research Methodology for Computer Science | 2 | 0 | 0 | **2** | **2** | 40 | - | - | - | **40** |
| | | **TOTAL** | **18** | **4** | **10** | **32** | **27** | **340** | **200** | **125** | **125** | **790** |
| Sem-II | 1 | Mathematical Foundation of Computer Science | 4 | 0 | 0 | **4** | **4** | 60 | 40 | - | - | **100** |
| | 2 | Distributed Computing | 3 | 1 | 2 | **6** | **5** | 60 | 40 | 25 | 25 | **150** |
| | 3 | Design and Analysis of Algorithms | 3 | 1 | 2 | **6** | **5** | 60 | 40 | 25 | 25 | **150** |
| | 4 | Soft Computing | 3 | 1 | 2 | **6** | **5** | 60 | 40 | 25 | 25 | **150** |
| | 5 | Big Data Analytics | 4 | 0 | 2 | **6** | **5** | 60 | 40 | 25 | 25 | **150** |
| | 6 | Pedagogy Studies | 2 | 0 | 0 | **2** | **0** | - | - | - | - | - |
| | | **TOTAL** | **19** | **3** | **8** | **30** | **24** | **300** | **200** | **100** | **100** | **700** |

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## M. TECH. SEMESTER – I (CE)
## SUBJECT: ADVANCED COMPILER TECHNIQUES

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

### 1 INTRODUCTION TO ADVANCED TOPICS

Review of Compiler Structure, Advanced Issues in Elementary Topics, The Importance of Code Optimization, Structure of Optimizing Compilers, Informal Compiler Algorithm Notation (ICAN)

### 2 CONTROL FLOW ANALYSIS

Approaches to Control-Flow Analysis, Depth-First Search, Preorder Traversal, Postorder Traversal, and Breadth-First Search, Dominators, Loops and Strongly Connected Components, Reducibility, Interval Analysis and Control Trees, Structural Analysis

### 3 DATA FLOW ANALYSIS

Basic Concepts: Lattices, Flow Functions, and Fixed Points, Taxonomy of Data-Flow Problems and Solution Methods, Iterative Data-Flow Analysis, Lattices of Flow Functions, Control-Tree-Based Data-Flow Analysis, Structural Analysis, Interval Analysis, Static Single-Assignment (SSA) Form, Dealing with Arrays, Structures, and Pointers

### 4 DEPENDENCE ANALYSIS AND DEPENDENCE GRAPHS

Dependence Relations, Basic-Block Dependence DAGs, Dependences in Loops, Dependence Testing, Program-Dependence Graphs

### 5 EARLY OPTIMIZATION

Constant-Expression Evaluation (Constant Folding), Scalar Replacement of Aggregates, Algebraic Simplifications and Re-association, Value Numbering, Copy Propagation, Sparse Conditional Constant Propagation

### 6 REDUNDANCY ELIMINATION

Common-Sub-expression Elimination, Loop-Invariant Code Motion, Partial-Redundancy Elimination, Redundancy Elimination and Reassociation, Code Hoisting

### 7 LOOP OPTIMIZATION

Induction-Variable Optimizations, Unnecessary Bounds-Checking Elimination

### 8 REGISTRATION ALLOCATION

Register Allocation and Assignment, Local Methods, Graph Coloring, Priority-Based Graph Coloring

## 9 INSTRUCTION SCHEDULING

branch scheduling, list scheduling

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Advanced Compiler Design and Implementation, by Steven Muchnick, Publisher: Morgan Kaufmann
2. Engineering a Compiler, by Keith Cooper and Linda Torczon, Publisher: Morgan Kaufmann
3. Optimizing Compilers for Modern Architectures, by Randy Allen & Ken Kennedy, Publisher: Morgan Kaufmann.

## M. TECH. SEMESTER – I (CE)
## SUBJECT: ADVANCE COMPUTER NETWORKS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

### 1 OVERVIEW

Overview of TCP/IP protocol suite, Different TCP/IP Layers and their major Functionalities

Various addressing used in TCP/IP

### 2 IP ADDRESSING & DELIVERY OF IP PACKETS

IPv4 addressing scheme and notations, Subnetting and Supernetting, Different Routing Methods

### 3 PROTOCOLS

ARP, RARP, IP, ICMP,IGMP ,TCP and UDP

### 4 WIRELESS NETWORKS

Introduction & Applications, Types of Wireless Networks

### 5 AD HOC WIRELESS NETWORKS

Introduction & Issues in Ad-hoc wireless networks, Ad Hoc wireless Internet, Issues of Routing Protocol, Various Routing Protocols, Energy Management in Ad Hoc Wireless Networks

### 6 TRANSPORT LAYER AND SECURITY PROTOCOLS FOR AD HOC WIRELESS NETWORKS

Issues in Designing a Transport Layer Protocol for Wireless Networks, Design Goals of a Transport Layer Protocol for Wireless Networks, Classification of Transport Layer Solutions TCP over Wireless Networks, Other Transport Layer Protocols for Wireless Networks

### 7 DELAY TOLERANT NETWORKS

Application and issues, Architecture and routing algorithms

## B. RECOMMENDED TEXTBOOK/ REFERENCE BOOKS


1. AdHoc Wireless Networks, Architectures and Protocols, 2nd Edition By: C. Siva Ram Murthy, B. S. Manoj. Publisher: Prentice Hall of India
2. Adhoc Mobile Wireless Networks: Principles, Protocols and Applications, 2nd Edition By:Subir Kumar Sarkar, T. G.Basavaraju, C. Puttamadappa Publisher: Auerbach Publications
3. Adhoc Networks: Technology & Protocols, 1st Edition By:Prasant Mohapatra, S.V. Krishna-murthy Publisher: Spriger
4. Principles of Wireless Networks, 4th Edition By: Kaveh Pahlavan, Prashant Krishnamurthy Publisher: Pearson Education
5. Wireless Networks, 1st Edition By: P. Nicopolitidis, M. S. Obaidat, G.I. Papadimitria, A.S. Pomportsis Publisher: John Wiley & Sons.
6. Wireless Communications & Networks, 2nd Edition By: W. Stallings Publisher: Prentice Hall

## M.TECH. SEMESTER – I (CE)
## SUBJECT: MACHINE LEARNING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

### 1 INTRODUCTION

Well posed learning problem, Perspective and issues in machine learning

### 2 CONCEPT LEARNING

Concept learning tasks, Finding maximally specific hypothesis, version space and candidate elimination, Inductive bias

### 3 DECISION TREE CLASSIFICATION

Appropriate problem for Decision tree learning, decision tree algorithm, hypothesis space search, Inductive bias in decision tree, Issues in decision tree leraning.

### 4 HYPOTHESIS EVALUATION

Estimating Hypothesis accuracy, Basics of sampling theory, Confidence interval, comparing learning algorithms

### 5 BAYESIAN LEARNING

Bayes theorem, Bayes theorem and concept learning, maximum likelihood and least square error hypothesis, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naive bayes classifier, Bayesian Belief Network, The EM algorithm.

### 6 SUPPORT VECTOR MACHINE

Max margin motivation: low density, high stability, Margin geometry to primal SVM formulation for separable training data, Dual formulation and role of alpha in a form of sparse local regression, Inseparable data, slack variables, hinge loss, upper bound on 0/1 training loss, Handling non-linear regression by lifting data points to higher dimension, Polynomial, Gaussian, RBF kernels, Sequential minimal optimization (SMO) algorithm

### 7 COMPUTATIONAL LEARNING THEORY

Probably learning an approximately correct hypothesis, sample complexity of finite hypothesis space, sample complexity of infinite hypothesis test, The mistake bound model of learning

### 8 INSTANCE BASED LEARNING

K-Nearest neighbor learning, Locally weighted regression, Radial basis function, Case based

reasoning, Lazy and Eager learning

## 9 CLUSTERING

Mixture model and Expectation maximization, K-Means Clustering, Distance based clustering, Density based clustering techniques

## 10 LEARNING SET RULES

Sequential covering algorithm, Learning first order rules, FOIL, induction and inverted deduction, Inverting resolution

## 11 ENSAMBLE LEARNING

Bagging and Boosting, Random forest, Adaboost

## 12 DIMENSIONALITY REDUCTION

Curse of dimensionality, Principal Component Analysis, Latent Semantic Analysis

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Machine Learning. T. Mitchell. McGraw-Hill, 1997.
2. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017
3. Pattern recognition and machine learning by Christopher Bishop, Springer Verlag, 2006.

## M. TECH. SEMESTER – I (CE)
## SUBJECT: DIGITAL IMAGE PROCESSING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

### 1 INTRODUCTION

Introduction, components of Digital Image Processing, examples, steps in DIP.

### 2 DIGITAL IMAGE FUNDAMENTALS

Elements of Visual perception, Light and Electromagnetic spectrum, Image Sensing and application, image sampling and quantization, Basic relationships between pixels, mathematical tools.

### 3 IMAGE TRANSFORMATION AND SPATIAL FILTERING

Basic intensity transformation, Histogram processing, Spatial filtering, smoothing and sharpening, combining spatial enhancement methods

### 4 IMAGE TRANSFORMATION IN FREQUENCY DOMAIN

Concepts, Sampling and Fourier transform, 1D and 2D Discrete Fourier Transform, properties of DFT, Basics of filtering, Image smoothing and sharpening, selective filtering, implementation.

### 5 IMAGE RESTORATION AND RECONSTRUCTION

Model of image degradation/restoration, noise models, restoration in spatial and frequency domain, estimating degradation function, inverse filtering, Wiener filtering, constrained least square filtering, geometric mean filter, image reconstruction from projections

### 6 COLOR IMAGE PROCESSING

Fundamentals, color models, pseudocolor image processing, full-color image processing, color transformation, smoothing and sharpening, segmentation based on color, noise in color images

### 7 WAVELETS AND MULTI-RESOLUTION PROCESSING

Background, multi-resolution expansion, wavelet transformation in one dimension, fast wavelet transform.

### 8 IMAGE COMPRESSION

Fundamentals, Huffman coding, golomb coding, arithmetic coding, LZW coding, run-length coding, symbol-based coding, bit-plane coding, block transform coding, predictive coding,

wavelet coding.

## 9 MORPHOLOGICAL IMAGE PROCESSING

Erosion and dilation, opening and closing, hit-or-miss transformation, basic morphological algorithms.

## 10 IMAGE SEGMENTATION

Fundamentals, point-line-edge detection, thresholding, region-based segmentation.

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Digital Image Processing (3 rd Edition) By: Rafael C. Gonzalez and Richard E. Woods Publisher: Pearson
2. Fundamental of Digital Image Processing, 1 st Edition By: Anil K. Jain, Publisher: Pearson Education
3. Introduction to Data Compression, 3rd Edition By: Khalid Sayood, Publisher: Morgan kaufmann.

## M. TECH. SEMESTER – I (CE)
## SUBJECT: ADVANCED SOFTWARE ENGINEERING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

### 1 INTRODUCTION
Software Product and Process, Phases in Software Development, Software Development Process Models.

### 2 SOFTWARE ANALYSIS AND DESIGN
Analysis Methods, Software Requirement Specifications, System Design Methods, Detailed Design, Architectural Design and Component Level Design, User Interface Design.

### 3 IMPLEMENTATION AND TESTING
Coding, Verification and Testing. Testing Techniques

### 4 SOFTWARE QUALITY
Quality Standards, Quality Assurance, Measuring Aspect of Software Quality, Software Reliability and Maintenance.

### 5 SOFTWARE METRICS
Software Measurement and Metrics, Software Quality, Metrics for Software Product, Process and Project.

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Software Engineering, Pressman, McGraw-Hill, 1992
2. Software Metrics , Fenton & Pfleeger, PWS Publication
3. Watts S. Humphrey, Managing The Software Process, Addison Wesley, 1989
4. Encyclopedia Of Software Engineering , J.J. Marciniak, Ed., Vols. 1 And 2 John Wiley,1994

## M. TECH. SEMESTER I (CE)
## SUBJECT: OPERATING SYSTEM DESIGN AND IMPLEMENTATION

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

1. **Booting and system calls**
2. **Devices And Device Drivers**
3. **Processes Description And Control**
4. **Signals**
5. **Memory Management And Virtual Memory**
6. **Threads, SMP, Microkernel, Exo-Kernel**
7. **Inter-process Communication (shared Memory, Semaphores, And Synchronization)**
8. **Kernel Interaction With Runtime Support Systems**
9. **Multiprocessor & Real-time Scheduling**
10. **Memory Management In UNIX/Linux**
11. **Fundamentals Of Real Time Operating Systems & Study Of Various RTOS – Real Time Operating**
12. **System :** RTAI, WinCE, VxWorks

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Operating System By William Stallings, PHI Publication
2. “The Design Of The UNIX O/S", Maurice J.Bach,PHI
3. "Modern Operating Systems", Tannenbaum, PHI
4. "O/S:A Design-Oriented Approach", Charles Crowley, TMH
5. Research Papers Related To RTOS, Linux Kernel Internals, Exo-Kernel

## M. TECH. SEMESTER – I (CE)
## SUBJECT: ADVANCED PROGRAMMING IN UNIX

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

1 **UNIX system overview**

2 **File I/O & Files and directories**

3 **System data files and information**

4 **Process environment**

5 **Process control & Process relationships**

6 **Signals**

7 **Threads**

8 **Daemon processes**

9 **Inter-process communication**

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. "Advanced Programming in the UNIX Environment" by W. Richard Stevens and Stephen A. Rago, 3rd edition, Addision Wesley Professional
2. "Advanced Linux Programming" by Mark Mitchell, Jeffrey Oldham, Alex Samuel, 1st edition, Pearson Education
3. "Beginning Linux Programming" by Neil Matthew and Richard Stones, 4th edition, Wiley Publishing Inc.
4. "Linux System Programming" by Robert Love, O'reilly

## M. TECH. SEMESTER I (CE)
## SUBJECT: ADVANCED DATA STRUCTURES

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

### 1 DICTIONARIES

Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.

### 2 HASHING

Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

### 3 SKIP LIST

Need for Randomizing Data Structures and Algorithms, Search andUpdate Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

### 4 TREES

Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

### 5 TEXT PROCESSING

Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

### 6 COMPUTATIONAL GEOMETRY

One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees.

### 7

Recent Trends in Hashing, Trees, and various computational geometry methods for effeciently solving the new evolving problem

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

## M. TECH. SEMESTER I (CE)
## SUBJECT: RESEARCH METHODOLOGY FOR COMPUTER SCIENCE

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 2 | 0 | 0 | 2 | 2 | 40 | - | - | - | 40 |

## A. DETAILED SYLLABUS

### 1 INTRODUCTION TO RESEARCH METHODOLOGY

Motivation and Objectives in Research, Distinct Approaches and Significance of research-Descriptive vs Analytical, Applied vs Fundamental, Quantitative vs Qualitative, Conceptual vs Empirical, The Significance of Research. Research Methods vs Methodology. Significance of research.

### 2 LITERATURE SURVEY

Finding Research Papers, Critical Reading, Developing a Literature, Authors, Editors, and Referees.

### 3 HYPOTHESIS, QUESTIONS AND EVIDENCE IN COMPUTER SCIENCE AND ENGINEERING

Hypotheses, Defending Hypotheses, Forms of Evidence, Use of Evidence, Approaches to Measurement

### 4 QUANTITATIVE AND QUALITATIVE STUDY DESIGNS, DATA COLLECTION

Concept of Quantitative and Qualitative Study Designs, Data collection in Quantitative and Qualitative research, Major approaches of Information gathering.

### 5 EXPERIMENTATION IN COMPUTER SCIENCE AND ENGINEERING

Persuasive Data, Interpretation, Robustness, Performance of Algorithms, Human Studies, Coding for Experimentation, Describing Experiments

### 6 PUBLICATION

Writing research papers, purpose, nature and evaluation, content and format, Presentation of Algorithms and graphs,Research Presentations.

### 7 ETHICS

Intellectual Creations, Plagiarism, Misrepresentation, Authorship

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. "Writing for Computer Science", by Justin Zobel, Springer,2014
2. "Guide to Advanced Empirical Software Engineering", by Forrest Shull, Springer,2008

3. “Research Methodology: A Step by Step Guide for Beginners”, by Ranjit Kumar, Pearson India,2005
4. Easterbrook, Steve, et al. "Selecting empirical methods for software engineering research." Guide to advanced empirical software engineering. Springer, London, 2008. 285-311.
5. S. Demeyer, "Research methods in computer science," 2011 27th IEEE International Conference on Software Maintenance (ICSM), Williamsburg, VI, 2011, pp. 600-600.
6. Nallaperumal, Krishnan & Krishnan, Annam. (2013). Engineering Research Methodology A Computer Science and Engineering and Information and Communication Technologies Perspective.
7. Research Design. Qualitative, Quantitative, and Mixed Methods Approaches. By John W. Creswell, Fourth Edition. SAGE Publication, 2014

## M. TECH. SEMESTER – II (CE)
## SUBJECT: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 0 | 4 | 4 | 60 | 40 | - | - | 100 |

## A. DETAILED SYLLABUS

1. Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains

2. Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood

3. Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.

4. Graph Theory: Isomorphism, Planar graphs, graph colouring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems

5. Computer science and engineering applications in Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

6. Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatic, soft computing, and computer vision

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. John Vince, Foundation Mathematics for Computer Science, Springer.
2. K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
3. M. Mitzenmacher and E. Upfal.Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
4. Alan Tucker, Applied Combinatorics, Wiley

## M. TECH. SEMESTER – II (CE)
## SUBJECT: DISTRIBUTED COMPUTING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

1 **Distributed System Architecture**

2 **Logical Time and Global States**

3 **Distributed Mutual Exclusion**

4 **Distributed Deadlock**

5 **Distributed File Systems**

6 **Distributed Shared Memory**

7 **Distributed Scheduling (job scheduling, load balancing, load sharing)**

8 **Consistency and Replication**

9 **Failure Recovery and Fault Tolerance**

10 **Security in Distributed Systems**

11 **Peer to Peer Systems**

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Advanced Concepts in Operating Systems by Mukesh Singhal and Niranjan Shivaratri, MGH
2. Distributed Systems: Principles and Paradigms by Andrew Tanenbaum and Maarten Steen, Pearson
3. Distributed Operating Systems: Concepts And Design by Pradip K. Sinha, Pearson
4. Distributed Systems : Concepts & Design by Colouris and Dollimore, Addison Wesley

## M. TECH. SEMESTER – II (CE)
## SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

1 **Notion Of Algorithms. Big-Oh, Small-OS, Theta & Omega Notations**

2 **Review Of Data Structures And Models Of Computation**

3 **Basic Paradigms, E.g. Greedy Algorithms, Divide And Conquer Strategies, Dynamic Programming**

4 **Graph Algorithms**

5 **Algorithms For Sorting & Searching**

6 **Order Statistics**

7 **String Matching & Sequence Comparison**

8 **Geometric Algorithms**

9 **Probabilistic Algorithms**

10 **The Classes P and NP And The Notation Of NP-completeness.**

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Aho, A. V. , Hopcroft J. E. , Ullman J.D., Design And Analysis Of Algorithms, Addison-wesly, 1974
2. Brassard G, And Bratley P., Algorithms, Theory And Practices, Prentice-Hall International-1988
3. Cormen T. H. , Leiserson C.E. And Rivest R. L., Introduction To Algorithms, MIT Press, 1990

## M. TECH. SEMESTER II (CE)
## SUBJECT: SOFT COMPUTING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

### 1 INTRODUCTION

Introduction to soft computing, Intelligent System, neural network, fuzzy logic and genetic algorithm

### 2 NEURAL NETWORK

Introduction, architecture, supervised and unsupervised learning, multilayer feed forward network and back propagation algorithm, Error-correction learning, Memory based learning, Hebbian learning, competitive learning, Boltzmann learning, Single layer perceptron, Multilayer perceptron.

### 3 CONVOLUTIONAL NEURAL NETWORK

Basics of convolutional neural networks, activation functions (soft-max, Relu), initialization, dropout, batch normalization, Update rules, ensembles, data augmentation, transfer learning, applications of CNN.

### 4 FUZZY LOGIC

Introduction, fuzzy sets and rules, fuzzy membership function, fuzzy controllers, application of fuzzy logic.

### 5 GENETIC ALGORITHM

Introduction, operators, selection, crossover mutations, different genetic algorithms and its applications.

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Neural Networks: A Comprehensive Foundation, S. Haykin, PHI
2. Introduction To Applied Fuzzy Electronics, Ahmad Ibrahim, PHI
3. Genetic Algorithms In Search, Optimization, And Machine Learning, D. E. Goldberg, Addison-Wesley
4. Fundamental of deep learning" by Nikhil Buduma

## M. TECH. SEMESTER II (CE)
## SUBJECT: BIG DATA ANALYTICS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## A. DETAILED SYLLABUS

### 1 INTRODUCTION

An overview of Data Warehousing and data mining.

### 2 A MULTI DIMENSIONAL DATA MODEL

Multi dimentional data cubes, Star, Starr Flakes & fact constellation Schema, concept Hierarchies, OLAP

### 3 DATA WAREHOUSE ARCHITECTURE

Steps for Design & Construction of Data Warehouse,A 3-Tier Data Warehouse Architecture, ROLAP, MOLAP, HOLAP

### 4 DATA PREPROCESSING

Overview, Need for Pre- Processing, Issues Related to Efficient Data Handling( Extacting, Tranformation And Handling of Large Databases)

### 5 DATA REDUCTION

Discretization & Concept Hierarchy Generation, Data Warehouse Implementation: Efficient Computation of Data Cubes, Indexing OLAP data, Efficient, Processing of OLAP Queries, Metadata, Data Warehouse Backend Tools & Utilities. Data Mining Premitives, Language & System Architecture: What defines a Data Mining Task ? A Data Mining Query Language, Architecture of a Data Mining System

### 6 CONCEPT DESCRIPTION

Characterization & Comparison: An Overview, Data generalization & Summarization-based Characterization, Analytical Characterization: Analysis & Attribute Relevance, Mining class Comparisons, Mining Descriptive Statistical Measures, Concept Description & Its Mining

### 7 MINING ASSOCIATION RULE

Basic Concepts, Market Basket Analysis, Mining Multi-Level, Association Rules From Transaction Rules from Trasactional Database, Mining Multi-Level Association Rules From Transaction Database, Mining Multi-Dimensional Association Rules From Relational Databases & Data Warehouses, From Association Mining To Correlation Analysis, Constraint Based Association Mining

## 8 CLASSIFICATION & PREDICTION

An Overview & Basic Concepts, Classification by Decision Tree Induction, Bayesian Classification, Classification by back Propagation, Classification Based on Concepts from Association Rules Mining, other Methods, such as Genetic Algorithm, Fuzzy set Approach, Case based Reasoning, etc., Prediction, classifier Accuracy

## 9 CLUSTER ANALYSIS

An Overview & Basic Concepts, Partitioning methods, hierarchical methods, density- based methods, grid-base clustering methods.

## 10 MINING COMPLEX TYPES OF DATA

An overview & basic concepts, mining spatial databases, mining multimedia databases, mining time series & sequence data, mining text databases, mining the world world wide web.

## 11 APPLICATIONS & TRENDS IN DATA MINING

Data mining applications, data mining system procedures & research prototypes, additional themes on data mining, social impact of data mining, social impact of data mining, trends in data mining. Popular products, and a methodology to select a data mining tool

## 12 INTRODUCTION TO BIG DATA

Introduction of Big Data and Hadoop – Overview and Evolution of Big-Data Hadoop, Architecture/Framework, HDFS Architecture/Framework, Map reduce, Hadoop Environment Setup, Distributed File System – Big Data and its Importance, Drivers for Big data, Big Data Analytics, Big Data Applications, Optimization techniques, Dimensionality Reduction techniques, Time series Forecasting, Social networking and its Application, Big Data analysis using Hadoop, Pig, Hive, Mongodb, Spark and Mahout, Data analysis techniques like Discriminant Analysis and Cluster Analysis, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), Introduction to NOSQL (Neo4j) and MongoDB, Hive Architecture, HBase concepts, PIG, Zookeeper - how it helpsin monitoring a cluster, HBase uses Zookeeper and how to Build Applications withZookeeper.

## 13 HADOOP

Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Algorithms using Map Reduce, Understanding inputs and outputs of MapReduce ,Map and Reduce tasks, Job, Task trackers ,Cluster Setup, SSH and Hadoop Configuration, HDFS Administering ,Monitoring and Maintenance Moving Data in and out of Hadoop, Data Serialization

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Jiawei Han & Michelline Kamber, Data Mining – Concepts & Techniques, Morgan Kaufmann Publishers ( Academic Press)
2. W. B. Frakes & R. Baeza – Yates Eds., Information Retrieval: Data Structures & Algorithms, Prentice Hall, 1992
3. Michael J A Berry & Gordon Linoff, Data Mining Techniques: For Marketing, sales, customer support
4. Pieter Adriaans & Dolf Zantinge, Data Mining, Pearson Education Asia, 2001

## M. TECH. SEMESTER II (CE)
## SUBJECT: PEDAGOGY STUDIES

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 2 | 0 | 0 | 2 | 0 | - | - | - | - | - |

## A. DETAILED SYLLABUS

### 1 INTRODUCTION AND METHODOLOGY

Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.

### 2 THEMATIC OVERVIEW

Pedagogical practices are being used by teachers in formal and informal classrooms in de-veloping countries. Curriculum, Teacher education.

### 3 EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES

Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evi- dence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

### 4 PROFESSIONAL DEVELOPMENT

alignment with classroom practices and follow-up support Peer support, Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes

### 5 RESEARCH GAPS AND FUTURE DIRECTIONS

Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dis-semination and research impact.

## B. RECOMMENDED TEXT / REFERENCE BOOKS


1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

# B. TECH. – SEMESTER-VIII (CH)
# COMPUTER AIDED DESIGN IN CHEMICAL ENGINEERING (PEC104)
# CORE ELECTIVE-IV

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 2 | 0 | 2 | 4 | 3 | 40 | 0 | 25 | 25 | 90 |

## A. COURSE OVERVIEW

Development of customized solution of chemical engineering design / optimization problems using various CAD tools. Use of computer for solving complex problems reduces human error, improves efficiency, removes redundancy and cost-effective optimal solutions can be obtained

**Objectives:**

To study applications of computer aided tools in design, optimization and control of chemical engineering systems. Emphasis is to develop CAD modules using MATLAB for solving various design problems, dynamic problems and optimization problems in chemical engineering

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | **Introduction to Computer Aided Design**<br>Motivation for using CAD in chemical engineering, Preliminaries of CAD, Tools of CAD, Onion model of process design | CO1<br>CO3 |
| 2. | **Computer aided design of process equipment**<br>Computer aided design of pressure vessel and algorithm development, Computer aided Nozzle design, Computer aided Head design, CAD module generation for Pressure Vessel using MATLAB | CO1<br>CO2<br>CO3 |
| 3. | **Computer aided optimization in Chemical engineering**<br>Introduction of Optimization, Linear Programming, Simplex and Big M method and its variants, Application of MATLAB for solving linear programming optimization problems, Nonlinear optimization in chemical engineering, Convexity and its determination, Unconstraint and constraint nonlinear optimization methods, Newton's method, Nelder-Mead method, Steepest descent method, Nonlinear optimization using MATLAB, CAD module generation for Optimization | CO1<br>TO<br>CO6 |
| 4. | **Process Synthesis and Pinch Technology**<br>Optimal Distillation column sequencing, Direct and indirect sequencing, side-rectifier, side-stripper columns, Prefractionator with heat integration, Petluyk column, Simulation studies of column sequencing, Heat Exchanger network design, energy target, computer aided design of HENS | CO1<br>TO<br>CO6 |
| 5. | **Process Flow-sheeting and simulation**<br>Flow sheet simulation algorithms, sequential modular and simultaneous modular approaches, Equation Oriented approach, tearing of recycle streams, Simulation examples using process simulators | CO1<br>TO<br>CO6 |

## C. PRACTICAL AND TERM WORK

Simulation experiments are designed to use various CAD tools such as MATLAB, ASPEN PLUS software for solving developing CAD modules for solving design problems, dynamic problems and optimization problems

## D. TEXT BOOKS


1. Bhattacharya, C. M.; Narayanan, C. M. *Computer Aided Design of Chemical Equipment*; New Central Book Agency (P) Ltd.: Calcutta, India, 1992
2. Husain, A. *Chemical Process Simulation*, Wiley Eastern Limited: New Delhi, 1986
3. Smith, R. *Chemical Process Design and Integration*, John Wiley & Sons Ltd.: England, 2005
4. Seborg, D. E.; Edger, T. F.; Mellichamp, D. A. *Process Dynamics and Control*, 2nd ed.; Wiley India, New Delhi, 2004


## E. REFERENCE BOOKS


1. Edger, T. F.; Himmelblau, D. M.; Lasdon, L. S. *Optimization of Chemical Processes*; 2 nd ed. McGraw-Hill: New York, 2001
2. B. V. Babu, *Process Plant Simulations*; Oxford Press, 2004


## F. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Understanding<br>Analysing<br>Applying<br>Evaluating<br>Creating<br>Remembering<br>evaluating | Formulate standard single/multivariable optimization Problem, **Understand** and Apply various optimization techniques to solve problems in Chemical Engineering using MATLAB. **Understand** distillation sequences using process simulation software |
| **CO2** | | Develop and **Analyse** energy target-based heat exchanger network using process simulation software. Analyse steady state and dynamic problems and create simulation modules for chemical processes using process simulation software.<br>**Understand** the ethics and morality in the context of CAD in Chemical Engineering |
| **CO3** | | **Apply** various CAD tools for solving design problems, Steady state and dynamic Analysis problem, optimal control problems |
| **CO4** | | **Do** critical evaluation of the performance of various CAD tools simulations for solving chemical engineering problems. |
| **CO5** | | Create CAD modules for design of process equipment |
| **CO6** | | **Generate** a matlab program for industrial application to carry out steady state and dynamics analysis. |

## G. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 2 | 2 | 2 | 3 | 2 | 3 | 2.3 |
| **PO2** | 1 | 1 | 3 | 3 | 3 | 3 | 2.3 |
| **PO3** | 1 | 2 | 3 | 3 | 3 | 3 | 2.5 |
| **PO4** | 1 | 1 | 2 | 3 | 2 | 3 | 2 |
| **PO5** | 0 | 0 | 2 | 3 | 3 | 3 | 1.8 |
| **PO6** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |
| **PO7** | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| **PO8** | 1 | 1 | 2 | 2 | 2 | 3 | 1.8 |
| **PO9** | 2 | 2 | 3 | 2 | 3 | 3 | 2.5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO10** | 1 | 2 | 3 | 2 | 2 | 3 | 2.2 |
| **PO11** | 2 | 3 | 3 | 2 | 2 | 3 | 2.5 |
| **PO12** | 3 | 3 | 3 | 2 | 3 | 3 | 2.8 |
| **PSO1** | 2 | 3 | 3 | 3 | 2 | 3 | 2.67 |
| **PSO2** | 3 | 3 | 3 | 2 | 3 | 2 | 2.67 |
| **PSO3** | 2 | 3 | 2 | 2 | 2 | 2 | 2.17 |
| **PSO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

# B. TECH. – SEMESTER-VI (CH)

# CHEMICAL PROCESS SAFETY (PEC102)

# (CORE ELECTIVE-II)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 0 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |

## A. COURSE OVERVIEW

To inculcate the safety culture among the undergraduate students of chemical engineering. To teach fundamentals of safety in process industries, current safety practices in industry by using various tools. To study industrial case studies and standards approved/recommended by CCPS, NFPA and Directorate of Industrial Safety and Health (DISH).

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | **Introduction to Process Safety**<br>Define: safety, hazard, risk, accident, incident, likelihood, consequence, loss prevention, domino effect, first aid, incident rate, lost workdays, occupational injury and illness, frequency rate, severity rate, fatality rate and fatal accident rate. Theory of accident causation, nature of accident process. | CO1 |
| 2. | **Process Safety Strategies and Case Studies**<br>Concept of Active, Passive, Inherent and Procedural Strategies. Case Studies: Analysis of mistakes made and lessons to learn from four significant chemical industry disasters: Flixborough (England), Pasadena (Texas), Seveso (Italy) and Bhopal (India). | CO1<br>CO3 |
| 3. | **Toxicological Studies**<br>Entry routes of toxicants into biological system and appropriate control strategy. Elimination of toxicants from biological system by various ways, target organ, acute and chronic toxicity and its toxicological studies, chemical and physical asphyxiates, TLV-TWA, TLV-STEL and TLV-C, LD 50 and LC 50. Detection of possible hazard through senses. | CO4 |
| 4. | **Industrial Hygiene**<br>Laws and regulations in Indian context and US context, role of OSHA, NIOSH, ACGIH, EPA, PSM vs. RMP. Safety work permits, Pre-start up and shut down procedures, emergency planning and response, mock drill, safety audit. Role of industrial hygienist: Identification using MSDS and NFPA diamond, Evaluation (quantification methods) and Control methods like Dyke and Enclosures, dilute and local ventilation, wet methods, good housekeeping and Personal Protective Equipment (PPE). | CO2<br>CO4 |
| 5. | **Fire and Explosion**<br>Basic definitions like fire, combustion, explosion, fire and flash point, auto-ignition etc., concept of fire triangle, flammability limits (LFL and UFL). Classification of fires, various extinguishing medium and its selection, mobile and stationary fire- fighting methods. Explosion types like mechanical explosion, detonation and deflagration, | CO1<br>CO2<br>CO3 |

| | | |
|---|---|---|
| | deflagration to detonation transition (DtoD transition), confined and unconfined explosion, dust explosions, vapor cloud explosion. BLEVE their causes and prevention, Numerical on fire & explosion. | |
| **6.** | **Source Models**<br>Concept of source models, flow of liquids and vapors through various geometries, flashing liquids, liquid pool evaporation, Realistic and worst-case releases. | **CO1**<br>**CO5** |
| **7.** | **Chemical Reactivity Hazard**<br>Concept of chemical reactive hazard, thermal run-away models and parametric sensitivity. Use of calorimeters and its types like DSC, ARC, ARRST, APTAC, VSP2 etc. Characterization of reactive chemical hazard using calorimeters. Strategies to control reactive hazard, case study of T2 laboratory for reactive hazard. | |
| **8.** | **Introduction to Reliefs and Relief Devices**<br>Need for relief devices, few terminologies like set pressure, max. Allowable working pressure, operating pressure, accumulation, overpressure, backpressure, blow down, max. allowable accumulated pressure etc., Location of reliefs, various relief devices like spring loaded (relief valve, safety valve and safety relief valve), mechanical, buckling pin and rupture dick. Selection criteria and combination criteria, effluent system, knock-out drum, cyclone, condenser, quench tank, scrubber, flare and incinerator. Concept of Basic process control systems (BPCS) and Safety instrumented system (SIS), sensor location criteria and redundancy of system, safety interlocks and alarm systems. | **CO1**<br>**CO2** |
| **9.** | **Hazard Identification and Hazard Analysis**<br>HAZID tools like hazard checklist, job safety assessment, hazard survey (Calculation of Dow and Mond Index). Hazard Operability (HAZOP case study), safety reviews, ALARP and Risk Management (RM). HAZAN using probabilistic methods, revealed and unrevealed failures, common failure modes and reliability calculations. Use of tools like FTA, ETA and LOPA analysis. | **CO1**<br>**CO5**<br>**CO6** |
| **10.** | **Safety Guidelines and Standards**<br>Safety in laboratory of academic institute and R&D houses, safety during loading and unloading of chemicals, safety while operating positive pressure and negative pressure systems, safety in tank farm, plant lay outing for safer operations, piping and electrical color code. Brief discussion on coverage of factories act (1948), Boiler act (1923), hazardous waste (management and handling) rules (1989), OISD guidelines and ISO-14000 (EMS), 18000 (OHSAS) and 31000 (RM). | **CO4**<br>**CO6** |

## C. TEXT BOOKS


1. Crawl, D. A.; Louvar, J. F. *Chemical Process Safety (fundamentals with applications)*; 3rd Ed.; Prentice Hall International Series, 2011


## D. REFERENCE BOOKS


1. Lees, F. P. *Loss* Prevention in the Process Industries (Hazard Identification, Assessment and Control); 2nd Ed.; Butterworth-Heinemann, 1980
2. Kletz, T. Learning from Accidents; 3rd Ed.; Gulf Professional Publishing, 2001
3. Stoessel, F. Thermal Safety of Chemical Processes (Risk Assessment and Process Design); Wiley-VCH, 2008
4. Banerjee, S. Industrial Hazards and Plant Safety; 1st Ed.; CRC Press, 2002

## E. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Understand Development Determine Analyse Evaluate Awareness | Understand the fundamentals of chemical process safety and the importance of process safety. |
| **CO2** | | Develop an ability to identify and quantify the potential hazards associated with chemical processes. |
| **CO3** | | Determining the issues pertaining to occupational safety and ethical aspects associated with process safety. |
| **CO4** | | Analyse the major industrial safety related regulations and guidelines. |
| **CO5** | | Evaluate the process system through mathematical modelling and implementation of the outcomes for the mitigation and prevention of accidents. |
| **CO6** | | Create awareness among students for the research and innovation in the field of process safety for sustainable future |

## F. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 3 | 3 | 3 | 2.5 | 2.5 | 2.5 | 2.8 |
| **PO2** | 3 | 3 | 2.5 | 2.5 | 2.5 | 2.5 | 2.7 |
| **PO3** | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| **PO4** | 2.5 | 2.5 | 2.5 | 3 | 2.5 | 2.5 | 2.6 |
| **PO5** | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| **PO6** | 3 | 3 | 2.5 | 2.5 | 2.5 | 2.5 | 2.7 |
| **PO7** | 3 | 3 | 3 | 2.5 | 2.5 | 2.5 | 2.8 |
| **PO8** | 3 | 3 | 3 | 2.5 | 2.5 | 2.5 | 2.8 |
| **PO9** | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| **PO10** | 2.5 | 3 | 2.5 | 2.5 | 2.5 | 2.5 | 2.6 |
| **PO11** | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| **PO12** | 3 | 3 | 3 | 3 | 3 | 2.5 | 2.9 |
| **PSO1** | 2 | 3 | 3 | 3 | 2 | 2 | 2.5 |
| **PSO2** | 2 | 3 | 3 | 3 | 2 | 2 | 2.5 |
| **PSO3** | 2 | 3 | 3 | 3 | 2 | 2 | 2.5 |
| **PSO4** | 2 | 3 | 3 | 3 | 2 | 2 | 2.5 |

# B. TECH. – SEMESTER-V (CH)

# CHEMICAL REACTION ENGINEERING-I (PCC108)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 0 | 3 | 6 | 4.5 | 60 | 40 | 25 | 25 | 150 |

## A. COURSE OVERVIEW

Selection, Design, Operation and Troubleshoot Ideal Reactors for various type of chemical reactions.

**Objectives:** Basic concepts of Kinetics and Rate law; Interpretation of rate of rate data; Design and Rating of Ideal Reactors involving homogeneous single reactions; Arrangement of different type and size of reactors for homogeneous reactions; Concept of Recycle Reactor for controlling mixing inside the reactors

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | **Introduction**<br><br>Introduction to chemical reaction engineering and Classification of chemical reactions Concept of Chemical kinetics. Role of Thermodynamics in chemical reaction engineering. Definition of Rate of reaction, Rate expression for various types of reactions. Variables affecting the rate of reaction: Temperature, Pressure, concentration, catalyst, inert, surface area etc. | **CO1**<br>**CO2**<br>**CO3** |
| 2. | **Kinetics of Homogeneous Reactions**<br><br>Effect of concentration on rate of reaction. Terminology in calculation of rate of reaction: Elementary vs non elementary reactions, Molecularity of reactions, order and rate constant of reaction, Irreversible vs Reversible reactions, concept of equilibrium constant. Effect of temperature on rate of reaction: Arrhenius theory, Collision theory & Transition state theory, comparisons of the theories. Kinetic of non-elementary reactions: matching reaction mechanism with rate law equation, Rule based derivation of rate law equation for given reaction mechanism and comparing with experimental rate law equation. | **CO1**<br>**CO2**<br>**CO3**<br>**CO4** |
| 3. | **Interpretation of Batch Reactor Data of Homogeneous Reactions**<br><br>Conversion in terms of concentration and pressure. Using Integral and Differential method of analysis to obtain kinetics of chemical reaction from obtained experimental data. Constant and variable volume reaction: irreversible, reversible, series, parallel, catalytic, autocatalytic reactions, Concept of variable volume reaction. Differential method of analysis: partial analysis of rate of reaction. Reactions with shifting order: Reactions with shifting of order from Higher to lower and lower to higher. | **CO1**<br>**CO2**<br>**CO3**<br>**CO4** |
| 4. | **Introduction to Reactor Design** | **CO5**<br>**CO6** |

| | | |
|---|---|---|
| | Introduction to concept of macro and micro mixing. Concept of ideal mixing in reactors. Definition and characteristics of various ideal reactors: Batch, CSTR, PFR, Selection of Batch or continuous mode of reactor operation. | |
| **5.** | **Single Ideal Reactors**<br><br>Reactor terminology - space time, space velocity, steady state condition, local conversion, global conversion, uniform *vs*. constant T, P and Concentration, Extent of reaction. Derive equation for Ideal Reactors from first principal model. Apply design equations of Ideal reactors to real system for single reactions and reactor. | **CO4**<br>**CO5**<br>**CO6** |
| **6.** | **Design for Single Reactions**<br><br>Comparison of various type of reactors for same order. Comparison of same type of reactors for various feed ratios for order more than one, comparison of MFR with that of PFR for same order for constant volume and variable volume reactors. Comparison of ideal reactors using graphical and analytical method. Multiple reactor system in series and/or parallel, Equal/unequal size reactors in series, Reactors of different types in series. Introduction to recycle reactor, Design of recycle reactor, Solution using graphical method, application of recycle reactor to autocatalytic reaction | **CO3**<br>**CO4**<br>**CO5**<br><br>**CO6** |
| **7.** | **Design for Multiple Reactions**<br><br>Maximizing desired product for parallel and series reactions. Mixed complex reactions | **CO5**<br>**CO6** |

## C. PRACTICAL AND TERM WORK

Experiment pertaining to determination of order and rate constant of reaction using integral & differential methods of analysis, effect of temperature on rate of reaction, study of pilot scale reactor. Application of computer by solving ordinary differential equation using numerical methods to compare the result predicted by numerical method with that of experimental data

## D. TEXT BOOKS

1. Levenspiel, O. *Chemical Reaction Engineering*; 3rd ed.; John Wiley & Sons (Asia) Pvt. Ltd : Singapore, 2014

## E. REFERENCE BOOKS

1. Scott, F. H. *Elements of Chemical Reaction Engineering;* 5th ed.; Prentice Hall India (p) Ltd.: New Delhi, 2016
2. Smith, J. M. *Chemical Engineering Kinetics*; 3rd ed.; McGraw Hill Incorporation: New York, 2000

## F. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | | **Understand** and **State** the fundamentals of chemical reactions |

| | | |
|---|---|---|
| | Understanding<br>Analysing<br>Applying<br>Remembering<br>Creating<br>Evaluating | (Classification, Definitions) and chemical kinetics |
| **CO2** | | Discuss the thermodynamic properties for multiphase & multicomponent mixtures for the equilibrium separation processes. |
| **CO3** | | **Explain** the **concept** of Rate of Reaction, **Evaluate** Kinetic Expression, **Examine** effect of various parameters on it |
| **CO4** | | **Apply** Kinetic Expression to experimental data and **compare** the results |
| **CO5** | | **Define** the **concept** of Ideal Reactor and **classify** the type of ideal reactors |
| **CO6** | | **Select**, **Design, Operate and Sketch** different type of reactors |

## G. COURSE MATRIX

| | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** | **CO6** | **AVG.** |
|---|---|---|---|---|---|---|---|
| **PO1** | 2 | 2 | 3 | 2 | 3 | 3 | 2.5 |
| **PO2** | 2 | 2 | 3 | 2 | 3 | 3 | 2.5 |
| **PO3** | 2 | 2 | 3 | 2 | 3 | 3 | 2.3 |
| **PO4** | 2 | 2 | 2 | 2 | 3 | 3 | 2.33 |
| **PO5** | 1 | 1 | 2 | 2 | 3 | 3 | 2 |
| **PO6** | 1 | 2 | 2 | 2 | 3 | 2 | 2 |
| **PO7** | 2 | 2 | 3 | 2 | 3 | 2 | 2.3 |
| **PO8** | 1 | 1 | 2 | 2 | 3 | 3 | 2 |
| **PO9** | 1 | 2 | 2 | 2 | 3 | 2 | 2 |
| **PO10** | 1 | 1 | 2 | 2 | 3 | 3 | 2 |
| **PO11** | 1 | 2 | 2 | 2 | 3 | 3 | 2.16 |
| **PO12** | 1 | 2 | 3 | 2 | 3 | 3 | 2.3 |
| **PSO1** | 2 | 3 | 3 | 3 | 2 | 3 | 2.67 |
| **PSO2** | 3 | 3 | 3 | 2 | 3 | 2 | 2.67 |
| **PSO3** | 2 | 3 | 2 | 2 | 2 | 2 | 2.17 |
| **PSO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

# B. TECH. – SEMESTER-VI (CH)
# CHEMICAL REACTION ENGINEERING-II (PCC112)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 0 | 3 | 6 | 4.5 | 60 | 40 | 25 | 25 | 150 |

## A. COURSE OVERVIEW

**Motivation:** Analysis, design, selection and operation of chemical reactors for non-ideal, non-isothermal and heterogeneous reactions in chemical process industries

**Objectives:** Fundamentals of non-ideality in reactors and change in conversion, Basic concepts of non-isothermal operations and design, Fundamentals of catalysis, mechanisms and kinetics of catalytic reactions, Basic analysis and design of fixed bed, fluidized bed, trickle bed and slurry reactors, Fundamentals and design of non-catalytic multiphase reactors (fluid-fluid, fluid-solid)

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | **Non-ideal Reactors**<br>RTD theory, understanding RTD curves and moments, Finding out RTD by experiments – Pulse and Step Input, Models for non-ideal flow – zero (segregation & maximum mixedness), one (Dispersion and TIS) and two parameter models | **CO1**<br>**CO6** |
| 2. | **Non-isothermal Operations and Design**<br>Material and Energy balances for CSTR and PFR/PBR, Design Algorithms for CSTR and PFR/PBR, Adiabatic and non-adiabatic design Procedures, Unsteady-state Batch reactor design Procedures, Concept of Multiple Steady states in CSTR | **CO2**<br>**CO6** |
| 3. | **Fundamentals of Catalytic Reactions**<br>Mechanism of solid catalyzed reaction, Experimental Methods for studying kinetics of catalytic reactions and data analysis, Design of Fixed bed catalytic reactors, Design of Fluidized bed catalytic reactors, Design of Trickle bed catalytic reactors | **CO3**<br>**CO6** |
| 4. | **Fundamentals of Fluid-Fluid Reactors and Reactor Design**<br>Kinetic regimes for mass transfer & reaction, Enhancement factor in gas-liquid reactions, Design of towers/tanks for fast & slow reactions | **CO4**<br>**CO6** |
| 5. | **Fundamentals of Fluid-Solid Reactors and Reactor Design**<br>Rate equation for heterogeneous reactions, the concept of rate controlling step, Design of Plug flow, Fluidized bed reactors | **CO5**<br>**CO6** |
| 6. | **Professional Ethics in Chemical Reaction Engineering**<br>Discussion on engineering ethical considerations, focusing on problems followingbest practices, Discussion of social and environmental considerations, the importance of considering engineering ethics | |

## C. PRACTICAL AND TERM WORK

Experiments to determine RTD & conversion form RTD for various geometries under laminar & turbulent flows, heterogeneous reaction system, and application of tank in series & dispersion models, RTD in a pilot scale batch reactor

## D. TEXT BOOKS

1. Levenspiel, O. Chemical Reaction Engineering; 3rd ed.; John Wiley & Sons (Asia) Pvt.Ltd : Singapore, 2014

2. Scott, Fogler. H. Elements of Chemical Reaction Engineering; 5th ed.; Prentice Hall India (p) Ltd.: New Delhi, 2016

## E. REFERENCE BOOKS

1. Smith, J. M. *Chemical Engineering Kinetics*; 3rd ed.; McGraw Hill Incorporation: NewYork, 2000

## F. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Understand<br>Analysis<br>Evaluate<br>Application<br>Create | **Understand** and **Analyse** the non-ideality in the reactors and**Evaluate** its performance |
| **CO2** | | **Apply** energy balance, **Analyze** and **Design** PFR, CSTR andBatch type non-isothermal reactors |
| **CO3** | | **Develop** Kinetic Expression from heterogeneous reaction experimental data and **analyze** the reaction mechanism involved |
| **CO4** | | **Analyse** different control regimes and **design** fluid-fluidcontactors accordingly |
| **CO5** | | **Analyze** and **Design** of non-catalytic fluid-solid reactors |
| **CO6** | | **Critiquing** Industrial Reactor and Implement solution Methodology for optimum Design of actual reactors |

## G. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO6** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO7** | 3 | 3 | 3 | 3 | 3 | 2 | 2.8 |
| **PO8** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO9** | 3 | 3 | 3 | 3 | 2 | 2 | 2.7 |
| **PO10** | 3 | 3 | 3 | 3 | 2 | 2 | 2.7 |
| **PO11** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO12** | 3 | 3 | 3 | 3 | 2 | 2 | 2.7 |
| **PSO1** | 3 | 3 | 3 | 3 | 2 | 2 | 2.7 |
| **PSO2** | 3 | 3 | 3 | 3 | 2 | 2 | 2.7 |
| **PSO3** | 3 | 3 | 3 | 3 | 2 | 2 | 2.7 |
| **PSO4** | 3 | 3 | 3 | 2 | 2 | 3 | 2.7 |

## B. TECH. SEMESTER – VI (CH)
## SUBJECT: CHEMICAL SYSTEM MODELING (PCCxxx)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut. | Prac. | Total | | Ext. | Sess. | TW | Prac. | Total |
| 3 | 1 | 0 | 4 | 4.0 | 60 | 40 | 0 | 0 | 100 |

## A. COURSE OVERVIEW

**Motivation:** To have a good grasp of mathematical modelling and its basic classification of various process, such as deterministic and stochastic processes. Students are made aware with specific applications of mathematical modelling in chemical engineering, which is generally referred to as chemical systems modelling

**Objectives:**

- The basic objective of this subject to give general approach for the model formulation of various chemical engineering systems
- Applying the basic principles of chemical engineering to the various systems

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Modeling Overview**<br>Physical modelling, mathematical modelling and its classification, principles of similarity in physical modelling, concepts of independent variables, dependent variables, boundary conditions partial Differential Equations & finite Difference | 6 | CO1 |
| [2] | **Mathematical Modelling in Mass Transfer**<br>Single stage, 2 stage & N stage extraction of steady state mass transfer process, unsteady state formulation of single stage extraction, unsteady state mass transfer (Fick's second law), gas absorption accompanied by chemical reaction (mathematical model formulation), finite difference – solvent extraction in N stage process, gas absorption in N stages (Kremser – Brown), N stirred tanks reactors in series, etc. | 15 | CO2<br>CO6 |
| [3] | **Mathematical Modelling in Heat Transfer**<br>Steady state heat conduction through hollow cylindrical pipe using various boundary conditions, unsteady state process of steam heating of liquid, heat transfer through extended surfaces (triangle & rectangle), steady state counter current cooling of tanks, unsteady state heat loss through maturing tank, unsteady state heat conduction, gas pre-heater, heat loss through circular flanges | 15 | CO3<br>CO6 |
| [4] | **Mathematical Modeling in Reaction Engineering**<br>The model of the chemical reaction with diffusion in a tubular reactor, chemical reaction with heat transfer in a packed bed reactor, gas absorption accompanied by chemical reaction and reactors in series. | 12 | CO4<br>CO6 |
| [5] | **Mathematical Modelling in Fluid Mechanics**<br>Continuity equation, model formulation of flow through a packed bed column, models on momentum transfer such as laminar flow in a narrow slit, model of flow between concentric cylinders and concentric spheres | 12 | CO5<br>CO6 |

| | | | |
|---|---|---|---|
| [6] | **Professional Ethics in Chemical System Modeling**<br>Ethical considerations for Modeling approach. Motivating the students to consider socio-environmental issues in a serious manner. Best practices to be followed with engineering ethics | | |

## C. TEXT BOOKS

1) B.V. Babu, Process Plant simulation, Oxford University Published in India.
2) Jensen V. G.; Jeffreys G. V., Mathematical Methods in Chemical Engineering, Academic Press, New York
3) Mickley H S; Sherwood T S; Reed C E, Applied Mathematics in Chemical Engineering 2nd Ed. Tata McGraw Hill Publishing Co. Ltd., New Delhi

## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | Understand and State the fundamentals of general approach on the modeling of chemical systems |
| CO2 | Application Analysis | Explanation of the concept of mathematical modeling of mass transfer unit operations |
| CO3 | Application Analysis | Conceptual modeling of heat transfer unit operations |
| CO4 | Application Analysis | Fundamentals of mathematical modeling in reaction engineering |
| CO5 | Application Analysis | Explain the concept of mathematical modeling of fluid flow unit operations |
| CO6 | Create | Discussion on the modelling approach of real industrial problems |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | |
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| CO6 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 |
| | | | | | | | | | | | | | | | | |
| Avg | 3 | 2.8 | 2.8 | 3 | 3 | 3 | 2.8 | 3 | 2.7 | 2.7 | 3 | 2.7 | 2.8 | 2.7 | 2.8 | 2.7 |

Justification:

A course on Chemical System Modelling is proposed in the AICTE model curriculum for Sem.VI. It came to my mind that the students should be able to understand the basics of modeling and develop the models for different chemical systems. This will help them to understand the specific applications of mathematical modelling in chemical engineering world and also make their task easy to perform simulation as well.

Questions:
Q1. What do you expect from the students after learning the subject like chemical system modelling?
Answer : Students should find the realistic differences among physical, mathematical, and chemical systems modelling.

Q2. Where have you given your main focus for this subject?

Answer: The focus is given on the related aspects of modelling such as the controlled system, principles of similarity, dependent and independent variables, parameters, and boundary conditions. Special emphasis is given to develop the relationship between various variables.

# B. TECH. – SEMESTER-V (CH)
# ENVIRONMENTAL ENGINEERING (PEC101)
# (CORE ELECTIVE-I)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | 0 | 100 |

## A. COURSE OVERVIEW

Environmental engineering deals with the application of engineering principles to the control, modification and adaption of the physical, chemical and biological factors of the environment in the interest of human's health, comfort and social wellbeing. The student will identify and troubleshoot for environmental pollution problems.

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | **Introduction to Environmental Pollution**<br>Introduction to environment, Biosphere, Hydrological and nutrient Cycles, Types of pollution and Pollutant | CO1 |
| 2. | **Air Pollution**<br>**Sources and Effects:** Air pollution – Definition and concentrations, classification and properties of air pollutants, criteria air pollutants, Photochemical smog, emission sources for air pollutants, Air pollution laws and standards in India, behaviour and fate of various air pollutants in atmosphere, Effects of air pollution on health, impact on vegetation and materials.<br>**Meteorological aspects of air pollutant dispersion:** Meteorology – definition and parameters, Temperature lapse rate, Inversion and atmospheric stability, Plume behaviour, Dispersion of air pollutants – The Gaussian plume model<br>**Air pollution sampling and measurement:** Ambient air sampling and stack sampling, Collection of gaseous air pollutants and Particulate pollutants, Analysis of air pollutants<br>**Air pollution control methods and Equipments:** Control methods, Principle and design of particulate matter control devices- gravitational settling chambers, cyclone separators, bag house filters, electrostatic precipitators, wet and dry scrubbers. Control of specific gaseous pollutants: **Control of specific gaseous pollutants:** Modification of operating conditions, modification of design conditions, effluent gas treatment methods. | CO2 |
| 3. | **Waste water engineering**<br>**Origin of waste water and waste water flow rates:** Introduction to waste pollution, Reasons for waste water treatment, Introduction to treatment operations, process and concepts, Components of waste water flow rates, Waste water sources and flow rates, Variation in wastewater flow, Analysis of waste water flow rate data, Reduction of waste water flows.<br>**Waste water characteristics:** Physical, Chemical and Biological characteristics of wastewater<br>**Waste water treatment:** Objective and classification of waste water treatment, Major factors for selection of system, Design parameters for waste water treatment, Reactor used in waste water treatment<br>**Physical unit operation and their design:** Objective and Application of Physical unit operations in waste water treatment, Various unit operations – Screening, Grit chambers, Flow equalization, Flocculation, Flotation., Sedimentation, Design of various units- Screening, Flow equalization, Flotation, Sedimentation. | CO3<br>CO4 |

| | | |
|---|---|---|
| | **Chemical Unit processes:** Objective and Application of Chemical unit processes in waste water treatment, Various chemical unit processes – Chemical Precipitation, Disinfection **Biological Unit processes:** Objective of Biological unit processes in waste water treatment, Important definition, Classification of biological unit processes, Bacterial growth and Kinetics of Bacterial growth, Suspended growth treatment process – Activated sludge process- Modification, Design, Aerated lagoons, Aerobic attached growth treatment processes – trickling filters & its design, rotating biological contractors, Introduction to anaerobic suspended growth treatment processes attached growth treatment process, sludge treatment & disposal, Introduction to advanced waste water treatment | |
| **4.** | **Solid waste management** | **CO5** |

## C. TEXT BOOKS

1. Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse,15th ed.; Tata McGraw Hill, New Delhi, 2003
2. C. S. Rao., Environmental Pollution Control Engineering,3rd ed., New Age International Publishers, Delhi, 2018

## D. REFERENCE BOOKS

1. Scott, F. H. Elements of Chemical Reaction Engineering; 5th ed.; Prentice Hall India (p) Ltd.: New Delhi, 2016
2. Smith, J. M. *Chemical Engineering Kinetics*; 3rd ed.; McGraw Hill Incorporation: New York, 2000
3. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. *Environmental Engineering*, Indian editon, Tata McGraw Hills
4. Martin Crawford, *Air pollution control theory*, Tata McGraw-Hill
5. G. L. Karia and R. A. Christian, *Waste water treatment – Concepts and Design approach*,2nd ed.; East Economy Edition

## E. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Evaluate Comprehension Application Synthesis Analysis | Understand the sources, effects and control measure of different types of pollution. (Air, Water, Land etc.) |
| **CO2** | | Analyse general air pollution problems, meteorological aspects, control and measure of particulate pollutants and gaseous pollutants. |
| **CO3** | | Apply the basic knowledge on water pollutants and waste water characteristics and build expertise in analysis and testing of water samples. |
| **CO4** | | Evaluate the significance of various unit operations and unit processes involved in waste water treatment, Create design of specific treatment methods for effluents of various chemical process industries |
| **CO5** | | Understand about solid waste, remember problems associated with solid waste disposal, evaluating various methods for solid waste treatment. |

## F. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | AVG. |
|---|---|---|---|---|---|---|
| **PO1** | 2 | 3 | 3 | 3 | 2 | 2.6 |
| **PO2** | 2 | 3 | 3 | 2 | 1 | 2 |
| **PO3** | 1 | 2 | 2 | 3 | 2 | 2 |
| **PO4** | 2 | 2 | 2 | 2 | 1 | 2.8 |
| **PO5** | 2 | 2 | 2 | 2 | 1 | 2.8 |
| **PO6** | 2 | 2 | 2 | 2 | 1 | 2.8 |
| **PO7** | 3 | 2 | 2 | 2 | 2 | 2.2 |
| **PO8** | 1 | 2 | 2 | 2 | 2 | 2.8 |
| **PO9** | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO10** | 1 | 2 | 2 | 2 | 2 | 2.8 |
| **PO11** | 1 | 2 | 2 | 2 | 2 | 2.8 |
| **PO12** | 2 | 2 | 2 | 2 | 2 | 2 |
| **PSO1** | 1 | 2 | 2 | 1 | 1 | 2.4 |
| **PSO2** | 1 | 1 | 2 | 2 | 1 | 2.4 |
| **PSO3** | 1 | 1 | 1 | 2 | 1 | 2.1 |
| **PSO4** | 1 | 1 | 1 | 1 | 2 | 2.1 |

BACK

# B. TECH. – SEMESTER-III (CH)
# GENERAL CHEMICAL TECHNOLOGY (PCC113)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

## A. COURSE OVERVIEW

**Motivation:** To inculcate the knowledge of various processes and operations of the chemical industries, among the undergraduate students of chemical engineering.

**Objective:**

- To study chemical manufacturing processes and their applications to specific chemical Industries.
- Main focus is on the raw materials, flow sheet, synthesis and detailed analysis of the processes.
- Enables the readers to integrate the fundamental knowledge of the basic disciplines & all other courses you have read or reading
- To understand the most important chemical processes, and to apply this knowledge and understanding to industrial processes.
- To familiarize the students with characteristics of Crude, its refining to get commercially important fractions and products.
- To help the students in understanding the unit operations and unit processes in manufacture of various petrochemicals and their downstream products like polymers, dyes, synthetic fibers and pharmaceuticals.
- To familiarize with environmental issues and engineering problems involved.

## B. COURSE CONTENT

| | TOPICS | Cos |
|---|---|---|
| 1. | **Water and Water Treatment**<br>Industrial use of water, demineralization, deionization, RO system, water treatment, concept of water resources management. | **CO1**<br>**CO2** |
| 2. | **Fuels & Energy**<br>Classification of fuels, Water gas, Producer Gas, Coke oven gas., Coal & coal chemicals, coking of coal, Various types of coal gasifiers. | **CO1**<br>**CO3** |
| 3. | **Cement & Glass Manufacturing**<br>Lime stone beneficiation, types of cement, Manufacturing of cement. Types of glass, manufacturing of glass. | **CO1**<br>**CO4** |
| 4. | **Sulphur and Electrolytic Manufacturing of Aluminum & Magnesium**<br>Manufacturing of elemental sulfur by Frasch process. Hydrogen sulfide conversion and from iron pyrites, | **CO1**<br>**CO3**<br>**CO4** |
| 5. | **Pulp & Paper Manufacturing**<br>Kraft process and sulfite process for manufacturing of pulp, chemical recovery system, types of paper, paper manufacturing process. | **CO1**<br>**CO3**<br>**CO4** |
| 6. | **Sugar & Starch Industry**<br>Manufacturing of sugar, starch, and dextrin | **CO1**<br>**CO3**<br>**CO4**<br>**CO5** |
| 7. | **Oils, Fats, Soaps & Detergents**<br>Vegetable oil Extraction method using Mechanical and Solvent extraction process. Hydrogenation of oil, cleaning mechanism of soaps and detergents, manufacturing | **CO1**<br>**CO3**<br>**CO4** |

| | | |
|---|---|---|
| | of soaps and glycerine, manufacturing of detergents | **CO5** |
| **8.** | **Overview of Petroleum and Petrochemical Industry Petroleum Refining**<br>Origin, formation and composition of petroleum, Petroleum reservoirs in India and World, Evaluation of petroleum, thermal properties of petroleum fractions, Important products-properties and test methods, Dehydration and desalting of crudes, Distillation of petroleum, Fractions-impurities, Gasoline Treatment, Treatment of Kerosene, Treatment of Lubes, Wax and purification, Thermal and Catalytic cracking, Catalytic reforming, Naphtha cracking, Coking, Hydrogen processes, Alkylation.<br>**Petrochemical Industry:** Overview of petrochemicals from petroleum feedstock. | **CO4**<br>**CO6**<br>**CO4**<br>**CO6** |
| **9.** | **Introduction to Polymers and Synthetic Fiber Industries**<br>Manufacture of phenol & urea formaldehyde resins, manufacture of PVC, polyethylene, etc, Manufacture of synthetic fibers (e.g. Industries nylon, polyester, acrylic, rayon etc) | **CO1**<br>**CO3**<br>**CO4**<br>**CO6** |
| **10.** | **Fine Chemicals, Drugs, Intermediates and Dyes**<br>Classification of pharmaceuticals, manufacture of important drugs and pharmaceuticals – salicylic acid, methyl salicylate, aspirin, antibiotics, & vitamins. | **CO1**<br>**CO3**<br>**CO4**<br>**CO6** |

## C. PRACTICAL AND TERM WORK

- To determine Flash and Fire point of given sample using Able's apparatus.
- To determine Flash and Fire point of given sample using Pensky Martin apparatus.
- To determine Aniline point of given oil sample.
- To determine Smoke point of Kerosene sample.
- To determine viscosity of given oil sample.
- To determine Cloud and Pour point of given oil sample.
- To determine Softening Point of given sample.
- To do proximate analysis of coal.
- ASTM distillation Test.
- Carbon Residue Test.
- Synthesis of Soap

From the above list, selected experiments may be performed by students for better understanding of theoretical concept.

## D. TEXT BOOKS


1. Dryden's Outlines of Chemical Technology, 2nd Ed. By M. Gopala Rao & Marshall Sitting, East West Press Pvt. Ltd., New Delhi
2. Shreve's Chemical Process Industries, 5th Ed. By, George F. Austin McGraw Hill International Edition
3. George F. Austin, Shreve's Chemical Process Industries, 5th Ed. McGraw Hill International Edition, NY, 1984
4. Bhaskara Rao, B.K., Modern Petroleum Refining Processes, 6th Ed. Oxford & Ibh, New Delhi, 2017
5. Bhaskara Rao, B.K., A Text On Petro Chemicals, 5th Ed, Khanna Publisher, New Delhi, 2010


## E. REFERENCE BOOKS


1. Chemical Process Industries, 4th Ed. by R. Norris Shreve & J. A. Brink, Jr. International Student's Edition
2. Pollution Control in Chemical Process Industries, 1st Ed. By S. P. Mahajan Tata McGraw Hill Publications, New Delhi

## F. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Understand<br>Develop<br>Explain<br>Analyse<br>Application<br>Awareness and sustainability | **Understand** the fundamentals of general chemical process technologies and the importance of these technologies |
| **CO2** | | **Develop** an ability to identify and quantify, various process conditions associated with chemical processes and operations. |
| **CO3** | | **Explaining** the production processes of various chemical products. |
| **CO4** | | **Analyse** the major engineering problems associated with production units of various chemical industries. |
| **CO5** | | **Application** of the process drawing tools for process flow diagrams. |
| **CO6** | | **Create awareness** among students for the research and **innovation** in the field of chemical process industries for environmental issues and sustainability. |

## G. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 3 | 2 | 3 | 3 | 3 | 3 | 2.8 |
| **PO2** | 3 | 2 | 3 | 3 | 3 | 3 | 2.8 |
| **PO3** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |
| **PO4** | 3 | 2 | 2 | 3 | 2 | 3 | 2.5 |
| **PO5** | 3 | 3 | 3 | 2 | 2 | 2 | 2.5 |
| **PO6** | 3 | 3 | 3 | 3 | 2 | 3 | 2.8 |
| **PO7** | 3 | 2 | 3 | 3 | 2 | 3 | 2.7 |
| **PO8** | 3 | 2 | 3 | 3 | 2 | 3 | 2.7 |
| **PO9** | 3 | 3 | 3 | 3 | 2 | 2 | 2.7 |
| **PO10** | 3 | 2 | 3 | 3 | 3 | 2 | 2.7 |
| **PO11** | 3 | 2 | 2 | 3 | 3 | 3 | 2.7 |
| **PO12** | 3 | 3 | 3 | 3 | 2 | 2 | 2.7 |
| **PSO1** | 2 | 3 | 3 | 3 | 2 | 2 | 2.5 |
| **PSO2** | 2 | 3 | 3 | 3 | 2 | 2 | 2.5 |
| **PSO3** | 2 | 3 | 3 | 3 | 2 | 2 | 2.5 |
| **PSO4** | 2 | 3 | 3 | 3 | 2 | 2 | 2.5 |

# B. TECH. – SEMESTER-IV (CH)
# HEAT TRANSFER (PCC104)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 0 | 3 | 6 | 4.5 | 60 | 40 | 25 | 25 | 150 |

## A. COURSE OVERVIEW

The course will introduce the fundamental concepts of various modes of heat transfer. It will further elaborate these concepts with theories and applications to the solutions of practically relevant chemical engineering problems. Some aspects of process design principles of various heat transfer equipment will be taken up in the later part of this course.

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | Modes of heat transfer: Conduction, Convection, and Radiation. Material properties of importance in heat transfer: Thermal conductivity, Specific heat capacity. Classification of heat transfer equipment's and processes | CO1 |
| 2. | Steady state conduction in one dimension. Basic law of heat conduction- Fourier's law, Steady state heat conduction through composite wall, Steady state heat conduction through a variable area: cylinder, sphere. Heat conduction in bodies with heat source: plane wall, cylinder, sphere. | CO2 |
| 3. | Newton's law of cooling. Dimensionless numbers and their physical significance, empirical correlations for free and forced convection. Thermal and hydrodynamic boundary layer, heat and momentum analogy. | CO2<br>CO1 |
| 4. | Definition, phenomena of boiling, boiling curve, regimes of boiling. Heat transfer to boiling liquids, the mechanism of nucleate boiling, correlation for pool boiling heat transfer: Nucleate boiling, critical heat flux, stable film boiling. Force convection boiling. | CO3<br>CO4 |
| 5. | Definition, phenomena of condensation, film type & drop wise condensation. Film condensation on vertical surface, condensation on horizontal tube or tube bank. | CO2<br>CO6 |
| 6. | Definition, basic principles, properties of solution. Performance of steam heated tubular evaporators: Capacity and economy, single and multiple effect evaporators, Boiling point elevation, heat transfer coefficient, enthalpy balance calculation. Method of feeding: forward & backward feed systems, Types of evaporators: natural circulation evaporator, forced circulation evaporator. | CO4<br>CO6 |
| 7. | Classification, heat exchanger analysis, LMTD for parallel and counter flow exchanger. Condenser and evaporator, overall heat transfer coefficient, fouling factor, correction factors for Multipass heat exchanger.<br>Effectiveness and number of transfer unit for parallel and counter flow heat exchanger. Design of Double pipe heat exchanger and shell and tube heat exchanger (kern's method of heat Exchanger design, Bell Delaware method). Introduction to compact heat exchanger and their design aspects. Importance of Ethics in design of heat exchanger and its importance in process industry. | CO4<br>CO5<br>CO6 |
| 8. | Basic definition radiation: Absorptivity, reflectivity, and transmissivity.<br>Blackbody radiation, laws of radiation: Planck's law, Wien's law, The Stefan- Boltzmann law for blackbody, Special characteristic of blackbody radiation, Kirchhoff's law, radiation between surfaces. | CO1<br>CO2 |
| 9. | Types of fins, heat flow through rectangular fin, infinitely long fin, fin insulated at the tip | CO2 |

and fin losing heat at the tip, efficiency and effectiveness of fin.

## C. TEXT BOOKS

1. Kern, D. Q., Process Heat Transfer, McGraw Hill, 1997
2. Dutta, B. K., Heat Transfer – Principles and Applications, PHI, 2004

## D. REFERENCE BOOKS

1. Holman, J. P., Heat Transfer, 9 ed., McGraw Hill, 2008
2. Sinnott, R. K., Coulson & Richardson's Chemical Engineering Design, Vol. 6, Elsevier Butterworth Heinemann,1996
3. Incropera Frank P., Dewitt David P., Bergman T. L., Lavine A. S., Seetharaman K.N., Seetharaman T. R., Fundamentals of Heat and Mass Transfer, Wiley, 2014

## E. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Understand Design Apply Analysis Evaluates Develop | Understand and analyse basic knowledge of heat transfer with the help of science and engineering fundamentals |
| **CO2** | | Design and solve conduction, convection and radiation problems. |
| **CO3** | | Build a bridge between theoretical and practical concept used in industry. |
| **CO4** | | Utilize heat transfer knowledge to design and analyse the performance of heat exchangers and evaporators. |
| **CO5** | | Use the techniques, skills, and modern engineering tools necessary for engineering practice. |
| **CO6** | | Analyse and calculate heat transfer in complex systems involving several heat transfer mechanisms. |

## F. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 2 | 2 | 2 | 3 | 3 | 3 | 2.5 |
| **PO2** | 2 | 3 | 2 | 2 | 3 | 2 | 2.3 |
| **PO3** | 1 | 2 | 2 | 3 | 2 | 3 | 2.2 |
| **PO4** | 2 | 2 | 2 | 3 | 2 | 3 | 2.3 |
| **PO5** | 1 | 2 | 3 | 3 | 3 | 3 | 2.5 |
| **PO6** | 2 | 1 | 3 | 2 | 3 | 2 | 2.2 |
| **PO7** | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| **PO8** | 2 | 1 | 3 | 2 | 3 | 1 | 2 |
| **PO9** | 1 | 2 | 2 | 3 | 2 | 3 | 2.2 |
| **PO10** | 1 | 2 | 2 | 2 | 3 | 2 | 2 |
| **PO11** | 2 | 1 | 2 | 3 | 3 | 3 | 2.3 |
| **PO12** | 3 | 3 | 3 | 3 | 3 | 2 | 2.8 |
| **PSO1** | 3 | 2 | 2 | 3 | 2 | 3 | 2.5 |
| **PSO2** | 3 | 3 | 2 | 3 | 3 | 3 | 2.8 |
| **PSO3** | 2 | 3 | 3 | 2 | 3 | 2 | 2.5 |
| **PSO4** | 3 | 3 | 3 | 2 | 3 | 3 | 2.8 |

# B. TECH. – SEMESTER-III (CH)
# INTRODUCTION TO CHEMICAL ENGINEERING (PCC---)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 2 | 0 | 2 | 4 | 3 | 40 | 0 | 25 | 25 | 90 |

## A. COURSE OVERVIEW

**Motivation:** Learn the basics and fundamentals of chemical engineering to entry level students
**Objective:** Objectives of this course is to understand Fundamental concepts of unit operations and unit processes, interpret data as table versus plot, draw and read PBD and PFD diagrams, apply suitable tools relevant to chemical engineering problems and calculations associated to the physio-chemical properties

## B. COURSE CONTENT

| | TOPICS | Cos |
|---|---|---|
| 1. | **Introduction and fundamentals**<br>About the discipline of chemical engineering, concept of unit operations and unit processes, operations in batch, semi-batch and continuous mode, flow pattern as co-current, counter-current and cross-current, concept of fluid solid contacting using fixed, moving and fluid beds. | **CO1** |
| 2. | **Overview of Chemical Process Industries (CPI)**<br>Satisfactory definition of CPI/GCT, important chemical process industries, its typical raw materials, products and end usages. | **CO2** |
| 3. | **Role of Chemical Engineer**<br>Role of chemical engineer in various aspects such as research, process development, process design & evaluation, plant design, construction (EPC firms), process supervision, plant technical service, product sales, general aspects of chemical engineering such as communication, human relations, professional activities & technical reading. Environmental, safety and ethical aspects associated with chemical engineering profession. | **CO2** |
| 4. | **Flowsheet Drawing**<br>Symbols as per Indian Standards 3232, basics of PBD, PFD and P&ID, systematic analysis of chemical processes by flowsheet reading and drawing. | **CO2**<br>**CO3** |
| 5. | **Useful Mathematical Methods**<br>Presentation of data as table and chart, basics of regression and correlation, linear and polynomial curve fitting using graphical and numerical method, determining goodness of fit (R2 calculation), graphical and numerical methods for interpolation, integration and to find the root of an equation, graphical addition & subtraction of mass (inverse lever arm rule) and calculation of mean values etc. | **CO5** |
| 6. | **Physical and Chemical Principles**<br>Process variables like temperature, pressure, density, viscosity, composition and flow rate. Ideal and real gas calculations and associated laws like Dalton and Amagat. Concept of vapor-liquid equilibria, laws like Raoult's and Henry's, dew and bubble calculations. | **CO4**<br>**CO6** |

## C. TEXT BOOKS

1. Andersen, L. B.; Wenzel, L. A. *Introduction to chemical engineering*; McGraw Hill Book Company, New York, 1961.

## D. REFERENCE BOOKS


1. Ghosal, S. K.; Sanyal S. K.; Datta, S. Introduction to Chemical Engineering; McGraw Hill Education, 1st Ed, 2007
2. Himmelblau, D. M.; Riggs, J. B. Basic Principles and Calculations in Chemical Engineering; PHI Learning PVt Ltd, 7th Ed, 2013


## E. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Conceptual<br>Evaluation<br>Designing<br>Analytical<br>Application<br>Problem solving | Understand the concepts of various unit operation, their mode of operation and applications. |
| **CO2** | | Define chemical process industries, the roles of chemical engineers and their ethical practices. |
| **CO3** | | Systematically analyze the process flow diagrams and piping & instrumentation diagrams of industry. |
| **CO4** | | Estimation of various physico-chemical properties using appropriate mathematical approaches. |
| **CO5** | | Application of computational tools (excel/c programming) to solve problems pertaining to process industries. |
| **CO6** | | Evaluation of problems relevant to ideal and real gases. |

## F. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 3 | 2 | 3 | 3 | 2 | 3 | 2.7 |
| **PO2** | 3 | 2 | 3 | 2 | 2 | 3 | 2.5 |
| **PO3** | 2 | 3 | 2 | 3 | 3 | 3 | 2.7 |
| **PO4** | 2 | 2 | 3 | 3 | 3 | 2 | 2.5 |
| **PO5** | 2 | 2 | 3 | 2 | 3 | 3 | 2.5 |
| **PO6** | 2 | 3 | 2 | 3 | 2 | 3 | 2.5 |
| **PO7** | 3 | 3 | 2 | 2 | 2 | 3 | 2.5 |
| **PO8** | 3 | 3 | 2 | 3 | 2 | 2 | 2.5 |
| **PO9** | 2 | 3 | 2 | 2 | 3 | 3 | 2.5 |
| **PO10** | 2 | 3 | 3 | 2 | 3 | 2 | 2.5 |
| **PO11** | 2 | 3 | 3 | 2 | 3 | 2 | 2.5 |
| **PO12** | 3 | 3 | 3 | 2 | 3 | 3 | 2.8 |
| **PSO1** | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| **PSO2** | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| **PSO3** | 3 | 2 | 3 | 3 | 3 | 3 | 28 |
| **PSO4** | 3 | 2 | 3 | 3 | 3 | 3 | 2.8 |

# B. TECH. – SEMESTER-III (CH)

# MATERIAL AND ENERGY BALANCES (PCC101)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | 0 | 100 |

## A. COURSE OVERVIEW

The basics of units, dimensions, dimensional analysis, and engineering calculations related to unit operations and unit processes. Analysis of chemical processes in steady-state and unsteady- state domain along with mass and energy balance involving scenario of recycle bypass and purge.

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | **Units, Dimensions and Dimensional Analysis**<br>System of units, fundamental & derived units, dimensional consistency, dimensional equations & empirical equations, different ways of expressing units of quantities and physical constants. Conversion of empirical formula from one-unit system to another. Dimensional analysis using Rayleigh and Buckingham method. | **CO1**<br>**CO2** |
| 2. | **Basic Chemical Calculations**<br>Composition of gaseous mixtures, liquid mixtures and solutions. Determination of hardness, elements present in compound, acidity-alkalinity and concentration based numerical. Behavior of real gas and determination of Van-der- Waals constants, and saturation pressure based numerical. | **CO1**<br>**CO2** |
| 3. | **Material Balance without Chemical Reaction**<br>Schematic representation of process, selection of key component and degree of freedom analysis. Material balance over unit operations like distillation, mixing unit, evaporator, absorber, stripper, extractors, crystallizers, dryer, humidifier and dehumidifier. Complex mass balance involving recycle, bypass and purge stream. In addition, mass balance in unsteady state domain over simple unit operation. | **CO3**<br>**CO4**<br>**CO5** |
| 4. | **Material Balance with Chemical Reaction**<br>Concept of limiting & excess reactants, conversion, yield and selectivity, material balance involving reactions with special reference to fertilizers, chlor-alkali, petrochemicals, pharma and dyestuff industry. | **CO3**<br>**CO4**<br>**CO5** |

| | | |
|---|---|---|
| **5.** | **Energy Balance**<br><br>Heat capacity of gas and gaseous mixtures, heat capacity of liquids and solids, sensible heat change in liquids and gases, enthalpy changes during phase change transformation, enthalpy changes accompanied by chemical reactions, thermo chemistry of mixing process, dissolution of liquids and solids, energy balance at plant elevated conditions and adiabatic temperature rise calculations. | **CO3**<br>**CO4**<br>**CO5** |
| **6.** | **Mass and Energy Balance over Flowsheet**<br><br>Mass and energy balance over connected equipment and complete mass and energy balance over at least one process flow sheet from Dryden. Ethics and decision making while performing mass and energy balance over flowsheet. | **CO6** |
| **7.** | **Fuels & Combustion**<br><br>Types of fuels, proximate and ultimate analysis of fuel, calorific value of fuels as gross and net, problems on combustion of coal, liquid fuels, gaseous fuels, sulphur and sulphur pyrites. | **CO1**<br>**CO2** |

## C. TEXT BOOKS


1. Bhatt, B. I., Thakore, S. B.; *Stoichiometry*; 5th Ed.; Tata McGraw Hill Education Pvt. Ltd., 2010.


## D. REFERENCE BOOKS


1. Himmelblau, D. M., Riggs, J. B.; Basic Principles & Calculations in Chemical Engineering; 7th Ed.; Prentice Hall India Learning Pvt. Ltd., 2013
2. Felder, R.M., Rousseau R.W.; Elementary Principles of Chemical Processes; 3rd Ed.; John Wiley & Sons Inc., 2005
3. Watson, K.M., Hougen, O.A., Ragatz, R.A.; Chemical Process Principles Part-I Material and Energy balances; 2nd Ed.; CBS Publishers & Distributors Pvt. Ltd., 2004


## E. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Understand<br>Develop | Understand the basic principles and unit conversion-based calculation techniques used in the chemical industries. |
| **CO2** | Apply | Define and develop analogy for chemical processes in steady- state and unsteady-state domain. |

| | | |
|---|---|---|
| **CO3** | Discuss<br>Evaluate<br>Analyse | Apply the basics of mass and energy balances and their applications in chemical industries by using examples primarily based on chemical operations. |
| **CO4** | | Discuss the possible ways of solving complex mass balance problems involving scenario of recycle, bypass and purge in chemical industries. |
| **CO5** | | Evaluate the energy consumption for both flow and non-flow processes. |
| **CO6** | | Analyse the complete mass and energy balance calculation for the entire chemical process. |

## F. COURSE MATRIX

| | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** | **CO6** | **AVG.** |
|---|---|---|---|---|---|---|---|
| **PO1** | 3 | 3 | 3 | 2 | 2 | 3 | 2.7 |
| **PO2** | 2 | 3 | 3 | 2 | 2 | 2 | 2.3 |
| **PO3** | 2 | 2 | 3 | 2 | 2 | 2 | 2.2 |
| **PO4** | 2 | 2 | 2.5 | 2 | 2 | 2 | 2.1 |
| **PO5** | 2 | 2 | 2 | 2.5 | 2 | 2 | 2.1 |
| **PO6** | 2 | 2.5 | 2 | 2 | 2 | 2 | 2.1 |
| **PO7** | 2 | 2 | 2 | 3 | 2 | 2 | 2.2 |
| **PO8** | 2 | 2 | 2 | 2 | 2 | 2.5 | 2.1 |
| **PO9** | 2 | 2 | 2.5 | 2 | 2 | 2 | 2.1 |
| **PO10** | 2 | 2.5 | 2 | 2 | 2 | 2 | 2.1 |
| **PO11** | 2 | 2 | 2 | 3 | 2 | 2 | 2.2 |
| **PO12** | 3 | 2 | 3 | 2 | 2 | 3 | 2.5 |
| **PSO1** | 2.5 | 2 | 2.5 | 2.5 | 2 | 2.5 | 2.3 |
| **PSO2** | 2.5 | 2.5 | 2 | 2.5 | 2.5 | 2.5 | 2.4 |
| **PSO3** | 2.5 | 2.5 | 2.5 | 2 | 2 | 2.5 | 2.3 |
| **PSO4** | 2.5 | 2 | 2.5 | 2 | 2.5 | 2.5 | 2.3 |

# B. TECH. – SEMESTER-IV (CH)

# MASS TRANSFER-I (PCC105)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | 0 | 100 |

## A. COURSE OVERVIEW

This course will provide an overview of mass transfer operation at basic to an intermediate level.

**Objective:** The purpose of this course is to introduce basic concepts of mass transfer and attain ability to identify, formulate, and solve mass transfer problems. To introduce basic concepts of mass transfer equipment and apply them for designing purpose. The goal is to provide students with the theoretical/analytical background to understand mass transfer operations as well as application and to tackle the sort of complex problems.

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| **1.** | Introduction to Mass Transfer Operations (MTO): Classification, methods of conducting MTO | **CO1** |
| **2.** | Molecular Diffusion in Fluids: Steady state molecular diffusion in fluids (both liquids & gases). Diffusivity of liquids & gases. | **CO1**<br>**CO2** |
| **3.** | Mass Transfer Coefficients: MT coefficients in laminar flow & turbulent flow. Theories of MT, heat, mass & momentum transfer in laminar & turbulent flow & their analogies. Simultaneous heat & mass transfer. Effect of chemical reaction on mass transfer. | **CO1**<br>**CO3** |
| **4.** | Diffusion in Solids: Fick's law. Unsteady state diffusion. Types of solid diffusion | **CO1**<br>**CO2** |
| **5.** | Inter Phase Mass Transfer: Equilibrium, diffusion between phases. Local & overall diffusion. Various processes & material balance for each of them | **CO1**<br>**CO3** |
| **6.** | Equipment for Gas – Liquid Operations: Gas dispersion. Liquid dispersion equipment | **CO4** |
| **7.** | Distillation: VLE data, flash distillation, simple distillation and continuous rectification. McCabe Thiele & Ponchon Savarit methods. Distillation in packed columns & vacuum distillation. Azeotropic distillation. Use of steam. Introduction to multicomponent distillation. Moral issues and ethics | **CO5**<br>**CO6** |

## C. TEXT BOOKS


1. Treybal, R.E. *Mass Transfer Operations*,3rd Ed.; Tata McGraw Hill: New Delhi, 2012

2. McCabe, W.L.; Smith. J.C.; Harriot, P. *Unit Operations in Chemical Engineering*, 4th Ed.; McGraw Hill Publications: NY, 1985

## D. REFERENCE BOOKS

1. Dutta, B. K. *Principles of Mass Transfer and Separation Processes*, 2nd ed.; Prentice Hall of India: New Delhi, 2007

2. Foust, S. *Principles of Unit Operations*, 2nd Ed.; Wiley: New York, 1980

## E. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Explain<br>Analysis Evaluates<br>Application | Explain the basic mechanism of mass transfer including diffusion and convective mass transfer |
| **CO2** | | Estimation of steady state molecular diffusion in fluids (both liquids and gases) |
| **CO3** | | Find the mass transfer coefficient and evaluate the problems related to interphase mass transfer |
| **CO4** | | Identify the equipment for different gas-liquid operations and solve related problems |
| **CO5** | | Generate VLE data and estimate the problems related to design calculation of distillation and absorption column |
| **CO6** | | Develop analytical skill of the students that helps in to solve the problems associated with real situation |

## F. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO2** | 3 | 3 | 3 | 2 | 3 | 2 | 2.7 |
| **PO3** | 3 | 3 | 3 | 2 | 3 | 2 | 2.7 |
| **PO4** | 3 | 3 | 3 | 2 | 2 | 2 | 2.5 |
| **PO5** | 2 | 2 | 3 | 2 | 3 | 2 | 2.3 |
| **PO6** | 2 | 2 | 2 | 2 | 2 | 3 | 2.2 |
| **PO7** | 3 | 2 | 2 | 3 | 3 | 2 | 2.5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO8** | 3 | 2 | 2 | 2 | 3 | 3 | 2.5 |
| **PO9** | 3 | 3 | 3 | 2 | 3 | 3 | 2.8 |
| **PO10** | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| **PO11** | 3 | 3 | 3 | 3 | 3 | 2 | 2.8 |
| **PO12** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO1** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |
| **PSO2** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |
| **PSO3** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |
| **PSO4** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |

# B. TECH. – SEMESTER-V (CH)
# MASS TRANSFER-II (PCC109)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 5.5 | 60 | 40 | 25 | 25 | 150 |

## A. COURSE OVERVIEW

**Motivation:** Study, Design, Operation and Application of various Mass transfer operation and equipments in Chemical Process Industry.

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | **Gas Absorption**<br>Equilibrium solubility of gases in liquids. Concept of idea and non-ideal solution. Material balance for single component transfer in absorption and stripping. Minimum Liquid-gas ratio and its significance. Counter current multi stage operation. Absorption factor and Stripping factor with significance. Solvent Selection Criteria for absorption. Multistage & packed tower operation. Concept of HETP and transfer units. | **CO1**<br>**CO3**<br>**CO5** |
| 2. | **Humidification**<br>VLE and Enthalpy for pure substances. Saturated & Unsaturated vapour–gas mixture and related terminologies such as dry bulb temperature, dew point, wet bulb temperature, percentage & relative saturation, adiabatic saturation temperature, humid heat, humid volume etc. Psychometric Chart in Humidification & dehumidification. Adiabatic saturation curves, wet bulb temperature theory, Lewis's relation Adiabatic & non-adiabatic operations. Types of cooling tower & design. | **CO2**<br>**CO6** |
| 3. | **Liquid-Liquid Extraction**<br>Equilibrium in extraction. Ternary diagram & tie line data. System of three liquids-one pair & two pairs partially soluble. Single stage & multistage extraction, Co-current and cross current extraction, Continuous counter current multistage extraction with and without reflux, Theory & performance of continuous contact equipments, Single stage & multistage equipments | **CO2**<br>**CO4**<br>**CO5** |
| 4. | **Adsorption & Ion Exchange**<br>Adsorption, Definition and industrial application. Types of adsorption & most commonly used adsorbents. Adsorption Equilibria & hysteresis, Effect of temperature on adsorption & Heat of adsorption. Adsorption of solute from dilute liquid Material balance and Freundlich's equation for single stage operation and multistage cross-current operation, counter current operation, Equipments for adsorption. Ion-Exchange Principles, Applications, Equilibria and Rate of ion-exchange | **CO2** |
| 5. | **Drying**<br>Equilibrium in drying. Batch drying & its mechanism, Continuous drying. Various types of moisture in drying. Rate of drying & time of drying. Cross-circulation drying. Batch & continuous drying equipments-Tray dryer, Tunnel dryer, Rotary dryers, Spray dryers, Fluidized bed dryer, etc | **CO5**<br>**CO6** |
| 6. | **Leaching**<br>Steady state and unsteady state leaching operations. Single stage leaching. Multistage cross current and counter current leaching. Rate of leaching. Application of leaching. | **CO6** |

| | | |
|---|---|---|
| | Leaching equipments | |
| **7.** | **Crystallization**<br>Principle of crystallization. Saturation & methods of saturation. Nucleation & Crystal Growth. Crystallization rate, Equilibria and yields. Caking of crystals, Application of crystallization, Crystallization equipments, Crystallization from melts | **CO1**<br>**CO2** |
| **8.** | **Introduction to Novel Separation Techniques**<br>Types of Novell Séparation techniques. Membrane Séparation processes like Ultra filtration, Nano filtration, Reverse Osmosis etc. | **CO1** |

## C. TEXT BOOKS

1. *Treybal, R.E. Mass Transfer Operations,3rdEd.; Tata McGraw Hill:New Delhi, 2012*
2. *McCabe, W.L.;Smith. J.C.; Harriot, P. Unit Operations in Chemical Engineering, 4th Ed.; McGraw Hill Publications: NY, 1985*

## D. REFERENCE BOOKS

1. Dutta, B.K. *Principles of Mass Transfer and Separation Processes*, 2nd Ed.; Prentice Hall of India: 2007
2. Foust, S. *Principles of Unit Operations*, 2nd Ed.; Wiley: New York, 1980

## E. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Understand<br>Relate<br>Design Optimize<br>Application<br>Develop | **Understand** how to use the basic fundamentals of Mass transfer in designing the unit operation equipments. |
| **CO2** | | **Relate** the theoretical fundamentals with practical aspects to improve the performance. |
| **CO3** | | **Design** (process) all Mass transfer equipments. |
| **CO4** | | **Optimize** the process and design parameters related to mass transfer equipments. |
| **CO5** | | **Apply** the design simulation tools to optimize the real process. |
| **CO6** | | **Develop** analytical skill of the students that helps in to solve the problems associated with real situation. |

## F. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 3 | 3 | 3 | 3 | 3 | 2 | 2.8 |
| **PO2** | 3 | 3 | 3 | 3 | 2 | 2 | 2.5 |
| **PO3** | 3 | 2 | 3 | 2 | 2 | 2 | 2.3 |
| **PO4** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO5** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO6** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO7** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO8** | 3 | 2 | 3 | 2 | 3 | 3 | 2.7 |
| **PO9** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO10** | 3 | 3 | 3 | 2 | 2 | 2 | 2.5 |
| **PO11** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO12** | 3 | 3 | 3 | 2 | 2 | 2 | 2.5 |
| **PSO1** | 3 | 3 | 3 | 2 | 3 | 3 | 2.8 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PSO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO4** | 3 | 3 | 3 | 3 | 3 | 2 | 2.8 |

# B. TECH. – SEMESTER-V (CH)

# NUMERICAL TECHNIQUES IN CHEMICAL ENGINEERING (PCC107)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

## A. COURSE OVERVIEW

Numerical solutions of various mathematical models describing steady state and dynamic behaviors of Chemical Process Systems and parameter estimation using numerical methods in Chemical Engineering.

**Objectives:** To introduce students to numerical methods used for solving engineering problems, in particular chemical engineering problems, using numerical methods and computer programming. Fundamentals of numerical methods/algorithms to solve systems of different mathematical equations (e.g. linear/nonlinear algebraic equations, ordinary / partial differential equations) will be introduced. The course would enable students to write their own computer programs using programming languages like C/C++ and commercial software like MATLAB. Hands-on experience will be provided to apply these computer programs to solve problems in different areas of chemical engineering, e.g. fluid flow, heat and mass transfer, chemical reaction engineering etc. Practical are involved for solving actual chemical engineering problems through computer programming and coding.

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | **Basics of Vectors, Scalars and matrix algebra**<br>Addition/subtraction, multiplication/division of vectors, matrix multiplication, inverse of matrix, determinant and rank of matrix, eigen values, sparse matrices, Use of MATLAB for matrix algebra, approximation and concept of error and error analysis | **CO1 CO3** |
| 2. | **Numerical methods for linear algebraic equations**<br>Gauss elimination method, Gauss-Jordan method, Jacobi method, Successive – over relaxation method, tri-diagonal matrix, MATLAB programming | **CO1 To CO3** |
| 3. | **Numerical methods for nonlinear algebraic equation**<br>Successive substitution method, Newton-Raphson method, Secant method, False position method, single variable and multivariable case studies, MATLAB functions for nonlinear algebraic equations | **CO1 To CO5** |
| 4. | **Eigen Value Problems**<br>Eigen value analysis of linear and nonlinear systems and solution of homogeneous equations using eigen values | **CO1 To CO3** |
| 5. | **Regression, interpolation, curve fitting, numerical integration** | **CO1** |

| | | |
|---|---|---|
| | Simple interpolation, Lagrange's interpolation, Newton's interpolation, Simpson's rule, trapezoid method, linear regression, polynomial regression, exponential and power regression, MATLAB routines and commands | **To CO3** |
| **6.** | **Numerical methods for IVP and BVP ordinary differential equations** | **CO1** |
| | Explicit and implicit ODEs, Euler's explicit and implicit methods, explicit Adams-Bashforth methods, implicit Adams-Mouton methods, Predictor – corrector methods, Runge-Kutta methods, MATLAB solvers for ODEs, Finite difference, Orthogonal collocation and Orthogonal collocation on finite-element methods for ODE-BVP, Shooting Methods for solving BVP | **To CO6** |
| **7.** | **Numerical methods for Partial differential equations** | **CO1** |
| | Steady state and dynamic PDES, method of lines, Crank-Nicholson method, finite-difference, Orthogonal collocation and orthogonal collocation on finite element method | **To CO6** |

## C. PRACTICAL AND TERM WORK

Simulation experiments are designed to use MATLAB software for solving linear/nonlinear algebraic equations for steady state problems in Chemical Engineering and for solving dynamic problems in Chemical Engineering. Simulation experiments for parameter estimation problems in chemical engineering systems are also designed

## D. TEXT BOOKS


1. Gupta, S. K. Numerical Methods for Engineers, 3rd ed.; New Age International Publishers: New Delhi, 2015
2. Chapra, S. C. Applied Numerical Methods with MATLAB for Engineers and Scientist, 3rd ed.; McGraw-Hill: New York, 2012


## E. REFERENCE BOOKS


1. Beers, K J. *Numerical Methods for Chemical Engineering Applications in MATLAB*, Cambridge University Press: UK, 2006
2. Constantinides, A.; Mostoufi, N. *Numerical Methods for Chemical Engineers with MATLAB Applications*, Prentice Hall International Series: New Jercy, 1999


## F. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Understanding<br>Analysing<br>Applying<br>Evaluating<br>Creating | **Remember** and **understand** the various numerical methods to solve various linear and nonlinear steady state and dynamic problems in chemical engineering systems described by ODE,<br><br>PDE, AE and NAE |

| | | |
|---|---|---|
| **CO2** | Remembering Evaluating | Carry out the **error analysis** in the numerical solutions of chemical engineering problems |
| **CO3** | | **Apply** linear algebraic equation solution techniques and nonlinear algebraic equation techniques for solving steady states of chemical engineering systems. Use MATLAB to **implement** numerical methods in simulations. |
| **CO4** | | **Do** critical evaluation of the performance of various numerical methods using simulations for solving chemical engineering problems. |
| **CO5** | | **Develop** MATLAB codes for various numerical methods |
| **CO6** | | **Generate** a MATLAB program for industrial application to carry out steady state and dynamics analysis. |

## G. COURSE MATRIX

| | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** | **CO6** | **AVG.** |
|---|---|---|---|---|---|---|---|
| **PO1** | 2 | 2 | 2 | 3 | 2 | 3 | 2.3 |
| **PO2** | 1 | 1 | 3 | 3 | 3 | 3 | 2.3 |
| **PO3** | 1 | 2 | 3 | 3 | 3 | 3 | 2.5 |
| **PO4** | 1 | 1 | 2 | 3 | 2 | 3 | 2 |
| **PO5** | 0 | 0 | 2 | 3 | 3 | 3 | 1.8 |
| **PO6** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |
| **PO7** | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| **PO8** | 1 | 1 | 2 | 2 | 2 | 3 | 1.8 |
| **PO9** | 2 | 2 | 3 | 2 | 3 | 3 | 2.5 |
| **PO10** | 1 | 2 | 3 | 2 | 2 | 3 | 2.2 |
| **PO11** | 2 | 3 | 3 | 2 | 2 | 3 | 2.5 |
| **PO12** | 3 | 3 | 3 | 2 | 3 | 3 | 2.8 |
| **PSO1** | 2 | 3 | 3 | 3 | 2 | 3 | 2.67 |
| **PSO2** | 3 | 3 | 3 | 2 | 3 | 2 | 2.67 |
| **PSO3** | 2 | 3 | 2 | 2 | 2 | 2 | 2.17 |
| **PSO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

# B. TECH. – SEMESTER-VI (CH)

# PROCESS EQUIPMENT DESIGN AND DRAWING (PCC---)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 0 | 3 | 6 | 4.5 | 60 | 40 | 25 | 25 | 150 |

## A. COURSE OVERVIEW

Design and fabrication of components of Industrial Chemical Vessels under various operating conditions

**Objectives:** The main objective of the course is to carry out mechanical design of Process Equipment in chemical process industries. The subject deals with introduction to Mechanical properties of Material of constructions and its selection for fabrication of vessels. The design of process vessel is done for Unfired Pressure vessels. The course focuses on designing main components of pressure vessel. It also deals with designing special components of pressure vessel for particular vessel as per their functions.

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | **Introduction**<br>● Introduction to design and drawing.<br>● Basic considerations in mechanical design of process equipment.<br>● Concept of pressure vessel, definition and type, selection of type of vessel.<br>● Methods of fabrication of vessel, economic consideration. | **CO1**<br>**CO3** |
| 2. | **Vessel Design**<br>● Selection Criteria for vessel design.<br>● Design Preliminaries like excessive allowable stress, design stress, factor of safety, Poisson's ratio, elastic deformation, plastic instability, brittle rupture, creep, thickness of vessel wall.<br>● Introduction to vessel codes and standards. | **CO1**<br>**CO2**<br>**CO3** |
| 3. | **Vessels under Internal Pressure**<br>● Design of pressure vessels under internal pressure<br>● Design of wall thickness based on Lame theorem and membrane stress theory<br>● Types of closers for pressure vessel, design thickness of closer<br>● Selection and Design of nozzles and reinforcement pads<br>● Introduction to flanges and gasket, types and selection, design of flanges for pressure vessels. | **CO2**<br>**CO3**<br>**CO4**<br>**CO5** |
| 4. | **Vessels under External Pressure**<br>● Industrial pressure vessels under external pressure<br>● Design of vessel wall in presence and absence of stiffeners using analytical & graphical methods | **CO2**<br>**CO3**<br>**CO4**<br>**CO5** |

| | | |
|---|---|---|
| | • Design of circumferential stiffeners<br>• Design of closers subjected to external pressure. | **CO6** |
| **5.** | **Reaction vessels**<br>• Introduction to various components of reaction vessel<br>• Selection and design of various jackets and Coil<br>Selection and design of Agitators based on torque, moment and critical speed. | **CO3**<br>**CO4**<br>**CO5**<br>**CO6** |
| **6.** | **Storage Vessels**<br>• Identification for storage for non-volatile & volatile liquids, storage of gases<br>• Types & constructional features of storage vessels<br>• Rectangular storage tank design<br>• Design of cylindrical storage tank, course to course calculation of wall thickness, bottom design, roof design | **CO3**<br>**CO4**<br>**CO5**<br>**CO6** |
| **7.** | **Design of Tall Columns**<br>• Industrial requirement of tall vessels<br>• Construction & features in column stress & determination of shell thickness | **CO3**<br>**CO4**<br>**CO5**<br>**CO6** |
| **8.** | **High Pressure Vessel**<br>• Types of high-pressure vessel<br>• Design of high-pressure vessel<br>• Construction features, materials for high pressure shell design, vessel closures | **CO3**<br>**CO4**<br>**CO5**<br>**CO6** |
| **9.** | **Design of Heat Exchanger**<br>• Basic introduction to heat exchanger and selection of heat exchanger,<br>• Fluid allocation in heat exchanger,<br>• process design of various components like tube, baffles, shell etc and<br>• Mechanical design of shell and tube heat exchanger based on TEMA class.<br>Pressure drop on shell side and tube side in heat exchanger. | **CO3**<br>**CO4**<br>**CO5**<br>**CO6** |
| **10.** | **Supports for Vessels**<br>Selection and design of different types – bracket or lug support, skirt support & saddle support, design calculations | **CO3**<br>**CO4**<br>**CO5**<br>**CO6** |

## C. PRACTICAL AND TERM WORK

Students are Divided in to two groups, one of the groups will go to computer centre, where they will use excel to carry out design of pressure vessel and its components based on theory class, whereas second group will go to drawing hall, where they will draw the pressure vessel components, they designed in computer centre with dimensions. They will be judged based on both design and drawing, as the title of subject emphasis on both.

## D. TEXT BOOKS

1. Umarji, S. B.; Mahajani, V.V. *Joshi's Process Equipment Design*; 5th ed.; Trinity Press: New Delhi, 2016

2. Brownel, L. E.; Young, E. H. *Process Equipment Design & Drawing*; 2nd ed.; Wiley Eastern Ltd.: New Delhi, 2005

## E. REFERENCE BOOKS

1. Bhattacharya, B.C. *Process Equipment Design: Mechanical Aspect*; 1st ed.; CBS Publisher and Distributors Pvt. Ltd.: New Delhi, 2014

2. Bhattacharya, B.C.; Narayanan, C.M. *Computer Aided Process Equipment Design*; 1st ed.; New Central Book agency (p) ltd.: Kolkata, 1992

## F. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Understanding<br>Analysing<br>Applying<br>Evaluating<br>Creating<br>Remembering<br>Evaluating | **Understand and state** the process condition and **Interpret** Process Flow Diagram |
| **CO2** | | **Classify** the type of Pressure Vessels along with all its components |
| **CO3** | | **Implementing** Codes and Standards to **Design** of Pressure Vessels and its components |
| **CO4** | | **Critiquing** Real life Industrial Problem and **Implement** solution Methodology for optimum Design |
| **CO5** | | **Organize** a trouble shoot path using various tools for betterment of society |
| **CO6** | | **Generate** a detail design report along with drawing to **plan** the fabrication of pressure vessel |

## G. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 2 | 2 | 2 | 3 | 2 | 3 | 2.3 |
| **PO2** | 1 | 1 | 3 | 3 | 3 | 3 | 2.3 |
| **PO3** | 1 | 2 | 3 | 3 | 3 | 3 | 2.5 |
| **PO4** | 1 | 1 | 2 | 3 | 2 | 3 | 2 |
| **PO5** | 0 | 0 | 2 | 3 | 3 | 3 | 1.8 |
| **PO6** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |
| **PO7** | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| **PO8** | 1 | 1 | 2 | 2 | 2 | 3 | 1.8 |
| **PO9** | 2 | 2 | 3 | 2 | 3 | 3 | 2.5 |
| **PO10** | 1 | 2 | 3 | 2 | 2 | 3 | 2.2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO11** | 2 | 3 | 3 | 2 | 2 | 3 | 2.5 |
| **PO12** | 3 | 3 | 3 | 2 | 3 | 3 | 2.8 |
| **PSO1** | 2 | 3 | 3 | 3 | 2 | 3 | 2.67 |
| **PSO2** | 3 | 3 | 3 | 2 | 3 | 2 | 2.67 |
| **PSO3** | 2 | 3 | 2 | 2 | 2 | 2 | 2.17 |
| **PSO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

# B. TECH. – SEMESTER-IV (CH)
# PARTICLES AND FLUID PARTICLE PROCESSING (PCC111)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | | Ext | S | TW | P | Total |
| 3 | 0 | 3 | 6 | 4.5 | 60 | 40 | 25 | 25 | 150 |

## A. COURSE OVERVIEW

**Motivation:** Describe basic concept of Mechanical Operations and troubleshooting of Industrial equipments for sustainable development of process industries.

**Objectives**: To develop basic concept of properties of particle and mixture along with its storage and transportation. Students are able understand of various mechanical operations like Screening, Size reduction & Enlargement, Filtration, Sedimentation, Agitation and Mixing used in Chemical Process Industries. The students are exposed to fundamental theory, calculations, and various types of equipment used in Chemical Process Industries related to Mechanical Operations.

## B. COURSE CONTENT

| | TOPICS | COs |
|---|---|---|
| 1. | **Solids**<br>● Introduction to solid particles<br>● Characteristics of solid particles and Concept of Sphericity<br>● Properties of mixture<br>● Introduction to nanoparticles properties & characterization | **CO1**<br>**CO2**<br>**CO5** |
| 2. | **Size Reduction & Enlargement**<br>● Principle of comminution, Types of crushers, grinders & disintegrators for coarse and intermediate & fine grinding<br>● Energy & power requirement for size reduction, laws of crushers & work index, close & open circuit grinding, feed control, mill discharge and removal & supply of heat in wet grinding<br>● Size enlargement– objectives, methods and equipment used in industries | **CO1**<br>**CO2**<br>**CO4** |
| 3. | **Screening & Other Separation Methods**<br>● Screen Terminology and various screen series and Differential and cumulative method of screen analysis<br>● Types of Industrial screen, comparison of ideal & actual screens and capacity & effectiveness of screens<br>● Principle of elutriation, floatation, jigging and electrostatic & magnetic separation processes | **CO2**<br>**CO3** |
| 4. | **Sedimentation**<br>● Concept of sedimentation, terminal settling velocity, batch settling test and free & hindered settling<br>● Flocculation, types of thickener & thickener area calculation, batch & continuous settling chambers and sorting of classifiers<br>● Centrifugal settling process, cyclone and principle of centrifugal sedimentation | **CO2**<br>**CO4** |
| 5. | **Filtration**<br>● Types of filtration, requirements of filter media and filter aids<br>● Principle of cake filtration, constant pressure filtration, batch & continuous filtration equipments – filter press, leaf filter, cartridge filter & rotary drum filter<br>● Theories of filtration, washing of cake, principle of centrifugal filtration and | **CO2**<br>**CO3**<br>**CO4** |

| | | |
|---|---|---|
| | suspended basket centrifuge, etc. | |
| **6.** | **Mixing & Agitation**<br>● Fundamentals of mixing & agitation, purpose of agitation and standard agitated vessel<br>● Types of impellers, vortex formation in agitated vessel, power consumption in agitated vessels, scale of agitated vessel and power consumption<br>● Characteristics of mixing equipment, mixing of pastes & paste masses, pony mixers, beater mixer, mixing of dry powder, ribbon blender & tumbler mixer etc | **CO3**<br>**CO4**<br>**CO5** |
| **7.** | **Storage and Conveying**<br>● Storage of solid, liquid and gases and types of storage vessels<br>● Types of flow in solid discharge and various problems<br>● Types of Mechanical & pneumatic conveying system | **CO4**<br>**CO6** |
| **8.** | **Ethics**<br>Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice | **CO1**<br>**CO5**<br>**CO6** |

## C. PRACTICAL AND TERM WORK

1. Experiments based on screening, screen efficiency, Size Reduction such as- Jaw crusher, Roll crusher and Ball mill
2. Sedimentation, filtration, Agitated vessel and Terminal settling velocity etc

## D. TEXT BOOKS

1. McCabe, L. W.;Smith, J.C.;Peter,H.*Unit Operations of Chemical Engineering;* 7th ed; Tata Mc-Graw Hill Publication:New Delhi, 2017
2. Narayanan, C.M.;Bhattacharyya, B.C. *Mechanical Operations for Chemical Engineers;* 3rd ed; Khanna Publishers: New Delhi,2014

## E. REFERENCE BOOKS

1. Harker, J.H.; Backhurst, J.R. *Richardson, Coulson & Richardson's Chemical Engineering Volume 2*; 5th ed; Butterworth-Heinemann: Oxford Woburn MA,2002
2. Badger, L.W.; Banchero, J. *Introduction to Chemical Engineering*; McGraw Hill: Singapore,1984

## F. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Understand<br>Analysing<br>Synthesis<br>Evaluating<br>Applying<br>Creating | **Describe** basic concept of Mechanical Operations used in chemical process industries |
| **CO2** | | **Classify and Explain** solid-solid, solid-fluid related operations |
| **CO3** | | **Identify** methods for measuring performance of equipments |
| **CO4** | | **Examine** the factors affecting on solid handling related operations with respects to the sustainable development of process industries |
| **CO5** | | **Experiment** related to various mechanical operations equipments during laboratory work including demonstration of advance instruments like particle size analyser and XRD |
| **CO6** | | **Generating** reports for selection, Design and troubleshooting of Industrial equipments |

## G. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PO2** | 3 | 3 | 3 | 3 | 2 | 3 | 2.8 |
| **PO3** | 3 | 3 | 3 | 2 | 3 | 2 | 2.7 |
| **PO4** | 3 | 3 | 3 | 2 | 2 | 2 | 2.5 |
| **PO5** | 2 | 1 | 2 | 2 | 3 | 2 | 2 |
| **PO6** | 2 | 2 | 2 | 3 | 3 | 3 | 2.5 |
| **PO7** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |
| **PO8** | 3 | 2 | 2 | 2 | 3 | 3 | 2.5 |
| **PO9** | 2 | 2 | 2 | 2 | 3 | 3 | 2.3 |
| **PO10** | 2 | 2 | 2 | 3 | 3 | 3 | 2.5 |
| **PO11** | 3 | 3 | 2 | 3 | 3 | 3 | 2.8 |
| **PO12** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **PSO1** | 3 | 2 | 3 | 3 | 3 | 3 | 2.8 |
| **PSO2** | 2 | 3 | 3 | 3 | 2 | 3 | 2.7 |
| **PSO3** | 3 | 3 | 3 | 2 | 3 | 2 | 2.7 |
| **PSO4** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |

## B. TECH. SEMESTER – IV (CH)
## SUBJECT: THERMODYNAMICS-II

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | 0 | 100 |

## A. COURSE OVERVIEW

Most of the separations in chemical process industries are equilibrium based which includes vapor-liquid(VLE), liquid-liquid(LLE), vapor-liquid-liquid(VLLE), solid-liquid(SLE) at equilibrium. This course encompasses the study of key thermodynamic properties at macroscopic level to handle such equilibrium cases and explore possible ways of solving problems associated with non-idealities in VLE, LLE, VLLE, SLE & reaction equilibria for multicomponent mixtures. These concepts will be applied in understanding several important industrial applications. Apart from this, the need of statistical thermodynamics & laws of thermodynamics will be studied at molecular level.

## B. COURSE CONTENT [Total 60 hrs]

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **Systems of Variable Composition. Ideal behavior**<br>Review of first and second law of thermodynamics, concept of chemical potential, Concept of equilibrium, Chemical Potential as a Criterion of phase equilibrium, Property changes for mixing of ideal gas mixtures and ideal solution, Raoult's law and its applications, Binary phase diagrams and problems. | 12 | CO1<br>CO2 |
| [2] | **Introduction to Solution Thermodynamics**<br>Concept of partial properties, definition of fugacity and fugacity coefficient of pure species and species in solution, Vapor Liquid Equilibrium(VLE), VLE by modified Raoult's law, VLE from K-value correlations, Flash Calculations, Positive & negative deviations from Raoult's law. | 16 | CO2<br>CO3 |
| [3] | **Phase Equilibria**<br>Phase rule, Duhem's theorem, Gibb's – Duhem equation, Definition of activity & activity coefficient, Lewis – Randall rule and Henry's law, excess properties, Models for excess Gibbs energy (Activity models) such as Redlich-kister equation, Wohl's equation, Van Laar equation, Margule's equation, Wilson equation, NRTL, UNIQUAC & UNIFAC, Thermodynamic consistency test for VLE data, Heat effects and property change of mixing processes, Liquid-Liquid Equilibria; Vapor-Liquid-Liquid Equilibria; Solid-Liquid Equilibria; Solid-Gas Equilibria, Ethics concern with VLE data. | 16 | CO3<br>CO4<br>CO5 |
| [4] | **Introduction to Chemical Reaction Equilibria**<br>Equilibrium criterion for a chemical reaction, concept of Equilibrium conversion (x), equilibrium constant (k), evaluation of equilibrium constants at different temperatures, equilibrium conversion of single reactions and multireaction equilibria, Phase rule for chemically reacting systems. | 10 | CO5 |
| [5] | **Introduction to Statistical Thermodynamics**<br>Probability theory, Different thermodynamic distributions- Boltzmann, Bose – Einstein & Fermi-Dirac, Laws of thermodynamics & their applications, Properties of elementary particles. | 06 | CO6 |

## C. TEXT BOOKS

1. Smith, J. M.; Van Ness, H. C. Introduction to Chemical Engineering Thermodynamics; Fourth Edition, McGraw Hill Book Company: Singapore, 1987.
2. Sonntag, R. E. & Van Wylen, Gordon J. Fundamentals of Statistical Thermodynamics; First Edition, John Wiley & Sons: United States of America, 1968.

## D. REFERENCE BOOKS

1. Narayan, K. V. A Textbook of Chemical Engineering Thermodynamics; Second Edition, PHI Learning Private Limited: Delhi, 2013.
2. Rao, Y.V.C. Chemical Engineering Thermodynamics; First Edition, Universities Press India Private Limited: Hyderabad, 1997.
3. S. Sandler, "Chemical, Biochemical and Engineering Thermodynamics",4th edition, Wiley, India.
4. Elliot, J.E.; Lira C.T. Introductory Chemical Engineering Thermodynamics; Second Edition, Pearson Education publishing as Prentice Hall: South Africa, 2012.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remembering<br>Understanding<br>Applying<br>Analysing<br>Evaluating<br>Creating | Recall the laws of thermodynamics & Understand relationship between the fundamental thermodynamic properties. |
| CO2 | | Discuss the thermodynamic properties for multiphase & multicomponent mixtures for the equilibrium separation processes. |
| CO3 | | Solve numerical problems involving equilibria of different phases such as VLE, LLE, VLLE, SLE, SVE as well as reaction equilibria. |
| CO4 | | Analyze the experimental VLE data and estimate the VLE data using activity models. |
| CO5 | | Selection of appropriate thermodynamic models to estimate the properties for mixtures involving equilibria of different phases as well as for reactions. |
| CO6 | | Introduce the different theoretical approaches to statistical thermodynamics. |

## F. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| PO1 | 2 | 3 | 3 | 3 | 3 | 2 | 2.7 |
| PO2 | 3 | 3 | 3 | 3 | 3 | 2 | 2.8 |
| PO3 | 2 | 3 | 3 | 3 | 3 | 2 | 2.7 |
| PO4 | 3 | 2 | 3 | 3 | 3 | 2 | 2.7 |
| PO5 | 3 | 2 | 3 | 3 | 3 | 3 | 2.8 |
| PO6 | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| PO7 | 3 | 3 | 3 | 3 | 3 | 2 | 2.8 |
| PO8 | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| PO9 | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| PO10 | 2 | 3 | 3 | 3 | 3 | 2 | 2.7 |
| PO11 | 3 | 2 | 3 | 3 | 3 | 2 | 2.7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO12** | 3 | 2 | 3 | 3 | 3 | 2 | 2.7 |
| **PSO1** | 2 | 3 | 3 | 3 | 3 | 2 | 2.7 |
| **PSO2** | 2 | 3 | 3 | 3 | 3 | 2 | 2.7 |
| **PSO3** | 2 | 3 | 3 | 3 | 3 | 2 | 2.7 |
| **PSO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

# M. TECH. – SEMESTER-I
# ADVANCED CHEMICAL REACTION ENGINEERING (MC142)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | P | TW | Total |
| 3 | 1 | 0 | 4 | 60 | 40 | 0 | 50 | 150 |

## A. COURSE OVERVIEW

Non-isothermal reactor design under steady state and unsteady state conditions, non-ideal flow modelling in real reactors, catalytic and non-catalytic heterogeneous reactions and reactor design, application of MATLAB for solving reaction engineering problems.

**Objectives:**

To introduce students to advanced topics of chemical reaction engineering, such as non-isothermal reactor design, multi-phase reactions and reactor design, catalytic reactions and reactor design and application of software for solving the associated problems of advanced topics of chemical reaction engineering

## B. DETAILED SYLLABUS

| | TOPICS | COs |
|---|---|---|
| 1. | Non-isothermal reactor design<br>Energy balance for CSTR/PFR/Batch reactor under adiabatic and non- adiabatic conditions, multiple steady states in CSTR/PFR, use of MATLAB for design/analysis of non-isothermal reactors. | CO1 to CO6 |
| 2. | Non-ideal flow and mathematical modeling<br>Zero parameter, one parameter and two parameter modeling of non-ideal flow in reactors | CO1 to CO6 |
| 3. | Fluid-fluid heterogeneous reactor design<br>Gas-liquid and liquid-liquid heterogeneous reactions, mathematical models, reactor design for fluid-fluid heterogeneous reactions | CO1 to CO6 |
| 4. | Fluid-solid heterogeneous reactor design<br>Gas-solid and liquid-solid heterogeneous reactions, mathematicalmodels, reactor design for fluid-solid heterogeneous reactions | CO1 to CO6 |
| 5. | Catalytic reactors<br>Solid catalyzed reactions and reactor design, mathematical models andreactor design | CO1 to CO6 |

## C. SEMINAR AND TERM WORK

A seminar topic of relevance to advanced reaction engineering is assigned to the student that may involve simulation and students are supposed to present the seminar work and submit theseminar project at the end the semester

## D. TEXT BOOK

1. Levenspiel, O., Chemical Reaction Engineering, 3rd edition, Wiley Eastern Pvt. Ltd

2. Fogler, H. S., Elements of Chemical Reaction Engineering, Prentice-Hall.

## E. REFERENCE BOOK

1. Smith, J. M., Chemical Engineering Kinetics, 3rd Edition, Mc-Graw Hill Publication

## F. COURSE OUTCOME

| COs | Skills | Statement |
|---|---|---|
| CO1 | Understanding | Remember and understand the non-isothermal reactor design, non-ideal flow modeling, heterogeneous catalytic and non-catalytic reactions and reactor design |
| CO2 | Analyzing | Carry out the analysis of non-isothermal reactors and heterogeneous reactors |
| CO3 | Applying | Apply software such as MATLAB, for design and analysis of non-isothermal reactors and heterogeneous reactors. |
| CO4 | Evaluating | Do critical evaluation of the non-isothermal reactors and heterogeneousreactors performances using simulations. |
| CO5 | Creating | Design reactors for non-isothermal conditions and for heterogeneousreactions |
| CO6 | Remembering evaluating | Generate a MATLAB program for industrial application to carry out steady state and dynamics analysis of non-isothermal reactors and heterogeneous reactors |

## G. COURSE OUTCOME

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | Avg |
|---|---|---|---|---|---|---|---|
| **PO1** | 2 | 2 | 2 | 3 | 2 | 3 | 2.3 |
| **PO2** | 1 | 1 | 3 | 3 | 3 | 3 | 2.3 |
| **PO3** | 1 | 2 | 3 | 3 | 3 | 3 | 2.5 |
| **PO4** | 1 | 1 | 2 | 3 | 2 | 3 | 2 |
| **PO5** | 0 | 0 | 2 | 3 | 3 | 3 | 1.8 |
| **PO6** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |
| **PO7** | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| **PO8** | 1 | 1 | 2 | 2 | 2 | 3 | 1.8 |
| **PO9** | 2 | 2 | 3 | 2 | 3 | 3 | 2.5 |
| **PO10** | 1 | 2 | 3 | 2 | 2 | 3 | 2.2 |
| **PO11** | 2 | 3 | 3 | 2 | 2 | 3 | 2.5 |
| **PO12** | 3 | 3 | 3 | 2 | 3 | 3 | 2.8 |
| **PSO 1** | 3 | 3 | 3 | 3 | 2 | 2 | 2.67 |
| **PSO 2** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PSO 3** | 3 | 3 | 3 | 3 | 2 | 2 | 2.67 |
| **PSO4** | 3 | 3 | 3 | 3 | 2 | 2 | 2.67 |

# M. TECH. – SEMESTER-I
# ADVANCED TRANSPORT PHENOMENA (MC141)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | P | TW | Total |
| 3 | 1 | 0 | 4 | 60 | 40 | 0 | 50 | 150 |

## A. COURSE OVERVIEW

**Motivation:** Transport phenomena is the subject which deals with the different transport processes such as momentum, energy and mass, ubiquitous in industry as well as in nature.

**Objectives:**

- To acquire knowledge on momentum, heat and mass transfer in Chemical engineering systems and their analogous behavior.
- Momentum, heat and mass transfer are taught together due to the underlying similarities ofthe mathematics tools and molecular mechanisms describing such processes.
- The students will be made aware of the core scientific connections and will be encouraged to solve problems based on relevant analogies

**Learning Outcomes:** On successful completion of course, students will be able to -

- Identify transport properties and analyze the mechanism of momentum, energy and mass transport.
- Apply conservation laws to formulate differential form of equations of change for mass, momentum and heat transfer problems.
- Solve linear partial differential equations along with appropriate boundary conditions to get the velocity, temperature and concentration profiles of different engineering problems.
- Recognize non-Newtonian fluids and apply appropriate models to solve them

## B. DETAILED SYLLABUS

| | TOPICS |
|---|---|
| 1. | **Transport by Molecular motion -** Momentum, energy and mass transport by molecular level |
| 2. | **Transport in turbulent flow and eddy transport properties** – Turbulent momentum, energy and mass transport |
| 3. | **Transport across the phase boundaries -** Friction factor, Heat transfer co-efficient and mass transfer co-efficient with use of empirical correlation |
| 4. | **Transport in large system -** Macroscopic balance in pieces of equipment or parts thereof for isothermal, non-isothermal and mixtures |
| 5. | **Transport by other mechanism -** Momentum transport in polymeric liquid, Energy transport by radiation and mass transport in multi component system. |

## C. TEXT BOOK

1. Bird R B, Stewart W E and Light fort R N, “Transport Phenomena”, John Wiley and Sons (2002)

## D. REFERENCE BOOK

1. Welty J R , Wilson R E and Wicks C E , “Fundamentals of Momentum , Heat and Mass Transfer”, 4th ed, John Wiley and Sons (2001).

2. John C Slattery, “Momentum, Energy and Mass transfer in continua”, McGraw Hill, Co. (1972)
3. Bennet C U and Myers J E, “Momentum, Heat and Mass Transfer” Tata McGraw Hill Publishing Co. (1975)
4. Robert S Brodkey and Harry C Hersing, “Transport Phenomena a Unified approach” McGraw Hill Book Co. (1988)

## E. COURSE OUTCOMES

| COs | SKILLS | STATEMENT |
|---|---|---|
| **CO1** | Evaluate<br>Comprehension<br>Application<br>Synthesis<br>Analysis | Identify and Evaluate mechanisms of transport phenomena, present in given isothermal and non-isothermal turbulent flow systems. |
| **CO2** | | Synthesize interrelations between the molecular, microscopic and macroscopic descriptions of transport phenomena. |
| **CO3** | | Explain similarities and differences between the descriptions of the combined fluxes and the equations of change for mass, momentum and heat transport. |
| **CO4** | | Apply the method of dimensional analysis to reformulate and then find the form of solutions of the equations of change, to determine the dependence of the interfacial fluxes on system parameters |
| **CO5** | | Evaluate conceptual and mathematical models design , from conservation principles,to complicated systems involving simultaneous mass, momentum, and/or heat transfer processes |

## F. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | AVG. |
|---|---|---|---|---|---|---|---|
| **PO1** | 2 | 3 | 3 | 3 | 3 | 2 | 2.7 |
| **PO2** | 2 | 3 | 3 | 3 | 2 | 2 | 2.5 |
| **PO3** | 1 | 2 | 3 | 2 | 3 | 2 | 2.2 |
| **PO4** | 2 | 2 | 2 | 3 | 2 | 2 | 2.2 |
| **PO5** | 2 | 2 | 2 | 2 | 3 | 2 | 2.2 |
| **PO6** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO7** | 3 | 2 | 2 | 2 | 2 | 2 | 2.2 |
| **PO8** | 1 | 2 | 2 | 2 | 2 | 2 | 1.8 |
| **PO9** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PO10** | 1 | 2 | 2 | 2 | 2 | 2 | 1.8 |
| **PO11** | 1 | 2 | 2 | 2 | 2 | 2 | 1.8 |
| **PO12** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PSO1** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PSO2** | 3 | 3 | 3 | 3 | 2 | 2 | 2.7 |
| **PSO3** | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **PSO4** | 3 | 3 | 3 | 3 | 2 | 3 | 2.8 |

# M. TECH. – SEMESTER-II
# COMPUTATIONAL AND NUMERICAL METHODS (MC233)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | P | TW | Total |
| 3 | 1 | 0 | 4 | 60 | 40 | 0 | 50 | 150 |

## A. COURSE OVERVIEW

Numerical solutions of various mathematical models such as lumped parameter models and distributed parameter models describing steady state and dynamic behaviors of Chemical Process Systems and parameter estimation using numerical methods in Chemical Engineering.

**Objectives:**

To apply numerical methods for solving various problems in chemical engineering systems and to develop computer programs using languages like C/C++ and commercial software like MATLAB in order to educate the students for solving research-oriented problems. Fundamentals of numerical methods/algorithms to solve systems of different mathematical equations (e.g. linear/nonlinear algebraic equations, ordinary / partial differential equations) will be introduced.

## B. DETAILED SYLLABUS

| | TOPICS | COs |
|---|---|---|
| 1. | **Basics of Vectors, Scalars and matrix algebra**<br>Addition/subtraction, multiplication/division of vectors, matrix multiplication, inverse of matrix, determinant and rank of matrix, eigen values, sparse matrices, Use of MATLAB for matrix algebra, approximation and concept of error and error analysis | CO1CO3 |
| 2. | **Numerical methods for linear algebraic equations**<br>Gauss elimination method, Gauss-Jordan method, Jacobi method, Successive – over relaxation method, tri-diagonal matrix, MATLAB programming | CO1CO2 CO3 |
| 3. | **Numerical methods for nonlinear algebraic equations**<br>Successive substitution method, Newton-Raphson method, Secant method, False position method, single variable and multivariable case studies, MATLAB functions for nonlinear algebraic equations | CO1 to CO5 |
| 4. | **Eigen Value Problems**<br>Eigen value analysis of linear and nonlinear systems and solution of homogeneous equations using eigen values | CO1 CO2 CO3 |
| 5. | **Regression, interpolation, curve fitting, numerical integration**<br>Simple interpolation, Lagrange's interpolation, Newton's interpolation, Simpson's rule, trapezoid method, linear regression, polynomial regression, exponential and power regression, MATLAB routines and commands | CO1 CO2 CO3 |
| 6. | **Numerical methods for IVP and BVP ordinary differential equations**<br>Explicit and implicit ODEs, Euler's explicit and implicit methods, explicit Adams-Bashforth methods, implicit Adams- Mouton methods, Predictor – corrector methods, Runge-Kutta methods, MATLAB solvers for ODEs, Finite difference, Orthogonal collocation and Orthogonal collocation on finite- element methods for ODE-BVP, Shooting Methods for solving BVP | CO1 to CO6 |
| 7. | **Numerical methods for Partial differential equations**<br>Steady state and dynamic PDES, method of lines, Crank-Nicholson method, finite-difference, Orthogonal collocation and orthogonal collocation on finite element methods | CO1 to CO6 |

## C. TEXT BOOKS

1. Gupta, S. K. Numerical Methods for Engineers, 3rd ed.; New Age International Publishers: New Delhi, 2015
2. Chapra, S. C. Applied Numerical Methods with MATLAB for Engineers and Scientist, 3rd ed.; McGraw-Hill: New York, 2012

## D. REFERENCE BOOKS

1. Beers, K J. Numerical Methods for Chemical Engineering Applications in MATLAB, Cambridge University Press: UK, 2006
2. Constantinides, A.; Mostoufi, N. Numerical Methods for Chemical Engineers with MATLAB Applications, Prentice Hall International Series: New Jercy, 1999.

## E. COURSE OUTCOMES

| COs | Skills | Statement |
|---|---|---|
| CO1 | Understanding | Remember and understand the various numerical methods to solve various linear and nonlinear steady state and dynamic problems in chemical engineering systems described by ODE, PDE, AE and NAE |
| CO2 | Analyzing | Carry out the error analysis in the numerical solutions of chemical engineering problems |
| CO3 | Applying | Apply linear algebraic equation solution techniques and nonlinear algebraic equation techniques for solving steady states of chemical engineering systems. Use MATLAB to implement numerical methods in simulations. |
| CO4 | Evaluating | Do critical evaluation of the performance of various numerical methodsusing simulations for solving chemical engineering problems. |
| CO5 | Creating | Develop MATLAB codes for various numerical methods |
| CO6 | Remembering Evaluating | Generate a MATLAB program for industrial application to carry out steadystate and dynamics analysis. |

## F. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 | Avg |
|---|---|---|---|---|---|---|---|
| **PO1** | 2 | 2 | 2 | 3 | 2 | 3 | 2.3 |
| **PO2** | 1 | 1 | 3 | 3 | 3 | 3 | 2.3 |
| **PO3** | 1 | 2 | 3 | 3 | 3 | 3 | 2.5 |
| **PO4** | 1 | 1 | 2 | 3 | 2 | 3 | 2 |
| **PO5** | 0 | 0 | 2 | 3 | 3 | 3 | 1.8 |
| **PO6** | 2 | 2 | 3 | 3 | 3 | 3 | 2.7 |
| **PO7** | 2 | 3 | 3 | 3 | 3 | 3 | 2.8 |
| **PO8** | 1 | 1 | 2 | 2 | 2 | 3 | 1.8 |
| **PO9** | 2 | 2 | 3 | 2 | 3 | 3 | 2.5 |
| **PO10** | 1 | 2 | 3 | 2 | 2 | 3 | 2.2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PO11** | 2 | 3 | 3 | 2 | 2 | 3 | 2.5 |
| **PO12** | 3 | 3 | 3 | 2 | 3 | 3 | 2.8 |
| **PSO 1** | 2 | 3 | 3 | 3 | 2 | 3 | 2.67 |
| **PSO 2** | 3 | 3 | 3 | 2 | 3 | 2 | 2.67 |
| **PSO 3** | 2 | 3 | 2 | 2 | 2 | 2 | 2.17 |
| **PSO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

# M. TECH. – SEMESTER-I
# INTRODUCTION TO ENVIRONMENTAL ENGINEERING (MC144)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | P | TW | Total |
| 3 | 1 | 0 | 4 | 60 | 40 | 0 | 50 | 150 |

## A. DETAILED SYLLABUS

| | TOPICS | COs |
|---|---|---|
| 1. | **Introduction to Environmental Engineering**<br>Ecology and various cycles, Acid rain, ozone depletion, greenhouse gases, photochemical smog, various types of pollutants, Environmental laws, introduction to environmental chemistry | CO1 |
| 2. | **Air Pollution and Control**<br>Air pollution sources and its classification, Effects of air pollutants, meteorological aspects of air pollution, Dry/wet adiabatic lapse rate and environmental lapse rate, atmospheric stability and plume behavior, Gaussian plume behavior model for area, line and point source.<br>Air pollutant sampling and measurement, various types of air pollution control methods, equipment and its design, selection criteria of air pollution control equipment | CO1<br>CO2 |
| 3. | **Industrial Waste Water Treatment**<br>Sources of industrial waste water and its characteristics, need of waste water treatment methods, use of various types of physical, chemical and biological methods for waste-water treatment under primary, secondary and tertiary methods, advanced oxidation processes, membrane technology for waste water treatment | CO3<br>CO4 |
| 4. | **Solid Waste Management**<br>Types and classification of solid waste, collection and transportation of solid waste, Solid waste disposal methods and 5R concept | CO5 |
| 5. | **Cleaner Production** – objectives, methods, Planning and strategy, case studies, Circular economy, Green Chemistry concept | CO3<br>CO4 |
| 6. | Noise Pollution sources of noise pollution & their control methods | CO5 |

## B. TEXT BOOKS

| | |
|---|---|
| 1. | Environmental Pollution Control Engineering by C. S. Rao, Wiley Eastern Ltd |
| 2. | Waste Water Engineering – Treatment, Disposal & Reuse by Metcalf & Eddy Inc. Tata McGraw Hill Publications |

## C. REFERENCE BOOKS

| | |
|---|---|
| 1. | Introduction to Environmental Engineering by Mackenzie L. Davis & David A. Cornwell, McGraw Hill International Publications |
| 2. | Environmental Engineering by Raw, Peavy & Tchobanoglous |
| 3. | Chemistry for Environmental Engineering 3rd Ed. by Sawyer &McCarty McGraw Hill |

## D. COURSE OUTCOMES

| COs | Skills | Statement |
|---|---|---|
| CO1 | Remembering<br>Understanding<br>Applying<br>Analysing<br>Evaluating<br>Creating | **Understand** the sources and effect of different types of pollution on the environment (Air, Water, Land etc.), Environmental Laws |
| CO2 | | Meteorological aspects of air pollution, Atmospheric stability and plume behavior, sampling and measurement of air pollutants, Air pollution control equipment and its **design** |
| CO3 | | Types of water pollutants and waste water characteristics, Collection and testing of waste water samples, Waste water treatment schemes |
| CO4 | | **Evaluate** the significance of advanced oxidation processes for waste water treatment, Cleaner and greener route of production, Circular economy |
| CO5 | | **Understand** about solid waste and its classification, Collection and Transportation of solid waste, Various disposal methods for hazardous solid waste, noise pollution and its control |

## E. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | Avg |
|---|---|---|---|---|---|---|
| PO1 | 2 | 3 | 3 | 3 | 2 | 2.6 |
| PO2 | 2 | 3 | 3 | 2 | 1 | 2.2 |
| PO3 | 1 | 2 | 2 | 3 | 2 | 2 |
| PO4 | 2 | 2 | 2 | 2 | 3 | 2.2 |
| PO5 | 3 | 2 | 2 | 2 | 3 | 2.4 |
| PO6 | 2 | 2 | 2 | 2 | 2 | 2 |
| PO7 | 3 | 2 | 2 | 2 | 2 | 2.2 |
| PO8 | 3 | 2 | 2 | 2 | 3 | 2.4 |
| PO9 | 2 | 2 | 2 | 2 | 2 | 2 |
| PO10 | 3 | 2 | 2 | 3 | 2 | 2.4 |
| PO11 | 3 | 3 | 2 | 2 | 2 | 2.4 |
| PO12 | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO 1 | 2 | 2 | 2 | 3 | 2 | 2.2 |
| PSO 2 | 2 | 3 | 2 | 3 | 2 | 2.4 |
| PSO 3 | 2 | 3 | 3 | 3 | 2 | 2.6 |
| PSO4 | 2 | 2 | 3 | 3 | 2 | 2.4 |

# M. TECH. – SEMESTER-II
# NEW SEPARATION TECHNIQUES (MC238)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | P | TW | Total |
| 3 | 1 | 0 | 4 | 60 | 40 | 0 | 50 | 150 |

## A. COURSE OVERVIEW

The course deals with the understanding of conventional separation techniques and new separation techniques used in chemical process industries. The subject focusing on the basics of multi component distillation and all types of membrane-based separation operations. The emphasis is given on the synthesis of membrane, characterization of membrane and selection of suitable type of membrane separation processes with industrial examples and other types of separation operations.

## B. DETAILED SYLLABUS

| | TOPICS | COs |
|---|---|---|
| 1. | **Introduction to Separation technology**<br>Fundamentals of Separation Processes and its classification, advantage and limitation of various conventional separation processes and need of new separation methods, basic terms associated with the membrane technology | **CO1** |
| 2. | **Multicomponent Distillation**<br>Concept of MCD, Bubble point dew point calculation, key component concept, short cut methods, number of stage calculation, Fensky and Underwood equation | **CO2** |
| 3. | **Membrane types, materials, synthesis and characterization**:<br>Definition of Membrane, Advantages and limitations of membrane technology compared to other separation processes, Membrane materials and properties, Synthesis methods of membrane, types of membrane andmembrane modules, Flux equation, transport mechanism, factors affecting on membrane operation | **CO3** |
| 4. | **Membrane processes**<br>Types of pressure driven membrane processes like microfiltration, ultra-filtration, reverse osmosis, nano filtration using membrane and their industrial applications, | **CO4** |
| 5. | **Other types of Separation processes –**<br>Gas separation, pervaporation, Ion exchange membrane and electrodialysis, introduction to liquid membrane, membrane distillation, membrane reactor, super critical fluid extraction | **CO5** |

## C. TEXT BOOKS


1. Membrane separation processes – Kaushik Nath, second edition, PHI learning private limited
2. Fundamentals of Multicomponent Distillation – Charles D Holland, McGraw Hill Chemical Engineering series


## D. REFERENCE BOOKS


1. Basic Principles of Membrane Technology, Mulder M, Kluwer Academic Publishers, London, 1996.
2. Membrane Technology and Research, Baker R. W., Inc. (MTR), Newark, California, USA, 2004.
3. Separation Process Principles – J.D. Seader , E.J. Henley , Second edition, Wiley

## E. COURSE OUTCOMES

| COs | Skills | Statement |
|---|---|---|
| CO1 | Remembering<br>Understanding<br>Applying<br>Analyzing<br>Evaluating<br>Creating | Understand about various types of conventional and new separation methods used in industry with their advantages and limitations |
| CO2 | | Concept of multi component distillation |
| CO3 | | Types of Membrane, synthesis method, characterization of membrane, membrane modules, factors affecting on membrane operations |
| CO4 | | Various types of pressured driven membrane operations |
| CO5 | | Basics of other types of separation operation including gas separation, electro dialysis, ion exchange membrane, supercriticalfluid extraction, LEM |

## F. COURSE MATRIX

| | CO1 | CO2 | CO3 | CO4 | CO5 | Avg |
|---|---|---|---|---|---|---|
| PO1 | 2 | 3 | 3 | 3 | 2 | 2.6 |
| PO2 | 2 | 3 | 3 | 2 | 1 | 2.2 |
| PO3 | 1 | 2 | 2 | 3 | 2 | 2 |
| PO4 | 2 | 2 | 2 | 2 | 2 | 2 |
| PO5 | 2 | 2 | 2 | 2 | 2 | 2 |
| PO6 | 2 | 2 | 2 | 2 | 3 | 2.2 |
| PO7 | 3 | 2 | 2 | 2 | 2 | 2.2 |
| PO8 | 3 | 2 | 2 | 2 | 3 | 2.4 |
| PO9 | 2 | 2 | 2 | 2 | 2 | 2 |
| PO10 | 1 | 2 | 2 | 2 | 2 | 1.8 |
| PO11 | 1 | 2 | 2 | 2 | 2 | 2.8 |
| PO12 | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO 1 | 2 | 2 | 2 | 3 | 2 | 2.2 |
| PSO 2 | 2 | 3 | 2 | 3 | 2 | 2.4 |
| PSO 3 | 2 | 3 | 3 | 3 | 2 | 2.6 |
| PSO4 | 2 | 2 | 3 | 3 | 2 | 2.4 |

**B.E. SEM III (CIVIL)**

# (CL-307) FLUID MECHANICS-I

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

## A. OBJECTIVES OF THE COURSE

The objectives of the course are

1. To explain basic principles of fluid mechanics to the students.
2. To explain hydrostatic forces acting on different surfaces
3. To explain the concept of buoyancy and flotation
4. To explain various devices used for fluid measurement

## B. DETAILED SYLLABUS

1. **INTRODUCTION** [04]
(a) Introductory Concepts and Definitions: Fluids and Soils; Liquid, Gas and Vapour; Coordinate systems, Continuum; Control volume.(b) Properties of Fluids: Density; Specific weight; Specific Volume; Specific Gravity; Bulk modulus of Elasticity; Pressure; Viscosity; Surface Tension; Capillarity.
2. **FLUID STATICS** [12]
(a) Fluid Pressure and It's measurement: Introduction; Variation of static pressure; Atmospheric, Gauge and Absolute Pressure; Hydrostatic Paradox; Pressure measurement by different devices; Hydraulic press. (b) Hydrostatic Force: Pascal's Law; Hydrostatic force on submerged plane and curved surfaces ; Location of Hydroststic force ; Applications of Hydrostatic force.(c) Buoyancy: Archimedes' Principle; Buoyant force; Determination of metacentric height; Stability of floating bodies.
3. **FLUID KINEMATICS:** [07]
(a) Fundamentals of Fluid Flow: Introduction; Methods of describing fluid motion; Velocity and acceleration of a fluid particle; Types of fluid flow; Streamline, Path line and Streak line; Existence of flow; Rotational and irrotational flow; circulation and vorticity; continuity equation in Cartesian coordinates in one - dimensional and three- dimensional form; continuity equation in polar coordinates; stream function and velocity potential function : relationship between these functions in Cartesian and polar coordinates; flow nets. Vortex Motion.
4. **FLUID KINETICS** [07]
Equation of motion and energy equation: , Forces acting on fluid in motion; Euler's equation of motion for one - dimensional and 3- dimensional flow; Bernoulli's equation from Euler's equation of motion; Application of Bernoulli's equation.
5. **FLUID FLOW MEASUREMENT** [09]
Measurement of discharge through a pipe by Venturimeter, Orificemeter, Orifice, Mouthpiece, Rotameter and velocity measurement by Pitot Tube.

Measurement of discharge through an Open Channel by a Weir, and Notch;
Time of emptying a tank through orifice; Weir and Notch.

6. **FLOW THROUGH PIPES** [09]

Introduction; Types of flow; Reynolds's experiments; Darcy - Weisbach formula, Chezy's formula, Manning's formula; Laws of Fluid Friction; Frictional loss: Other Minor losses in pipe flow; Total Energy Line and Hydraulic Gradient Line; Power transmission through pipes; Pipes in series and Equivalent pipe; Pipes in parallel; Branched pipe; Water hammer phenomena in pipe flow; Loss of head due to friction in tapering pipe; Loss of head due to friction in a pipe with side tapings.Steady flow in conduits: Network of pipes and its hydraulic analysis by Hardy Cross method; Syphon and Rising Mains.

**COMPUTER APPLICATIONS TO SPECIFIED PROBLEMS.**

## C. LEARNING OUTCOMES

On the completion of the course one should be able:

1. To understand various types of fluid properties and their use in fluid mechanics.
2. To understand various types of hydrostatic forces acting on different types of hydraulic structures such as dams, spillways, lock gates etc.
3. To understand the concepts of buoyancy and flotation and its practical utility.
4. To calibrate fluid flow measuring devices like venturimeter, orifice meter, notches, orifice, mouthpieces.
5. To understand various types of flow measuring devices and their practical utility.
6. To understand the concepts of pipe flow and its practical utility.

## D. RECOMMENDED TEXTBOOKS

1. Fluid Mechanics, by R K Bansal; Laxmi Publications
2. Fluid Mechanics by A K Jain, Khanna Publishers, New Delhi

## E. REFERENCE BOOKS

1. Fluid Mechanics by R.K.Rajput, S. Chand & Co. publications
2. Fluid Mechanics & Hydraulic Machines by P.N.Modi and S.N.Seth, Standard Book House
3. Fluid Mechanics and Machinery by H M Raghunath, CBS Publishers.
4. Fluid Mechanics by D.S. Kumar, S.K. Kataria & Sons
5. Fluid Mechanics, by V L Streeter, and E B Wylie, McGraw Hill, 1985, New York
6. Theory and Applications of Fluid Mechanics by K. Subramanya, Tata-McGraw Hill Publishing Co., 1993, New Delhi

7. Introduction to Fluid Mechanics, SI edition, 2005 by E.J. Shaughnessy, I.M. Katz, and J.P. Schaffer, Oxford University Press, New Delhi
8. Fluid Mechanics by F.M. White, McGraw Hill, New York
9. Engineering Fluid Mechanics by R.J. Garde, and A.C. Mirajgaoker, New Chand & Sons
10. **Web Materials:**
    1. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/fluid_mechanics/index.htm
    2. http://nptel.iitm.ac.in/video.php?subjectId=105101082
    3. http://nptel.iitm.ac.in/courses/IIT-MADRAS/Hydraulics/index.php
    4. http://nptel.iitm.ac.in/video.php?subjectId=105103096

## F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)

| Experiment No. | Name of Experiment |
|---|---|
| **1.** | Study of various pressure measurement devices |
| **2.** | Determination of force of buoyancy on different objects |
| **3.** | Experimental determination of metacentric height of a floating body |
| **4.** | Drawing a flow net |
| **5.** | Reynold's experiment |
| **6.** | Determination of loss of head due to friction in a pipe |
| **7.** | Verification of Bernoulli's theorem |
| **8.** | Flow Measurement through Notch |
| **9.** | Determine Hydraulic coefficients of a circular orifice. |
| **10.** | Flow Measurement through Venturimeter |

# (CL-313) STRUCTURAL ANALYSIS-I

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 2 | 0 | 60 | 40 | 25 | 0 | 125 | 4 | 2 | 0 | 6 |

## A. OBJECTIVES OF THE COURSE

To equip the students with the comprehensive methods of structural analysis with emphasis on analysis of elementary determinate structures.

## B. DETAILED SYLLABUS

1. **FORCES IN DETERMINATE PIN JOINTED TRUSSES:** [09]
   Different types of pin jointed trusses, Analysis of trusses using (i) Method of Joints (ii) Method of Sections (iii) Graphical Method.
2. **STRAIN ENERGY** [03]
   Resilience, Strain Energy in Tension Compression, Bending and Torsion, Proof Resilience, Impact Loads.
3. **STRENGTH THEORIES:** [02]
   Different Theories of Elastic Failure and their Applications.
4. **SLOPE AND DEFLECTION OF STATICALLY DETERMINATE BEAMS:** [14]
   Differential Equation of the Elastic Curve, fundamental Double Integration Method, Macaulay's Method, Moment Area Method, Conjugate Beam Method, Unit Load Method and Castigliano's First Theorem .
5. **DIRECT AND BENDING STRESSES:** [03]
   Short Columns subjected to eccentric load, Middle Third Rule, Kernal (Core) of Section
6. **COLUMNS AND STRUTS:** [05]
   Buckling of Columns, different end conditions, effective length, least radius of gyration, Euler's Theory of Long Columns – its applicability and limitations, Rankine's Formula, Secant Formula
7. **UNSYMMETRICAL BENDING:** [04]
   Unsymmetrical Bending, Z – Polygon, Shear Centre.
8. **INFLUENCE LINES:** [08]
   **Statically Determinate Beams** – I.L. for Support Reaction, Shear and bending moment for UDL and several Point Loads. Criteria for maximum effect.
   **Statically Determinate Trusses** – I.L. for Forces in members for UDL and Point Load
   Application of ILD for the structural analysis problem
   **Term Work** shall consist of Graphical and/or analytical problems based on all the topics of the syllabus of Structural Analysis – I.

## C. LEARNING OUTCOMES

The students have the advanced knowledge of methods of analysis for determinate simple structures.

After successful completion of the course, student will be able to

1. Apply principles of statics to determine reactions & internal forces in statically determinate structures.

2. Determine displacements of statically determinate structures.
3. Determine stresses due to axial & eccentric loading.
4. Determine buckling load for columns & struts with different end Conditions.
5. Determine strain energy stored in a body.

**D. RECOMMENDED TEXTBOOKS**

1. Applied Mechanics by S. B. Junnarkar and H. J. Shah, Charotar Publication
2. Strength of Materials by Ramamrutham

**E. REFERENCE BOOKS**

1. Strength of Materials by B.C.Punmiia
2. Structural Analysis by Hibbler R C; Pearson Education
3. Structural Analysisby Aslam Kassimali, Cenage Learning
4. Devdas Menon Structural Analysis by Devdas Menon, Narosa Publications
5. Structural Analysis by Hibbeler, Pearson Education
6. Theory of Structures by Timoshenko S.P.& Young D.H, McGraw Hill
7. Fundamentals of structural Mechanics and analysis by M.L. Gambhir,, Printice Hall India

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

NIL

# (CL-314) SURVEYING -I

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

## A. OBJECTIVES OF THE COURSE

To develop concepts of various types of land surveying and prepare and interpret maps and drawing.

## B. DETAILED SYLLABUS

1. **INTRODUCTION:** [02]
   Introduction to Surveying. Classification of Surveys and Classification of Surveying.

2. **MEASUREMENT OF DISTANCES:** [05]
   Chain and Tape Survey, Standard Metric Chains, Methods of Chaining, Instruments used for taking offsets, Correction for Sloping Ground, Obstacles in Horizontal Distance measurement, Field Works, Plotting, Conventional Signs, Degree of Accuracy.

3. **COMPASS SURVEYS:** [08]
   Magnetic Compass - Principles, Procedures, Precautions and Corrections; Traverse with Prismatic Compass.

4. **LEVELLING:** [07]
   Dumpy, Tilting and Automatic Levels, Staves - Methods of Leveling, Precautions and Corrections, Level Field Book, Plotting and Contouring.

5. **THEODOLITE:** [08]
   Transit Theodolite- Uses, Temporary Adjustments, Measurement of Vertical and Horizontal Angles, Theodolite Traverse, Latitude and Departure, Balancing.

6. **MINOR INSTRUMENTS:** [03]
   Principles and Uses of Planimeter, Abney Level, Tangent, Clinometers, Box Sextant, Pantograph.

7. **PLANE TABLE SURVEY:** [04]
   Instruments, Adjustments, Methods of Plane Tabling, Errors, Accuracy and Advantages.

8. **SETTING OUT WORKS FOR BUILDING AND ALIGNMENTS OF BRIDGE, TUNNEL, AND DAM.**
   Practical, Sectional Work and Term-Work shall be based on the course under Surveying-II [03]

## C. LEARNING OUTCOMES

Students are expected to use all surveying equipments, prepare longitudinal section& Cross Section as well as contour maps and carryout surveying works related to land and civil engineering projects.

1. Surveying & Leveling by N NBasak, Tata McGraw Hill Publication

## D. REFERENCE BOOKS

1. Surveying Volume-1 by S K Duggal, Tata McGraw Hill Publication
2. Fundamentals of Surveying by S K Roy, PHI Learning Pvt. Ltd Publication
3. Surveying & Levelling by S C Rangwala, Charotar Publication House

## E. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)

| Experiment No. | Name of Experiment |
|---|---|
| **1.** | Perform ranging and tapping operations in different field conditions and use of EDM |
| **2.** | Study of Surveyor Compass & Prismatic Compass; and measurement of bearings of lines for given traverse. |
| **3.** | Perform temporary adjustments of Dumpy level; Take and record the level reading in the level book and Determine Reduced level using Rise & Fall method and Height of line of collimation method by applying checks |
| **4.** | Carry out fly levelling using Auto level in different field conditions. |
| **5.** | Introduction to plane table survey with accessories and methods of orientations. |
| **6.** | Various methods of plane table survey. |
| **7.** | Study of Transit Theodolite; measurement of horizontal angle by repetition method for a given closed traverse. |
| **8.** | Measurement of area of figure with irregular boundary by Planimeter. |
| **9.** | **List of Projects:** |
| | 1. Theodolite traverse survey project |
| | 2. Profile levelling and contouring survey project |
| | 3. Plane table survey project |

# (CL-315) CONSTRUCTION TECHNOLOGY-I

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

## A. OBJECTIVES OF THE COURSE

To make the students aware of the various techniques and practices on various stages of building construction and careful selection of suitable construction components & To learn current building drawing practices for various building Components.

## B. DETAILED SYLLABUS

1. **Introduction:** [02]

   Classification of buildings, Components of buildings and their broad functions, Types of building & Building system, Frame structure, Load bearing, Steel Structure etc.

2. **Foundation** [07]

   Open excavations, braced excavations, Functions, Classification, suitability and constructional features of shallow foundations, building foundation in black cotton soil, machine foundation, failure of building foundation, constructional features and suitability of pile foundations used for buildings, Damp proofing in building construction, Underpinning

3. **Masonry** [06]

   Technical terms used in masonry, design concepts, Classification and construction features of common stone masonry, principles of brick masonry construction, bonds in brick masonry, construction of reinforced brick masonry and partition walls used in buildings, design concepts and construction details of Arches & lintels

4. **Flooring** [04]

   Type of flooring and its suitability, Construction details of CC/RCC flooring, Tile floorings (mosaic, glazed, marble), timber floorings, Industrial floorings

5. **Stair case** [02]

   Requirement, location and classification, construction features of RCC, metal stairs.

6. **Doors & Windows** [05]

   Classification, material, suitability, requirement & location, construction features of panelled & flushed doors/windows, fixtures & fastenings for doors/windows, metal doors/windows

7. **Roofs:** [04]

   Classification, functions and requirement of roofs, roofing materials, construction of trussed roofs with AC/GI sheets, pre-cast and in-situe RCC roofs

8. **Building finishes** [03]

   Plastering, pointing, painting and white washing: construction materials & methods

9. **Building protection and maintenance** [03]

   Fire proofing, water proofing and anti-termite treatments, building maintenance

## C. LEARNING OUTCOMES

After successful completion of the course, student will be able to

1. understand various building components and construction activities identify and select appropriate openings, roofs, flooring and types of finishes for buildings etc.
2. select appropriate mode of vertical movements and design of staircase
3. apply special treatments like water resistance, thermal insulation acoustical construction
4. learn to draw various building elements & working drawing

## D. RECOMMENDED TEXTBOOKS

1. Building Construction by Dr. B.C. Punamia, Laxmi Publication-Delhi
2. Civil Engineering Drawing, Building Construction by Gurucharan Singh & S.C. Rangwala , Charotar Publication

## E. REFERENCE BOOKS

1. Building Construction byS.C Rangwala, Charotar Publication
2. Building Construction by Sushil Kumar, Standard Publishers
3. The Construction of Building by R. Barry, ELBS
4. Building Construction Handbook by Chudly&Greeno
5. Indian Standard Institution, National Building Code of India, ISI, 1984, New Delhi

## F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)

1. Drawings of all the above components e.g. Brick masonry bonds and junctions, Stairs, Doors & Windows
2. Preparation of working drawing (Plan, elevation & section) of single story building from given line sketch or given measurements

# (CL-316) ENGINEEERING MATERIALS

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 0 | 60 | 40 | 0 | 0 | 100 | 3 | 0 | 0 | 3 |

## A. OBJECTIVES OF THE COURSE

To introduce students to various materials commonly used in civil engineering construction and their properties.

## B. DETAILED SYLLABUS

**1. Introduction** [04]

Classification of Engineering Materials ; Properties of Materials; Physical properties, Mechanical properties, Electrical properties, Magnetic properties, Chemical properties; Properties of Building materials; Structure of Atom, Bonding in solids, Metallic Bonding, Ionic Bonding, Vanderwalls force; Crystalline and Non-Crystalline nature of solids, Imperfections in crystal structure, Types of Imperfections-Vacancies, Dislocations, Plastic deformation of single crystal, Slip, Twinning etc.

**2. Stones** [02]

Stone as building material ; Criteria for selection ; Tests on stones ; Deterioration and Preservation of stone work.

**3. Bricks** [02]

Classification ;Manufacturing of clay bricks ;Tests on bricks ; Compressive Strength ; Water Absorption ; Efflorescence.

**4. Ceramic Materials** [02]

Tiles; Roofing tiles; Flooring tiles; Glazed tiles, Special Industrial tiles, Earth ware, Stoneware, Porcelain.

**5. Lime** [02]

Sources of lime; Properties and constituents of lime; Uses of lime; Classification and Manufacturing of lime; Preparation of lime mortar

**6. Cement** [03]

Cement ; Ingredients ; Manufacturing process ; Types and Grades ; Properties of cement and Cement mortar ; Hydration ; Compressive strength ; Tensile strength ; Fineness; Soundness and consistency ; Setting time.

**7. Timber and other materials** [06]

Timber ; Market forms ; Industrial timber; Plywood ; Veneer ; False ceiling materials ; Panels of laminates ; Steel ; Aluminum and Other Metallic Materials – Composition – Aluminium composite panel ; Uses ; Market forms ; Mechanical treatment

**8. Paints, Varnishes and Distempers** [04]

Definition of Paints ; Function of Paints ; Preparation of an oil paint; characteristics of paint ; Painting on Metallic surfaces and plastered surfaces.

Definition of Varnishes ; Function of Varnishes; Constituents of varnish; characteristics of varnish; Process of varnishing; Properties and types of distempers; distempering process.

9. **Plastic** [02]

Constituents of plastics; classification of plastics; properties of plastic; application of plastics.

10. **Metals and Alloys** [04]

Ferrous alloys like plain carbon and alloy steels, cast iron.; Non-ferrous alloys of copper, Nickel and Aluminum : Their compositions, properties and industrial application.

11. **Advanced Materials used for Building Construction** [05]

Fibre textiles – Geomembranes and Geotextiles for earth reinforcement, Fly ash; Gypsum and Gypsum Plaster; Concrete hollow blocks – Lightweight concrete blocks advance waterproofing materials, Fibre Reinforce Plastic.

## C. LEARNING OUTCOMES

On completion of this course the students will be able to

1. Compare the properties of most common and advanced building materials.
2. Understand the applications of these materials.
3. Understand the relationship between material properties and structural form.
4. Understand the importance of experimental verification of material properties.

## D. RECOMMENDED TEXTBOOKS


1. Rajput.R.K., Engineering Materials, S. Chand and Company Ltd., 2008.
2. Duggal.S.K., Building Materials, Third Edition, New Age International, 2008.
3. Rangwala S.K., Engineering Materials, Charotar Publications,2008


## E. REFERENCE BOOKS


1. Varghese.P.C, Construction Materials, Prentice Hall Inc., 2007.
2. Jagadish.K.S, Alternative Building Materials Technology, New Age International, 2007
3. Relevant Indian Standard Codes of Practice.


## F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)

NIL

**B.E. SEM IV (CIVIL)**

**(CL-410) RAILWAY AND TOWN PLANNING**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Ext** | **Sess.** | **TW** | **Prac** | **Total** | **Lect** | **Tut** | **Prac** | **Total** |
| 4 | 0 | 0 | 60 | 40 | 0 | 0 | 100 | 4 | 0 | 0 | 4 |

**A. OBJECTIVES OF THE COURSE**

To introduce students with various components of railway engineering as well as town planning with recent advances.

**B. DETAILED SYLLABUS**

**[A] RAILWAY ENGINEERING**

1. Introduction:
   Types, Gauge, Alignment of Railways, Track Components.
2. **Permanent Way:** [04]
   Types of rails and Fastening, Welding of Rails, Conning of wheels, Roaring Rails, Creep.
   Sleepers- Timber, Steel, Cast iron and Concrete sleepers, sleeper spacing, ballast-functions and specifications, formation and drainage of permanent way.
3. **Geometric Design:** [04]
   Grade and Curves, super elevation, cant deficiency, grade separation.
4. **Resistance to traction:** [04]
   Stresses in rails, sleeper, ballast and formation.
5. **Points and Crossings:** [03]
   Layout of simple turnouts, A crossover, Gathering line.
6. **Station and Yards:** [03]
   Layout of wayside stations, Junctions and terminals, Marshalling Yards and formation of trains.
7. **Signalling and Interlocking** [04]
   Working of engineering block, Mechanical, Electrical and Automatic Signalling and Interlocking, Centralized traffic control.

**[B] TOWN PLANNING**

1. **Introduction:** [02]
   Origin and Growth of town, Principles of Town Planning, stages of development, T.P. Schemes.
2. **Civil Surveys:** [03]
   Purpose, type, data required, elements of city planning, circulation pattern, landscape pattern of
   building, use of master plan, central areas, town centre, civic spaces, shopping centre.
3. **Housing:** [04]
   Neighbourhood Units, Layout with houses

4. **Building bye-laws** [04]

Applicability of building bye laws, FSI, Set-Back, Light plane.

5. **Industry:** [05]

Priorities, Classifications, Siting Industrial estate.

6. **Redevelopment:** [06]

Slum clearance scheme, Town planning schemes, Satellite town, Control of ribbon development,
street pattern, green belt, ring road and bye passes.

**C. LEARNING OUTCOMES**

On completion of this course students will be able to

1. Understand the and its components of railway engineering importance.
2. Understands the design aspects of track and pavement of railways.
3. Realize Role of railways in national development.
4. Understand the problems of urban planning and can give possible solutions of it.
5. Understand the terms related to civic bodies and its working pattern.

**D. RECOMMENDED TEXTBOOKS**

1. Town Planning- Charotar Publication – S.C. Rangwala
2. Railway Engineering- Saxena

**E. REFERENCE BOOKS**

1. Fundamentals of town planning- Dhanpat Rai & Sons. – G.K.Hiraskar
2. Planning and Designing of Buildings- Engg. Book Publishers- Sane Y.S.

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

NIL

## (CL-411) FLUID MECHANICS-II

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 2 | 0 | 60 | 40 | 25 | 0 | 125 | 4 | 2 | 0 | 6 |

### A. OBJECTIVES OF THE COURSE

The objectives of the course are

1. To explain to the students the important concepts of laminar, turbulent and compressible flow and their applications in the civil engineering.
2. To explain to the students the important concepts of open channel flow.
3. To explain to the students the concepts of dimensional analysis and its practical use in design of hydraulic structures.
4. To encourage the students to use programming techniques for the solution of problems in Civil Engineering

### B. DETAILED SYLLABUS

1. **OPEN CHANNEL FLOW:** [18]

(a) Introduction; comparison between open channel flow and pipe flow ;classification of open channel flows; Velocity distribution in open channel flow ; Uniform flow : Chezy, Bazin ,Manning , Ganguillet and Kutter's formula; most efficient hydraulic channel cross sections. (b)Specific energy: concept of specific energy and specific force; specific energy and specific force curves; applications of these curves to channel transitions; metering flumes.

(c) Critical flow: critical flow in trapezoidal, rectangular and triangular channel.

(d) Gradually Varied Flow: Dynamic equation of gradually varied flow; classification of channel slopes; classification of surface profiles; Characteristics of surface profiles; back water and draw down profile computations.

(e) Hydraulic Jump: Hydraulic jump in rectangular channel; Sequent depths and their relation; Classification of jump; loss of energy in hydraulic jump; elements and characteristics of hydraulic jump; location of hydraulic jump; Applications of Hydraulic Jump. Hydraulic jump in non - rectangular channel.

2. **LAMINAR FLOW** [07]

Introduction; laminar flow in circular pipes: Hagen - Poiseullie Equation ; laminar flow between parallel plates: (i) both plates at rest (ii) lower plate at rest and upper plate moving in it's own direction - Couette's flow; (iii) Both plates moving in opposite direction. viscosity and it's measurement.

3. **TURBULENT FLOW IN PIPES:** [07]

Characteristics of turbulent flow; hydro-dynamically smooth and rough boundaries; velocity distribution for turbulent flow in pipes; Karman - Prandtl equation; Nikuradse's experiments on artificially roughened pipes; Moody's diagrams; Stanton's diagrams, Aging of pipes; Friction factor in turbulent flow for smooth & rough pipes.

4. **BOUNDARY LAYER THEORY** [05]

Boundary layer definition and characteristics; Momentum equation for boundary layer; Laminar and turbulent boundary layer; Total drag due to laminar and turbulent layers; Boundary layer separation and control.

5. **DIMENSIONAL ANALYSIS AND PRINCIPLES OF SIMILITUDE:** [07]
Concepts of dimensions and dimensional homogeneity; dimensionless parameters; Raleigh and Buckingham theorems; principles of similitude applied to the models of hydraulic structures; selection of scales; distorted models; scale effect.

6. **HYDRAULIC MACHINES:** [04]
(a) Turbines: Types of turbines; their characteristics and working; selection of turbines; cavitation.
(b) Pumps: Types of pumps; their characteristics and working.
(c) Hydraulic ram, hydraulic cranes and lifts.
**COMPUTER APPLICATIONS TO SPECIFIED PROBLEMS.**

## C. LEARNING OUTCOMES

On the completion of the course one should be able to understand:

1. The important concepts of open channel flow.
2. The important concepts of laminar, turbulent and compressible flow and will be able to understand their applications in the civil engineering.
3. The important concepts of dimensional analysis and its practical use in design of various hydraulic structures.
4. The use programming techniques for the solution of problems in Civil Engineering.

## D. RECOMMENDED TEXTBOOKS

1. Fluid Mechanics by A K Jain, Khanna Publishers, New Delhi
2. Fluid Mechanics, by R K Bansal; Laxmi Publications

## E. REFERENCE BOOKS


1. Flow in open channels by K. Subramanya, Tata-Mcgraw Hill Publication
2. Open Channel flow by Madan Mohan Das, PHI
3. Fluid Mechanics by R.K.Rajput, S. Chand & Co. publications
4. Fluid Mechanics & Hydraulic Machines by P.N.Modi and S.N.Seth, Standard Book House
5. Hydraulic Fluid Mechanics & Fluid Machines by S. Ramamurtham, Dhanpatrai Publishing Co.
6. Open Channel Hydraulics by V.T. Chow, McGraw Hill.
7. Flow through open channels by Rajesh Srivastava, Oxford University Press.
8. Fluid Mechanics by D.S. Kumar, S.K.Kataria& Sons
9. Theory and Applications of Fluid Mechanics by K. Subramanya, Tata-McGraw Hill Publishing Co., 1993, New Delhi
10. Engineering Fluid Mechanics by R.J. Garde, and A.C. Mirajgaoker, New Chand & Sons
11. Fluid Mechanics by F.M. White, McGraw Hill, New York

**12 Web Materials:**

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13 http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/fluid_mechanics/index.htm

14 http://nptel.iitm.ac.in/video.php?subjectId=105101082

15 http://nptel.iitm.ac.in/courses/IIT-MADRAS/Hydraulics/index.php

16 http://nptel.iitm.ac.in/video.php?subjectId=105103096

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

NIL

## (CL-412) STRUCTURAL ANALYSIS-II

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 2 | 0 | 60 | 40 | 25 | 0 | 125 | 4 | 2 | 0 | 6 |

### A. OBJECTIVES OF THE COURSE

To equip the students with the comprehensive methods of structural analysis with emphasis on analysis of elementary indeterminate structures.

### B. DETAILED SYLLABUS

1. **General:** [04]
   Static and Kinematic Indeterminacy of Beam, Plane Frames, Plane Truss, Three Dimensional Structures. Stable and Unstable Structures. Principle of Superposition, Maxwell's Reciprocal Theorem.
2. **Energy Principles:** [10]
   Castigliano's Theorem II, Analysis of Statically Indeterminate Beams, Trusses and Frames by Method of Consistent Deformation.
3. **Slope Deflection Method:** [06]
   Analysis of Continuous Beams including settlement/rotation of support.
4. **Moment Distribution Method:** [08]
   Analysis of Continuous Beams and Frames including sway. Use of Symmetry.
5. **Analysis Of Fixed Beams** [04]
   for internal forces due to various loading type, support settlement and support rotation.
6. **Analysis Of And Two Hinged And Three Hinged Arches** for internal forces under the various loading condition [06]
7. **Matrix Methods:** [08]
   Introduction to Flexibility and Stiffness Method. System Approach to analysis of Beams and
   Plane Frame
8. **Application Of Computer** for various problems in all the above method of Analysis. [02]
   **Termwork :**
   Shall consist of at least 25 problems based on the Course under STRUCTURAL ANALYSIS-II

### C. LEARNING OUTCOMES

The students have the advanced knowledge of methods of analysis like matrix methods, arch analysis and indeterminate simple structures analysis.

After studying this subject students will be able to:

1. Determine reactions & internal forces in statically indeterminate structures
2. Determine forces and reactions in fixed beams and ar
3. Determine the maximum reaction, shear force and bending moment for beams and trusses for rolling loads

### D. RECOMMENDED TEXTBOOKS

1. Basic Structural Analysis by C.S. Reddy, Tata McGraw Hill Publications.

2. Intermediate Structural Analysis by Wang C. K.; Tata McGraw Hill book Company, New Delhi

**E. REFERENCE BOOKS**

1. Mechanics of Structures, Vol. I I by S. B. Junnarkar and H. J. Shah, CharotarPublication.
2. Mechanics for Engineers by F.P. Beer and Jhonston, "", McGraw Hill, New Delhi
3. Structural Analysis by Hibbler R C; Pearson Education
4. Structural Analysis by Devdas Menon, Narosa Publications
5. Indeterminate Structural Analysis by Kinney S., Oxford & IBH
6. Fundamentals of structural Mechanics and analysis by M.L. Gambhir, Printice Hall India
7. Theory of Structures by Timoshenko S.P.& Young D.H, McGraw Hill

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

NIL

## (CL-413) SURVEYING -II

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

### A. OBJECTIVES OF THE COURSE

This subject deals with horizontal and vertical alignment for different sight conditions. Also, students are also exposed to the Modern Survey equipments.

### B. DETAILED SYLLABUS

1. **PERMANENT ADJUSTMENTS** [04]
   Optics of the Telescope; Permanent Adjustment of Dumpy Level, Tilting Level and the Vernier Theodolite.
2. **TACHEOMETRY** [05]
   Principles of Tachometry; Use of analytic lenses; Field-work; Computation, Tachometric Table, Direct Reading Tachometers: Applications of Tachometry by digital Theodolite.
3. **CURVES** [06]
   Theory of Simple, Compound, Reverse & Vertical Curves, Transition curves – Cubic , Spiral Cubic Parabola and Lemniscates.
4. **ELECTRONIC DISTANCE MEASUREMENTS** [04]
   Principles & Instruments used, Trilateration, study of Total station.
5. **PHOTOGRAMMETRY** [04]
   Principles, Photo-Theodolite, Aerial Photogrammetery, Stereoscopy and parallax and their applications, Field-Work, Plotting from air photographs, Applications of air Surveys.
6. **ERRORS** [04]
   Mistakes; Cumulative & Compensating Errors, Probability Curve; Principle of Least Squares; Probable Errors; R.M.S. Value; Weighted Observations. Adjustments of a Trilateration Network.
7. **HYDROGRAPHY** [05]
   Gauge, Sounding, Location of Sounding.
8. **FIELD ASTRONOMY & INTRODUCTION OF REMOTE SENSING, GIS AND GPS** [08]
   Field astronomy fundamentals, spherical Trigonometry, determination of s terrestrial co-ordinate and Azimuth, Introduction to GIS and GPS.

### C. LEARNING OUTCOMES

Students are expected to use modern surveying equipments, prepare layout o contour map by using tacheometry survey, plotting of horizontal curves and able to f understand concepts o advanced surveying methods of remote sensing.

### D. RECOMMENDED TEXTBOOKS

1. Surveying Volume-1 & 2 by S K Duggal, Tata McGraw Hill Publication

### E. REFERENCE BOOKS

1. Fundamentals of Surveying by S K Roy, PHI Learning Pvt. Ltd Publication
2. Surveying & Levelling by S C Rangwala, Charotar Publication House
3. Surveying Volume 1,2 & 3 by Dr. K.R. Arora
4. Surveying and Levelling Vol. I and II by T.P Kanetkar and S.V Kulkarni, Vidyarthi Book Depot, Pune

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

| Experiment No. | Name of Experiment |
|---|---|
| **11.** | Introduction To Transit Theodolite |
| **12.** | Angle Measurement using Transit Theodolite by Repetition Method & Reiteration method |
| **13.** | Height Measurement Of a Tall Building By Transit Theodolite |
| **14.** | Instrument Constants For A Given Tacheometer |
| **15.** | Tacheometry Survey Practice To Find RLs of Different Points for uneven ground |
| **16.** | Practice on Tangential Tacheometry |
| **17.** | To Find Gradient Getween Two Points By Tacheometry Survey |
| **18.** | Plotting Of Circular Curve When L>>R by using linear methods |
| **19.** | Plotting Of Circular Curve When L<<R by using linear methods |
| **20.** | Project On Plotting Of Circular Curve By Rankine's Method |
| **21.** | Introduction to Modern Survey Instruments (i) Digital Theodolite (ii) Total Station |
| **22.** | Introduction to Computer application in Surveying like Profile levelling, Contouring, GPS, GIS etc. |
| **23.** | **List of Projects:** |
| | 1. Tacheometry survey project |
| | 2. Plotting of circular curve by using Rankine's method by single instrument and by double instruments. |
| | 3. Plotting of Combined curve |

**B.E. SEM VI (CIVIL)**

**(CL-513) GEOTECH AND APPLIED GEOLOGY**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Ext** | **Sess.** | **TW** | **Prac** | **Total** | **Lect** | **Tut** | **Prac** | **Total** |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

To understand the role of geology in design and construction of major civil projects .....
To Provide basic knowledge of types of soils and its classifications.
To carry out field and laboratory test to identify soils in Geotechnical engineering practice.

**B. DETAILED SYLLABUS**

1. **INTRODUCTION:** [01]
Definition, brief historical development, future prospects.

2. **PHYSICAL GEOLGY AND ORIGIN AND NATURE OF SOIL:** [03]
Surface Process and Landforms, Weathering and Erosin, Introduction to geological agents (river, wind, oceans, glaciers, groundwater) and their actions, Basic introduction of earth and crust of earth.

3. **ORIGIN AND NATURE OF SOIL:** [02]
Formation of soil by various agents, residual soils, alluvial soils, marine and lacustrine soils, Loess, Till, Peat.

4. **SOIL STRUCTURE AND TEXTURE:** [07]
Soil particle size and shape, specific surface, Clay minerals, atoms and atomic bonds, structure of clay minerals, different types of soil mass structures, soil particle size distribution, mechanical and hydrometer analysis.

5. **PHYSICAL PROPERTIES OF SOILS:** [04]
Void ratio, Porosity, degree of saturation, moisture content, unit weight, specific gravity, relative density of soil, Weight-Volume functional relationship.

6. SOIL WATER: [02]
Effect of moisture content on soil, ground water, hygroscopic moisture, capillary water, apparent cohesion.

7. **SOIL-WATER CONSISTENCY:** [03]
Liquid limit, Plastic limit, Plasticity Index, Liquidity Index, Shrinkage limit, Plasticity chart.

8. **IDENTIFICATION AND CLASSIFICATION OF SOIL:** [03]
Field identification of soil Engineering classification of soil, Textural classification of soil, group index, Unified classification of soil, I.S. Classification of soil, Practical use of soil classification.

9. **SUBSURFACE INVESTIGATION:** [03]
Planning soil exploration, Methods of exploration, Soil borings, sounding, sampling, spacing and depth of borings, Stand and penetration test, record of field investigation.

10 **MINERALS:** [02]
Definition, important physical properties of Minerals, basic idea of Crystal System, study and identification of common rock forming Minerals, Clay Minerals and their properties.

**11 ROCKS:** [03]

Definition and Main rock types

A. Igneous rocks: Definition, Acidic and Basic Rocks, Textures and Classification of Igneous Rocks, Dykes and Sills, Study and Identification of Common Igneous Rocks with their uses.

B. Sedimentary Rocks : Definition, Mode of Formation, Particle Size in Sediments, Consolidation,

Structures of Sedimentary Rocks, Classification, Study and Identification of common Sedimentary Rocks with their uses.

C. Metamorphic rocks; Definition; Agents, Types and Grades of Metamorphism. Classification and Structures of Metamorphic Rocks. Study and Identification of common Metamorphic rocks with their uses.

**12. GEOLOGICAL STRUCTURES:** [02]

Stratification, Outcrops, Dip and Strike, Use of Clinometer Compass, Types of Folds & Faults, Unconformity and Joints, Effects of Geological Structures on Engineering Structures.

**13. SUBSURFACE WATER:** [03]

Source, varieties and distribution of subsurface water, Water Table, Ground water mounds and depression effects of Cone of depression. Fluctuation of water table relationship, Fresh and Saline ground water. Artesian water and Springs, Methods of ground water investigation.

**14. ROCK MECHANICS:** [05]

Geotechnical Investigation in Rocks, Methods of rock exploration, Core drilling and core recovery, R.Q.D., Geological and Engineering classification of rocks, Important physical and mechanical properties of rocks and their methods of testing in laboratory. Outlines of Seismic and Resistively methods.

**C. LEARNING OUTCOMES**

An ability to carry out specific field investigation including collection of soil and rock samples for testing and observation of soil and rock behaviour also able to identify and classify soil based on standard geotechnical engineering practice.

**D. RECOMMENDED TEXTBOOKS**

1. Soil Mechanics and Foundation engineering by B.C.Punmia, Laxmi Publishers
2. Engineering and General Geology by Parbin Singh, Katson Publication

**E. REFERENCE BOOKS**


1. Soil Mechanics and Foundation engineering by V.N.S Murthi, UBS Publisher
2. Principles of Geotechnical Engineering by B.M. Das, Tata McGraw Hill Publication
3. SP-36-1: Compendium of Indian standards on soil Engineering: Part-1 Laboratory testing of Soils for civil Engineering Purpose.
4. SP-36-2: Compendium of Indian standards on soil Engineering: Part-2 Field testing of Soils for civil Engineering Purpose.
5. IS : 13365 Classification system of rock mass.
6. IS: 9143 Method of determination of Unconfined compressive strength.
7. IS:12070 Code of Practice for Design and construction of shallow foundation on Rocks.
8. IS:13030 methods of test for laboratory determination of water content, porosity, density and related properties of Rock material.


**F. Experiment No.**

| | **Name of Experiment** |
|---|---|
| **1** | Field density test by core cuter method. |
| **2** | Field density test by sand replacement method. |
| **3** | To determine specific gravity of soil sample. |
| **4** | To determine percentage of various size of soil particles by fine sieve analysis. |
| **5** | To determine percentage of various size of soil particles by hydrometer analysis. |
| **6** | To determine liquid limit and plastic limit of given soil sample. |
| **7** | To determine shrinkage limit of given soil sample. |
| **8** | To determine % free swell of soil. |
| **9** | To determine Relative density of soil. |
| **10** | Rock Identification. |
| **11** | To determine Physical properties of Rock. |
| **12** | To determine Compressive strength of rock and one point method. |
| **13** | To determine slake durability of rock. |
| The termwork shall consist of about 25 problems from the course work. | |

## (CL-514 ) STRUCTURAL ANALYSIS - III

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 2 | 0 | 60 | 40 | 25 | 0 | 125 | 4 | 2 | 0 | 6 |

### A. OBJECTIVES OF THE COURSE

To equip the students with the classical methods of structural analysis with emphasis on analysis of indeterminate structures.

### B. DETAILED SYLLABUS

1. Plastic Method: [06]
   Elementary Plastic Theory of Bending, Plastic Hinges, Plastic Moment of Resistance, Shape Factor, Load Factor, Collapse Load, Collapse Mechanism, Analysis of Beams And Portal Frame
2. Influence Lines for Indeterminate Structures [08]
   Muller Breslau Principle Applied to Beams & Frames.
3. Approximate Methods: Portal Method, Cantilever Method and substitute method [04]
4. Beams Curved In Plan And Elevation [03]
5. Spherical And Conical Domes [03]
6. Column Analogy Method: [06]
   Application To Fixed Beams - Analysis Of Beam Of Prismatic And Non-Prismatic Types. Evaluation Of Stiffness And Carry-Over Factors.
7. Prestressed Concrete [08]
   Properties Of High Grade Concrete And High Steel, Pre-Tensioning And Post-Tensioning, Losses In Prestress, Analysis Of Sections In Flexure.
8. Stiffness Member Approach [10]
   Stiffness Member Approach For Beams And Plane Truss

### C. LEARNING OUTCOMES

The students have the advanced knowledge of methods of analysis like Plastic methods, Approximate Method and Prestressed Concrete.

After studying this subject students will be able to:

- Determine the maximum reaction, shear force and bending moment for Indeterminate beams and trusses for rolling loads.
- Determine reactions & internal forces in statically indeterminate structures.
- Determine forces and reactions in spherical and conical domes.

## D. RECOMMENDED TEXTBOOKS

1. Basic Structural Analysis by C. S. Reddy, Publisher- Tata McGraw Hill

## E. REFERENCE BOOKS

1. Indeterminate Structural Analysis By Kinney Publisher- Oxford
2. Indeterminate Structural Analysis By C. K. Wang Publisher- Tata McGraw Hill
3. Analysis Prestressed Concrete By Krishna Raju Publisher- Tata McGraw Hill
4. Fundamentals of structural Mechanics and analysis by M.L. Gambhir, Printice Hall India

## F. LIST OF TUTORIALS

1. Plastic Method
2. Influence Lines for Indeterminate Structures
3. Stiffness Member Approach
4. Prestressed Concrete
5. Column Analogy Method
6. Beams Curved In Plan And Elevation
7. Approximate Methods

## (CL-515 ) PLANNING & ARCHITECTURE

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

### A. OBJECTIVES OF THE COURSE

To understand, plan, develop and design different types of buildings and the systems affiliated to it. It also take care of safety, economy, convenience, adoptability, sustainability and energy saving
concepts in building design.

### B. DETAILED SYLLABUS

1. **General Principle of Architecture** [04]
   Study of general principles of architectural proportions and compositions. – Mass composition, principle of elevation development technique and colours.

2. **Building regulations & building bye-laws**, layout plan, built-up area, FSI, frontage/setbacks, parking etc., vertical transportation, projections, fire & safety. [03]

3. **Principles of Planning**. – Basic areas in residential buildings, process of planning, family requirements, conceptual plan outline, principle and techniques of functional planning. [06]

4. **Planning of residential buildings** - Plan preparation for residential units, structure, space and analysis, activity space, elements of human scale, size and dimension, furniture layout. [04]

5. **Planning of Non-Residential Buildings**- Approach of activity for public buildings, hostel, school, office, primary health centre- space norms, basic areas, functional setting areas. [04]

6. **Building Drawings**- Key plan, site plan, working drawing, perspective drawing, introduction to building drawing software. [09]

7. Use of National Building Code guide lines for building services, electrification, plumbing, firefighting system etc., Basic Principles [06]

### C. LEARNING OUTCOMES

1. Students can plan the buildings according to architectural principles incorporating building bye laws.
2. Students can draw various design alternative plans for various types of buildings.

### D. RECOMMENDED TEXTBOOKS

1. Planning & Designing of Buildings, by Y.S. Sane. Engineering Book Publishers, Pune

### E. REFERENCE BOOKS


1. Building Planning and Drawing, by, Kumara Swamy and Kameshwar Rao. Charotar Publications.
2. Building Drawings, by, Shah-Kale-Patki, Tata McGraw Hill
3. Civil Engineering Drawing, by, Gurucharan Singh, Chand Publications.
4. National Building Code (2016)/ SP-7

F. **LIST OF DRAWING SHEETS TO BE PREPARED:**

| Experiment No. | Name of Experiment |
|---|---|
| **1.** | Planning of Residential Building |
| **2.** | Planning of Flat in Multi-storey Building |
| **3.** | Planning of Public Building |
| **4.** | Planning of Institutional Building |
| **5.** | Planning of Industrial Building |

## (CL-516 ) DESIGN OF STRUCTURES-I

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 2 | 0 | 60 | 40 | 25 | 0 | 125 | 4 | 2 | 0 | 6 |

### A. OBJECTIVES OF THE COURSE

To make students familiar with the fundamental design philosophies of reinforced concrete and steel structures and learn element design.

### B. DETAILED SYLLABUS

**(I) DESIGN OF REINFORCED CONCRETE STRUCTURES**

1. **INTRODUCTION:** [03]
   Introduction to various design methods i.e. Working Stress Method, Ultimate Load Method and Limit State Method - Brief History and Comparison.

2. **DESIGN OF BEAMS BY WORKING STRESS METHOD:** [03]
   Design of Singly Reinforced Rectangular Beams by Working Stress Method for Flexure only.

3. **ELEMENT DESIGN BY LIMIT STATE METHOD:** [18]
   Design of Singly Reinforced and Double Reinforced Rectangular Beams for Limit State of Collapse for Flexure, Design of Flanged Beams for Limit State of Collapse for Flexure, Design of Rectangular Beams for Limit State of Collapse for Shear, Design One-way and Two-way slabs (all simply supported), Design of Axially loaded Short Columns and Isolated Footings, Staircase.

**(II) DESIGN OF STEEL STRUCTURES**

1. **INTRODUCTION:** [05]
   Introduction to various design methods i.e. Working Stress Method, Ultimate Load Method and Limit State Method - Brief History and Comparison. WSM applied to Tension and Compression Members.

2. **DESIGN OF TENSION MEMBERS:** [05]
   Members made up of single and built-up sections, Choice of sections, Connections (riveted, bolted & welded), Splices.

3. **DESIGN OF COMPRESSION MEMBERS:** [06]
   Single and Built-up sections, Choice of sections, lacing and battering.

4. **BEAMS:** [04]
   Laterally Restrained and Unrestrained including deflection check.

5. **FOUNDATIONS:** [04]
   Design of Slab base, Gusseted base.

### C. LEARNING OUTCOMES

At the end of this course, students will be able to handle element design of RCC Structures and Steel Structures as per Limit State Method of Design.

### D. RECOMMENDED TEXTBOOKS


1. Reinforced Concrete Design by S Unnikrishna Pillai & Devdas Menon, Tata McGraw Hill Publication
2. Design of Steel Structures by N. Subramanian, Oxford Publication

## E. REFERENCE BOOKS


1. Design of RCC Structures Vol-I by H. J. Shah, Charotar Publication
2. Reinforced Concrete Design by N. Krishna Raju, R. N. Pranesh, New Age International Publishers.
3. Design of RCC Structures by P. C. Varghese, PHI Publications
4. Limit State Design of Steel Structures, S. K. Duggal, Mc Graw Hill Publications.
5. Design of Steel Structures, Arya & Ajmani, Nemchand & Sons Publications.
6. IS 456:2000 (Reaffirmed 2005), Plain and Reinforced Concrete - Code of Practice (Fourth Revision)
7. IS 800:2007, General Construction in Steel – Code of Practice (Third Revision)
8. IS 875 (Part 1): 1987, Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures (Dead Loads)
9. IS 875 (Part 2): 1987, Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures (Imposed Loads)
10. IS 875 (Part 1): 2015, Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures (Wind Loads)
11. SP24, Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete Structures
12. SP 6(1), Handbook for Structural Steel Sections.


## F. LIST OF TUTORIALS

1. Orientation Exercise
2. Design of RCC Beam by WSM
3. Design of RCC Beam by LSM for Flexure and Shear
4. Design of T-Beam
5. Design of Simply Supported Slabs
6. Design of Axially Loaded RCC Column & Footing
7. Design of Connections
8. Design of Tension Members
9. Design of Compression Members
10. Design of Steel Beams

## (CL- 517 ) Concrete Technology

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Prac. | Ext | Sess. | TW | Prac | Total | Lect. | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

### A. OBJECTIVES OF THE COURSE

To make the students aware of the various techniques and practices on basic construction materials like Cement, Concrete, aggregates etc. and careful selection of suitable construction
materials and their mix proportions to satisfy performance criteria of structure.
To get on hand practical experience of various Quality control techniques for Concrete.

### B. DETAILED SYLLABUS

1. **Cement** [06]

History of cementing materials, Manufacture of Portland cement, Chemical composition and hydration mechanism of OPC, Properties of cement hydrates, Composition, properties and use of various cements, Physical properties and testing of cement

2. **Aggregates** [04]

Classification of aggregates based on size, source and shape, texture ; Physical properties of aggregates, specific gravity, bulk density, porosity and absorption, Moisture content, Strength and soundness of aggregate, Alkali-aggregate reaction,Grading requirements and practical grading, gap graded aggregates

3. **Admixtures** [03]

Water reducing admixtures, plasticizers, super plasticizers, Accelerators, Retarders, Air entraining agents, water proofing agents, Effect of various admixtures on concrete properties, Mineral admixtures

4. **Fresh Concrete** [03]

Workability – factors affecting workability, Measurement of workability, Segregation and bleeding of concrete, Batching, Mixing, Conveying, Placing, compacting and curing of concrete.

5. **Strength of concrete : -** [03]

Factors affecting strength, water-cement ratio,
Gel/space ratio,
Maturity concept of concrete, Tensile and Compressive strength of concrete,
Failure mechanism under compression and tension.

6. **Elasticity, Creep and Shrinkage** [03]

Elastic properties of concrete, factors affecting modulus of elasticity,
Dynamic and static modulus, creep of concrete, factors affecting creep
Shrinkage-classification, reasons and mechanism of various shrinkage in concrete, Moisture movement in concrete.

7. **Durability** [04]

Permeability of concrete, sulphate attack & its control,
Sea water attack, corrosion, thermal properties of concrete,
Fire resistance, resistance of concrete to freezing and thawing conditions,
Resistant to abrasion, erosion and cavitations, crack in concrete & its control

8. **Testing of concrete** [03]

Compression test – cube and cylinder, tensile strength testing
Non-destructive testing – Rebound hammer,
Ultrasonic pulse test, Pull out test, variation in test results

9. **Mix Design** [03]

Statistical quality control of concrete, concept of mix design, Specification of mix design, IS method for concrete mix design, Acceptability criteria, Variability of result. Statistical quality control of concrete, concept of mix design

10. **Special Concrete** [04]

Classification, raw material and application of special concretes , Self compacting concrete, High strength and High Performance Concrete, High volume fly ash concrete, Light weight concrete, polymer concrete, fibre-reinforced concrete, High density concrete, Aerated concrete.etc. Special concreting methods: Pumpable concrete, Ready mix concrete.

## C. LEARNING OUTCOMES

After successful completion of the course, student will be able to

Understand basic constituents of the concrete and their applications.
Overall understanding on manufacturing process of concrete, behaviour of Concrete, characteristics of concrete.
In addition to traditional methods, students will get to know about Modern Concretes, Various admixtures and Quality control techniques through on hand practical experience.
Do most optimum methods for Concrete mix designs.

## D. RECOMMENDED TEXTBOOKS


1. M.S.Shetty “Concrete Technology” S.Chand Publishers, New Delhi,2005
2. A.N.Neville & J.J.brooks “ Concrete technology” ELBS publication,1987


## E. REFERENCE BOOKS AND I.S CODES.


1. Mehta, P.K, Monterio P.J.M.”,Concrete -Microstructure, Properties and Materials” Third edition, McGraw hill Publishers, New Delhi,1993
2. M.L.Gambhir “Concrete Technology” McGraw hill Publishers,N.Delhi,2005
3. A.N.Neville “ Concrete technology” ELBS publication,1987
4. I.S. Concrete Mix Proportioning- Guidelines.(IS10262:2009)
5. IS:456-2000, “Plain and Reinforced concrete code of practice, BIS, New Delhi
6. IS:383-1970. “Specification for coarse and fine aggregates from natural source of concrete, BIS, New Delhi.


## F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)

| Experiment No. | Name of Experiment |
|---|---|
| 1. | Fineness of cement (By sieving). |
| 2. | Standard Consistency of cement paste. |
| 3. | Initial and Final setting time of cement |
| 4. | Compressive strength of cement mortar. |
| 5. | Sieve analysis of coarse and fine aggregates. |
| 6. | Slump test. |
| 7. | Compacting factor test |
| 8. | Flow test |
| 9. | Compressive strength of cubes and cylinders |
| 10. | Modulus of Rupture test |
| 11. | Rebound hammer test |
| 12. | Ultrasonic Pulse Velocity Test |

**B.E. SEM VI**

**(CL- 613) SOIL MECHANICS**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

To establish an understanding of the fundamental concepts of mechanics of different types of soil materials including behaviour of materials.
To build the necessary theoretical background for design and construction of foundation systems.

**B. DETAILED SYLLABUS**

**1. INTRODUCTION** [01]

Introduction, Types of problems – Plastic, elastic and elasto-plastic analysis, Problems for soil as contraction and foundation material.

**2. PERMEABILITY AND SEEPAGE:** [06]

Introduction to permeability, Darcy's Law and its validity, Discharge and Seepage velocities, Laboratory determination of permeability, Field methods of determination of k, Approximate values of the co-efficients of permeability, permeability of stratified soil masses, factors affecting permeability
Introduction to Seepage, Laplace equation, Flow net construction, Determination of quantity of seepage and seepage pressure and uplift pressures, Quick sand condition,

**3. COMPACTION:** [06]

Definition, theory of compaction, Laboratory compaction tests, Factors affecting compaction in the field, Effect of compaction on soil properties, Field compaction, Specifications of field compaction, Special compaction techniques.

**4. STRESS DISTRIBUTION STRESSES IN SOIL:** [10]

Introduction, Boussinesq's equation for concentrated load, Westergaard's equation for concentrated loads, Comparison of Boussinesq and Westergaard's equations, Line loads, Strip loads, Stresses beneath the corner of a rectangular foundation, Stresses under uniformly loaded circular footing, vertical stress beneath loaded areas of irregular shape, Pressure isobars, Newmark's Influence chart

**5. CONSOLIDATION OF SOILS:** [07]

Compressibility of Soils, Definition and Mechanism of Soil, Consolidation, Spring Analogy, Compression Index, Coefficient of Compressibility, Coefficient of volume change, Derivation of Terazagi's One Dimensional consolidation Equation, Time factor and consolidation ratio, calculation of consolidation settlement for uniform pressure increment in clay layer, one Dimensional consolidation test, Laboratory and theoretical time curves.

6. **SHEARING RESISTANCE AND STRENGTH:** [07]
Mohr's strength theory, Mohr-Coulomb strength theory, Types of shear tests: Direct shear test, Unconfined compression test, triaxial compression test, Drainage conditions – UU, CU, CD, Vane shear Test, Effective Stress principle.

7. **EARTH PRESSURE:** [06]
Active and passive earth pressure due to backfill, Earth Pressure at rest, Rankine's earth pressure theory, Coulomb theory of earth pressure, Culmann's graphical method to find Active earth
pressure, Poncelete's construction for active earth pressure.

8. **STABILITY OF SLOPES:** [05]
Idealized Condition used in the analysis, factor of safety, Infinite and finite slopes, Stability of Infinite slopes, Introduction to Swedish Circle Method of Analysis, Fellenius method to locate centre of most critical failure rupture, Taylor's Stability Number.

## C. LEARNING OUTCOMES

An ability to apply knowledge of mathematics, science and engineering,
An ability to design and conduct experiments also analyze
and interpret data, An ability to identify, formulate and
solve engineering problems

## D. RECOMMENDED TEXTBOOKS

1. Soil Mechanics and Foundation engineering by V.N.S Murthi, UBS Publisher

## E. REFERENCE BOOKS


1. Principles of Geotechnical Engineering by B.M. Das, Tata McGraw Hill Publication
2. SP-36-1: Compendium of Indian standards on soil Engineering: Part-1
   Laboratory testing of Soils for civil Engineering Purpose.
3. SP-36-2: Compendium of Indian standards on soil Engineering: Part-2
   field testing of Soils for civil Engineering Purpose.
4. Soil Mechanics and Foundation engineering by B.C.Punamia, Laxmi Publishers
5. Basic Soil Mechanics by Whitlow, Construction Press
6. Advanced Soil Mechanics by B.M. Das, Tata McGraw Hill Publication


## F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)

| Experimen t No. | Name of Experiment |
|---|---|
| 1. | To determine Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for a given soil sample by Light Compaction test. |

| | |
|---|---|
| | using Constant Head Permeability test. |
| **2.** | To determine Coefficient of the Permeability of the given soil sample<br>using Falling Head Permeability test. |
| **3..** | To determine Shear Strength parameters (c & Φ) of given soil sample<br>using Direct Shear test. |
| **4.** | To determine shear strength parameters (c & Φ) of given soil sample using<br>Unconfined Compression test. |
| **5.** | To determine undrained shear strength of given clay soil sample using<br>Laboratory Vane Shear test. |
| **6.** | To determine shear strength parameters (c & Φ) of given soil sample using<br>Triaxial Unconsolidated Undrained test |
| **7.** | To determine consolidation parameters of given soil sample using odometer test. |
| **8.** | To determine Coefficient of the Permeability of the given soil sample |

## (CL-614) ENVIRONMENTAL ENGINEERING

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

### A. OBJECTIVES OF THE COURSE

To understand basic concepts and unit process of water and sewage treatments. To understand sources of water, water requirement for various uses and estimate the quantity of drinking water and domestic waste water for a given locality. To know the characteristics which defines quality of drinking water and sewage. To learn the design of conventional water and sewage treatment plants. To understand sewerage system and its design.

### B. DETAILED SYLLABUS

**1. INTRODUCTION** [02]

Sources of Environmental contaminants, Water supply,
Sewerage,
Sources & types of water pollutants, Interrelationship of environmental System Overview : Water Resource Management System, Waste water management system.

**2. QUANTITY OF WATER & SEWAGE** [03]

Relation of quantity & population, water use for different purposes, design periods, Per capita demand, Various types of Water demand : Domestic , Institutional, Fire, Public use demand, Factors affecting water demand, Methods of Population forecasting, suitable application of each method, Numerical examples on methods of forecasting population and water requirement. , Variation in water demand- Seasonal, Monthly, Hourly and daily variation.

**3. QUALITY OF WATER** [04]

Water & its impurities, Water quality criteria for drinking purpose, Water analysis, IS standards for potable water, Determination of physical, characteristics of Water : Temperature, Turbidity, Colour, Taste and odor , Determination of chemical characteristics of Water : pH, Solids, Chloride, Hardness., Flouride, Iron and Manganese, Nitrogen etc., Determination of bacteriological characteristics of Water : MPN, Membrane Filter technique.

**4. COLLECTION OF WATER** [02]

Intakes, Types of Intakes : Canal intake, River intake, Lake intake, Reservoir intake.

**5. WATER TREATMENT** [05]

Conventional water treatment & its objectives , Sedimentation, Coagulation-flocculation, Filtration, Mechanism of filtration, Disinfection, Miscellaneous water treatment techniques

**6. DISTRIBUTION OF WATER** [03]

Distribution system, Elevated service reservoir, Valves, Design of water distribution system

**7. SEWERAGE** [02]

General considerations, terminology, separate versus combined system of sewer.

**8. SEWERAGE SYSTEM** [03]

Sewer materials, Sewer appurtenances, Design of sewer systems, Construction and maintenance of sewer

**9. CHARACTERISTICS OF WASTEWATER** [05]

Variability of wastewater & water analysis, Physical characteristics ,Chemical characteristics, Biological Characteristics, Decomposition of sewage,Bio-chemical oxygen demand, chemical oxygen demand, B.O.D. Test, Numericals based on B.O.D., Microbiology of sewage, Decomposition of sewage, sampling.

**10. WASTE-WATER TREATMENT** [09]

Objectives, Preliminary treatment , Physical unit processes : Screening,grit removal, Oil and grease removal, Sedimentation, Physico treatment process : Coagulation -Flocculation ,Flow Diagram of Sewage treatment plant, Biological Unit Processes : Theory, Principles, Design of Activated sludge process, ASP & its modifications, operational difficulties in ASP, SVI, SDI, Attached growth processes- trickling filters, Std. rate and High rate trickling filter, Operational difficulties, Design using NRC equations, Waste stabilization ponds, Onsite Sewage treatment process- Septic tank and its design., Basics of Anaerobic digestion, Process biochemistry of sludge digestion.

**11. SLUDGE TREATMENT & ITS DISPOSAL** [02]

Importance of sludge management, Quantity & quality of sludge,Major sludge treatment processes, Management & disposal of sludge.

**12. SEWAGE DISPOSAL** [02]

Disposal techniques, Water quality management in rivers , Water quality-modelling- DO Sag curve.

**13. AIR POLLUTION** [06]

Air Resource Management System, Sources of Air pollutants, Classification of pollutants, Ambient air quality standards , Origin and fate of air pollutants, Meteorology- Atmospheric dispersion, Effect of air pollutants on health, vegetation and material, Air pollution control of stationary sources.

## C. LEARNING OUTCOMES

After learning this subject student will able to

Estimate the quantity of drinking water and domestic waste water for a given locality.

Know the characteristics which defines quality of drinking water and sewage.

Understand various unit processes and operations used for water and domestic wastewater treatment

Design conventional water and sewage treatment plants.

## D. RECOMMENDED TEXTBOOKS


**1.** G.S.Birdie & J.S. Birdie "Water supply and Sanitary Engineering",Dhanpatrai Publishing Company Ltd., 2007.

2 Metcalf & Eddy "Waste water Engineering-Treatment, Disposal and Reuse",Tata Mcgraw Hill publication,2005

3 M.L.Davis and D.A. Cornwell "Introduction to Environmental Engineering", Tata Mcgraw Hill publication,2005

## E. REFERENCE BOOKS

**1.** Steel & MgZee "Water & Waste water Engineering" Tata Mcgraw Hill publication,2003

**2.** Peavy, Rowe, Tchobanoglous "Environmental Engineering" , McGraw Hill International edition,1985

**3.** K N Duggal "Elements of Environmental Engineering", S.Chand & Company Ltd,2010

**4.** "Manual on Water supply and treatment"3rd Ed.Pub: CPH & Env. Engg. Organization, Ministry of Urban Development, Govt. Of India, New Delhi, 1991.

**5.** "Manual on Sewage and Sewerage treatment"3rd Ed.Pub: CPH & Env. Engg. Organization, Ministry of Urban Development, Govt. Of India, New Delhi, 1991.

## F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD

| Exp. No. | Name of Experiment |
|---|---|
| **1.** | pH Value of water sample |
| **2.** | Turbidity of water sample |
| **3.** | Total solids of water sample |
| **4.** | Total suspended solids of water sample |
| **5.** | Total hardness of water sample |
| **6.** | Jar test |
| **7.** | Biological oxygen demand ( BOD ) of waste water sample |
| **8.** | Chemical oxygen demand (COD) of waste water sample. |
| **9.** | Determination of Suspended Particulate matter(SPM) in air |

The term work shall consist of about 25 problems from the coursework.

## (CL- 615 ) WATER RESOURCE ENGINEERING

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 0 | 60 | 40 | 0 | 0 | 100 | 3 | 0 | 0 | 3 |

### A. OBJECTIVES OF THE COURSE

The objectives of the course are to explain to the students

- Water resources of world and India, Scope and application of hydrology
- Hydrologic cycle, Various types of rain gauges to measure precipitation, Analysis of rainfall data, Various types of water losses and to estimate evaporation and infiltration loss from a basin, Run-off process
- Uses of hydrograph in water resources, Concept of stream gauging, Importance floods in water resources and flood frequency studies, Techniques of artificial recharge, The concept of groundwater development and management.

### B. DETAILED SYLLABUS

**1. INTRODUCTION** [02]

Hydrologic cycle; History of hydrology, Scope and application of hydrology; Hydrologic equation.

**2. PRECIPITATION** [07]

Forms of precipitation; Types of precipitation; Measurement of precipitation; Adjustment of precipitation data; Double mass curve analysis; Mean areal depth of precipitation; Optimum Rain-Gauge Network Design; Depth - Area - Duration analysis; Geographical distribution, Time distribution and variability of precipitation; Graphical Representation of precipitation; Analysis of rainfall data

**3. WATER LOSSES** [06]

(a) Various types of water losses

(b) Evaporation; Factors affecting evaporation; Measurement of evaporation; Evaporation in reservoirs; Methods of computation; Methods of reducing evaporation;

(c) Infiltration; Factors affecting Infiltration; Methods of Determining Infiltration; Infiltration Indices

**4. RUN-OFF** [04]

Runoff process; Relation of storm period; Rainfall to runoff; Factors affecting runoff; Methods of computation; Gauging of stream; Stage – Discharge Relationships; Interpretation of stream flow records.

**5. HYDROGRAPH ANALYSIS** [06]

Definition; Components of stream flow, hydrograph; Separation of hydrograph components; Factors affecting shape of hydrograph; Unit hydrograph; Propositions of unit hydrograph; Derivation of Unit Hydrograph from flood Hydrograph; Altering Duration of Unit Hydrograph; Unit Hydrograph from complex storms; S-hydrograph; Instantaneous unit hydrograph; Synthetic unit hydrograph.

**6. SUBSURFACE HYDROLOGY** [05]

Techniques of artificial recharge; Solutions to Transient problems of ground water mounds; Theory of subsurface drainage; Stream aquifer system; Ground water quality; Sea water intrusion into coastal aquifers; approximate solutions; Multiple well systems; Hydrogeologic systems analysis; Digital and analogue models for evaluations of aquifer response; Groundwater development and management.

7. **FLOODS** [06]

Causes of floods; Factors affecting flood flow; Methods of estimation of peak flood; Flood frequency studies; Envelope curves; Rational method; Gumbel's method; Flood control.

**Relevant computer programs / tools to be used in respective chapters.**

## C. LEARNING OUTCOMES

On the completion of the course the students should be able to:

- Calculate mean precipitation depth over a catchment
- Understand various methods of analysis of rainfall data
- Understand various types of water losses and their measurement
- Determine run-off from a catchment
- Understand different types of hydrographs, derivation of unit hydrograph from flood hydrograph and derivation of flood hydrograph from unit hydrograph
- Understand various types of stream gauging methods ,Estimate peak flood for a given basin

## D. RECOMMENDED TEXTBOOKS

1. Hydrology – Principles, Analysis, Design by H M Raghunath, New Age International Publishers

## E. REFERENCE BOOKS


1. Engineering Hydrology by K Subramanya, Mc-Graw Hill Publications (India) (P) Ltd.
2. A Text Book of Hydrology by P JayaRami Reddy, Laxmi Publication (P) Ltd., New Delhi
3. Applied Hydrology by K N Mutreja, Tata Mc-Graw Hill Company Ltd.
4. A Text Book of Hydrology and Water Resources by R K Sharma, Dhanpat Rai and Sons.
5. Water Resources Engineering by Larry W Mays, John Wiley and Sons, Inc.
6. IS 4987- 1994: Recommendations for establishing net work of rain gauge stations
7. IS 4986 - 2002: Installation of Rain gauge (Non-Recording Type) and Measurement of Rain - Code of Practice
8. IS 1192 – 1981 – Velocity – Area methods for measurement of flow of water in open channels
9. IS 3918 – 1966 – Code of practice for use of current meter (cup type) for water flow measurement
10. IS 5973-1970- Pan Evaporimeter (Amendment no.3) (Reaffirmed 1990)
11. IS 6509-1971- Recommendation for liquid flow measurement in open channels by weirs and flumes – weirs of finite crest width for free discharge (Reaffirmed 1990)
12. IS 6062 - 1971: Method of Measurement of Flow of Water in Open Channels Using Standing Wave Flume-fall (reaffirmed 1989)
13. IS 6063- 1971: Method of measurement of flow of water in open channels using standing wave flume (reaffirmed 1989)
14. IS 6939: 1992-Methods for determination of evaporation from reservoirs
15. IS 8389: 2003-Installation and Use of Rain gauges, Recording - Code of Practice

.
16 Handbook of Hydrology by David R Maidment, Mc-Graw Hill Inc.
.
17 Handbook of Applied Hydrology by Vijay P. Singh, Mc-Graw Hill Education
.

**List of open source learning websites**

- http://nptel.ac.in/courses/105101002/
- http://nptel.ac.in/courses/105104103/
- http://nptel.ac.in/downloads/105105110/

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE) : NIL**

## (CL- 616) DESIGN OF STRUCTURES-II

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

### A. OBJECTIVES OF THE COURSE

To make students familiar with the design of Reinforced Concrete and Steel structures.

### B. DETAILED SYLLABUS

#### (I) DESIGN OF REINFORCED CONCRETE STRUCTURES

1. **LOADS:** [01]
   Loading Standards as per BIS, Distribution of Loads, Computation of Wind Load and Earthquake Forces, Combination of Loads

2. **STRUCTURAL LAYOUT FOR BUILDINGS:** [03]
   Continuous Beam, Typical Floor Design including Two ways Continuous Slab.

3. **DESIGN OF COLUMNS:** [04]
   Short and Slender Columns with Uniaxial and Biaxial Bending.

4. **DESIGN OF FOOTINGS:** [06]
   Combined Footing and Raft.

5. **STRUCTURES:** [10]
   Cantilever Shed, Portal Frames, Rectangular Water Tanks, Retaining wall

#### (II) DESIGN OF STEEL STRUCTURES

1. **CONNECTIONS:** [03]
   Unstiffened, Moment and Shear resisting Structural Connections. Design and detailing of connection between Roof Truss to Column, Column to Beam, Beam to Beam and Truss to Bed Block.

2 **DESIGN OF ROOF TRUSSES** [06]
   Various types of Trusses and their selection in Industrial Structures. Effect of Wind & EQ or other loads on Trusses, Structural Detailing. Monitored and Knee-Braced Trusses.

3. **DESIGN OF BEAM COLUMN:** [03]
   Design of members subjected to combined actions, bending with compression/tension.

4. **DESIGN OF STEEL STRUCTURES:** [12]
   Cantilever Shed, Plate Girder, Industrial Building (Rolled/Tubular) including Gantry Girder, Through and Deck Type Bridges.

### C. LEARNING OUTCOMES

At the end of this course, students will be able to handle basic RCC and Steel Structures design as per Limit State Method.

### D. RECOMMENDED TEXTBOOKS

Publication

1. Design of Steel Structures by N. Subramanian, Oxford Publication

## E. REFERENCE BOOKS

1. Design of RCC Structures Vol-II by H. J. Shah, Charotar Publication
2. Reinforced Concrete Design by S. N. Sinha, McGraw Hill Education; Thirdedition.
3. Design of RCC Structures by P. C. Varghese, PHI Publications
4. Limit State Design of Steel Structures, S. K. Duggal, Mc Graw Hill Publications.
5. Design of Steel Structures, Arya & Ajmani, Nemchand & Sons Publications.
6. Design of Steel Structures, S. Ramamrutham, Dhanpatrai Publishing Company.
7. IS 456:2000 (Reaffirmed 2005), Plain and Reinforced Concrete - Code of Practice (Fourth Revision)
8. IS 800:2007, General Construction in Steel – Code of Practice (Third Revision)
9. IS 875 (Part 1): 1987, Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures (Dead Loads)
10. IS 875 (Part 2): 1987, Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures (Imposed Loads)
11. IS 875 (Part 1): 2015, Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures (Wind Loads)
12. SP24, Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete Structures.
13. SP16, Design Aids for Reinforced Concrete Structures.
14. SP34, Handbook on Concrete Reinforcement and Detailing

## F. LIST OF TUTORIALS:

1. Orientation Exercise
2. Design of RCC Slabs
3. Design of RCC Footings
4. Design of RCC Columns
5. Design of Cantilever Retaining Wall
6. Connection Design
7. Design of Steel Truss
8. Design of Plate Girder
9. Design of Gantry Girder
10. Design of Beam Column.

## (CL- 617) CONSTRUCTION TECHNOLOGY-II

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 0 | 60 | 40 | 0 | 0 | 100 | 3 | 0 | 0 | 3 |

### A. OBJECTIVES OF THE COURSE

To create awareness about advanced construction practices for Sub Structure & Super Structure of heavy structures under various conditions & To give knowledge of various construction
equipments & their selection criteria.

### B. DETAILED SYLLABUS

1. **Introduction:** [02]

Role of Construction equipment in Engineering Projects. Standard equipment and special equipment, Benefits of Equipment

2. **Earth Moving Equipment:** [10]

Engineering fundamentals of earth moving equipments like Rolling and Grade resistance, Coefficient of Traction, Effect of altitude and temperature on performance, Rim pull and Drawbar pull etc.
Wheel and Crawler mounted equipments and its operations, types, use and output of: Bulldozers, Scraper, Dragline, Power shovel, Excavator (Hoe) Trencher, Material handling equipments, Compaction equipments

3. **Concrete Equipments** [04]

Equipments for concrete production- Mixers, Transit mixers, Batching plant -Ready mix concreting etc.,
Concrete Transportation & Placing Systems-Concrete pumps etc, Various tools for Concreting work & Compaction works

4. **Coffer Dam, and Caisson** [04]

Coffer Dam: Type, Use and Selection of Coffer Dam, Forces acting on a coffer dam, Economical height, leakage problems
Caisson: Classification, use and selection criteria of caissons, Transportation, launching and sinking of various caissons, Construction problems
Diaphragm wall: Introduction & Construction Methodology

5. **Excavation Support System** [02]

Introduction to excavation support systems- Diaphragm wall, Soil nailing etc., Construction methodologies, Advantages & Uses

5. **Ground water Control During Excavation** [02]

Importance, Selection Criteria, Various methods: Sump, Bore-well, well points, Electro osmosis, Grouting, Freezing, shotcrete etc.

6. **Form Work** [04]

Materials &arrangement System for Formwork, Formwork for foundations, columns, beams,
walls etc.

7. **Economic Analysis of Equipment** [08]

Time value of money concept, Replacement Analysis, Owning & Operating Cost, Buy, Rent, Lease Concept, Economic & Physical life of equipment

## C. LEARNING OUTCOMES

After successful completion of the course, student will be able to

- understand various advanced techniques and construction methodology prevailing in construction practices
- Identify suitable construction equipments for any activity and their economic selection
- select appropriate method for from work systems

## D. RECOMMENDED TEXTBOOKS

1. Construction Planning, Equipment by Peurifoy, L., Schexnayder, C.J. and Shapira, McGraw Hill, New Delhi, 8th Edition, 2010
2. Construction Equipment and its planning and application by Dr. Mahesh Verma, Metropolitan Book Company, New Delhi,2003

## E. REFERENCE BOOKS

1. Construction Equipment and Management by S.C. Sharma, Khanna Publication, New Delhi,2003
2. Construction Technology by Shankar S.K, Saraswati S, Oxford University Press, New Delhi,2008
3. CWC guidelines on Equipment for river valley projects
4. IS 4926 : Code of practice for Ready Mix concrete
5. IS 14687 (1999): Guidelines for falsework for Concrete
6. Formwork of Concretes: Basic Design Principles and Construction Methods (3rd Edition) by C.K. Austin, Trans-Atlantic Publications

## F LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)

Nil

**B.E. SEM VII (CIVIL)**

**(CL-710) Irrigation and Hydraulic Structures**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Ext** | **Sess.** | **TW** | **Prac** | **Total** | **Lect** | **Tut** | **Prac** | **Total** |
| 03 | 02 | 00 | 60 | 40 | 25 | 00 | 125 | 03 | 02 | 00 | 05 |

## A. OBJECTIVES OF THE COURSE

The objectives of the course are to explain to the students

- Types of irrigation systems and irrigation efficiencies
- Different crop seasons and optimum utilization of irrigation water
- Design of irrigation canals by different methods
- Different types of diversion headworks
- Theories of seepage and design of weirs and barrages
- Canal regulators, canal modules and other miscellaneous canal structures
- Cross drainage works
- Dams in general and gravity dam and earth dam in particular

## B. DETAILED SYLLABUS

### 1. IRRIGATION [02]

Definition of irrigation, necessity of irrigation in India, advantages of irrigation and disadvantages of over-irrigation, types of irrigation, techniques of water distribution in farms, quality of irrigation water, water logging problems.

### 2. WATER REQUIREMENTS OF CROPS [04]

General, crop period and base period, duty and delta, importance of duty, measures to improve duty, crop seasons, optimum utilization of irrigation water, irrigation efficiencies, consumptive use, consumptive irrigation requirement and net irrigation requirements, estimation of consumptive use, soil – moisture relationship, estimating depth and frequency of irrigation on the basis of soil moisture regime concept.

### 3. CANAL IRRIGATION SYSTEM [02]

General, alluvial and non-alluvial canals, alignment of canals, distribution system for canal irrigation, certain definitions, computing design capacity of irrigation canal, canal regulation, Warabandhi system.

### 4. DESIGN OF IRRIGATION CANALS

Design of stable channels in India by Kennedy's and Lacey's approach, design of canal on alluvial soils and non-alluvial soils, use of Garret's diagrams, use of Lacey's

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gi

me diagrams and canal lining, design of canals by tractive force approach, cross – section of an irrigation canal, balancing depth of excavating canal. [04]

**5. DIVERSION HEADWORKS** [04]

(a) Introduction, purpose, weirs and barrages types, causes of failures, layout of diversion headworks.

(b) Bligh's and Khosla's theory, component parts, Design of vertical drop weir.

**6. CANAL FALLS** [02]

Definition and location, types of falls, design of - trapezoidal notch fall, simple vertical drop fall, Sarda type fall, straight glacis fall.

7. **REGULATORS, MODULES AND OTHER MISCELLANEOUS CANAL STRUCTURES** [05]

Canal regulation and canal regulation works, alignment of off-taking canal, distributary head regulator and cross regulator, silt control, location of head works, retrogression, types of canal escapes, types of metering flumes, requirements of good canal outlet, types of outlets, criteria for judging performance of outlets.

**8. CROSS DRAINAGE WORKS** [03]

Definition, types of cross – drainage works, selection of suitable type of cross – drainage work, design considerations for cross – drainage works.

**9. GRAVITY DAMS** [04]

Dams in general, various types of dams, problems in dam construction, selection of type of dam and their classification, factors governing selection of particular type of a dam, selection of a dam site, gravity dam, forces acting on a gravity dam, modes of failures and criteria for structural stability of gravity dams, elementary and practical profile of a gravity dam, high and low gravity dams, design of High and low gravity dam; galleries, joints, keys and water seals.

**10. EARTHEN DAMS** [04]

Introduction, types of earthen dams, methods of construction, causes of failures of earthen dams, design criteria for earth dams, selecting a suitable preliminary section of an earth dam, phreatic line in earth dam, stability of earth slopes, seepage control through embankments and foundations of earth dams, design of filters, slope protection, rockfill dam.

**11. SPILLWAYS** [02]

Necessity and types, energy dissipation and scour protection devices, I.S.I criteria for design of hydraulic jump type stilling basins with horizontal and sloping aprons, crest gates, outlet works.

**COMPUTER APPLICATIONS TO SPECIFIED PROBLEMS**

## C. LEARNING OUTCOMES

On the completion of the course the students should be able to:

- Understand necessity of irrigation in India and various types of irrigation systems
- Understand various types of irrigation efficiencies and determine net irrigation requirements (NIR), field irrigation requirements (FIR) and gross water

requirements (GIR)

- Design irrigation canals

- Understand the importance of diversion head works and to determine uplift pressure at key points of a hydraulic structure
- Understand functions of canal falls, canal escapes, regulators and modules
- Understand functions of cross drainage works
- Design of gravity and earth dams

**D. RECOMMENDED TEXTBOOKS**

1. Irrigation Engineering and Hydraulic Structures by S K Garg, Khanna Publishers.

**E. REFERENCE BOOKS**

1. Irrigation, Water Resources and Water Power Engineering by P N Modi, Standard Book House
2. Irrigation, Water Power and Water Resources Engineering by K R Arrora, Standard Publishers Distributors.
3. Irrigation and Water Power Engineering by B C Punmia and Pande B B Lal, Laxmi Publications (P) Ltd., New Delhi
4. Fundamental of Irrigation Engineering by Bharat Singh, Nem Chand and Brothers,

**List of open source learning websites**

http://nptel.ac.in/courses/105102159/

http://nptel.ac.in/downloads/105105110/

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE) – Nil**

## (CL- 711) PROFESSIONAL PRACTICE AND VALUATION

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3.0 | 0.0 | 1.0 | 4.0 |

### A. OBJECTIVES OF THE COURSE

To build the professional skills, construction procedures and knowledge on valuation techniques and property analysis.

### B. DETAILED SYLLABUS

**1. ESTIMATES:** [04]

Necessity and types, Approximate and detailed estimates, methods and Uses.

**2. SPECIFICATIONS:** [04]

Definition, objects and Importance, Requisites of good specification, classification of specifications, Standard specifications, Specifications of some important typical items.

**3. RATE ANALYSIS:** [03]

Purpose, factors affecting rate analysis, SOR, Task works per day, rate of material and labour, rate analysis of typical items.

4. **CONDITIONS OF CONTRACT**: [04]

Definition, object, importance, general provisions, typical conditions of contract.

**5. CONTRACTS:** [06]

Meaning and Importance, Essential requirements of a contract, Types of contract- Labour contract, Negotiated contract, SOR contracts, contract documents, termination of contract, responsibilities of the engineer, the contractor and client, earnest money and security deposits.

**6. TENDER:** [02]

Meaning, Opening, Scrutiny and acceptance of tenders, Revocation of tender, unbalanced tender, liquidated damages.

[02]

**7. Arbitration:**

Definition, Arbitrator and referee, types of arbitration, powers of an arbitrator, process of arbitration, advantages of arbitration.

**8. EASEMENTS:**

Definition, Essential characteristics, Creation of easements, Extinguishment of easements. [02]

**9. VALUATION:**

Purposes, Cost - price - value, Different forms of value, Freehold and leasehold properties, Sinking fund, Amortization, depreciation and obsolescence, Capitalized [05]

value and year's purchase, Interest rates, Ideal investment, Mortgage, Annuity, Methods of valuation.

**10. WORKS AND STORES ACCOUNTING:** [04]

Stores, Vouchers and receipts, Capital works and repair works, Administrative approval and technical sanction, Measurement book, Muster roll, Daily reports, Imp rest, Advance payments, Work-charged establishments, Inventory

**C. LEARNING OUTCOMES**

Critically analyse and apply industry professional knowledge, theoretical, methodological and ethical concepts in valuation practices.
Critically analyse and synthesise property data to undertake an evidenced based market analysis.
Analyse and synthesise property data and trends to determine property value for a commercial or specialised property

**D. RECOMMENDED TEXTBOOKS**

1. Estimation and Costing by Rangwala, Charotar Publications.
2. Estimating & Costing in Civil Engineering Theory & Practice by B.N. Dutta, UBSPD.

**E. REFERENCE BOOKS**

1. Estimating, Costing, Specification and Valuation in Engineering by M. Chakraborti,
2. Estimation, Costing and Accounts by D.D. Kohli, S. Chand & Co.
3. Textbook of Estimating and Costing (Civil Engineering) by G.S. Birdie, Dhanpat Rai Publications.

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE): Nil**

## (CL-712) FOUNDATION ENGINEERING

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 2 | 0 | 60 | 40 | 25 | 0 | 125 | 4 | 2 | 0 | 6 |

### A. OBJECTIVES OF THE COURSE

To build the necessary theoretical background for design and construction of foundation systems.

### B. DETAILED SYLLABUS

**1. INTRODUCTION:** [01]

Different types of footings, Suitability of foundation on different soil types, difference between shallow and deep foundation, factors governing the choice of soil type.

**2. BEARING CAPACITY OF SHALLOW FOUNDATIONS:** [12]

General requirements of satisfactory performance of foundation, basic terminologies, types of soil failures, Bearing capacity theories (Shear Criteria): Prandtl's, Rankine's, Terzaghi's, Meyerhoff's, IS code on sand and clay,
Bearing capacity (Settlement Criteria) from Standard Penetration Test, Bearing capacity from Plate Load Test, Calculation of Total settlement: immediate, consolidation and differential.

**3. BEARING CAPACITY OF RAFT OR MAT FOUNDATION:** [03]

Introduction, Combined footings, Common types of Mat foundation, Bearing capacity of mat foundation, Compensated foundation.

**4. PILE FOUNDATION:** [12]

Introduction, Classification of pile, Load transfer mechanism, Methods for determining bearing capacity of single pile: Static equation for estimating pile capacity, Dynamic formulae (Engineering New's Formula, IS code method), Pile Load Test on sand, clay and layered soil, Efficiency of pile group, Bearing capacity of pile group in clay and sand, pile group settlement, Negative skin friction.

5. **UNDER-REAMED PILE**: [04]

Introduction, Installation method, Bearing capacity of under-reamed pile.

6. **FOOTINGS ON COLLAPSIBLE SOIL**: [02]

General consideration, significant characteristics of collapsible soil, design of foundation on un-wetted collapsible soils and soils subjected to wetting, treatment methods for collapsible soils.

7. **FOOTINGS ON EXPANSIVE SOIL**: [02]

General consideration, significant characteristics of expansive soil, clay mineralogy and mechanism of swelling, design of foundation in expansive soil, treatment methods for expansive soils.

8. **CAISSON FOUNDATION**: [04]

Introduction, Types of caissons, stability analysis of caissons, Determination of Scour depth in cohesionless soils, thickness of steining of well.

9. **GROUND IMPROVEMENT TECHNIQUES**: [08]

Necessity for ground improvement, Field compaction, vibroflotation, Sand drains, Wick drains, Soil stabilisation using admixtures.

## C. LEARNING OUTCOMES

Students will be able to design shallow foundation with shear and settlement criteria.
Students will be able to design pile foundations and caissons,
Students will be able to design foundation on critical soils and study different ground improvement techniques.

## D. RECOMMENDED TEXTBOOKS

1. Soil Mechanics and Foundation engineering by B.C.Punamia, Laxmi Publishers
2. Soil Mechanics and Foundation Engineering by VNS Murthy, CBS publishers

## E. REFERENCE BOOKS


1. Principles of Foundation Engineering by Brija M. Das, Cengage Learning
2. Soil Mechanics and Foundation Engineering by K. R. Arora, Rajsons publications
3. Soil Mechanics and Foundation Engineering by P. Purushothama Raj, Pearson education
4. Foundation Design and Construction by M.J.Tomlinson, Longman Singapore Publishers (Pte) Ltd.
5. Foundation Analysis and Design by Joseph E. Bowles, McGraw – Hill Companies Inc.
6. Pile Foundation Analysis and Design, H. G. Poulos & E. H. Davis, John Wiley and Sons, Inc. Canada
7. Morden geotechnical Engineering by Alam singh, CBS Publishers & Distributors
8. Foundation Design, Principles and Practices by Donald P. Coduto, Prentice Hill, Upper Saddle River, New Jersey.
9. IS: 6403 – 1981 Code of practice for determination of bearing capacity of shallow foundations
10. IS:8009 - 1976 Code of practice of settlements of foundations
    Part 1: Shallow foundation subjected to symmetrical static vertical loads
    Part 2: Deep foundations subjected to symmetrical static vertical loading
11. IS 2911 (Part 1 to 4) - 2010 Practice for design and construction of pile foundations

12. IS 15284 (Part 1) – 2003 Design and Construction for Ground Improvement — Guidelines (Stone Columns)
13. IS 15284 (Part 2) - 2004 Design and Construction for Ground Improvement — Guidelines (Preconsolidation using Vertical Drains)
14. SP-36-1: Compendium of Indian standards on soil Engineering: Part-1 Laboratory testing of Soils for civil Engineering Purpose.
15. SP-36-2: Compendium of Indian standards on soil Engineering: Part-2 field testing of Soils for civil Engineering Purpose.

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE):**
NIL

## (CL-713) CONSTRUCTION MANAGEMENT AND ECONOMICS

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 0 | 60 | 40 | 0 | 0 | 125 | 4 | 0 | 0 | 4 |

### A. OBJECTIVES OF THE COURSE

To make students familiar with the basics of Construction management, project planning and allocation.

### B. DETAILED SYLLABUS

**1. INTRODUCTION** [02]

Construction Industry in India:
Construction & Economy - Requisites for successful contractor. Requisites for profitable construction business.

**2. ORGANISATION & MANAGEMENT:** [03]

Organization: Types, Principles, Suitability. Management: Principles, Functions, Benefits. Management Information Systems and Techniques.

**3. CONSTRUCTION PLANNING:** [12]

Necessity, factors points to be taken care of- Mobilization - Resources planning-scheduling phasing of work, CPM procedures, calculation for floats-updating of network time-grid diagram time-cost optimization. Resources allocation - Resources leveling.

**4. PROGRAM EVALUATON & REVIEW TECHNIQUE PERT:** [04]

Time concept, Calculations-frequency distribution curves

**5. FINANCIAL ANALYSIS:** [08]

Financial comparisons of alternatives & Different cost-its implications, decision making Benefits of financial analysis.

**6. CONSTRUCTION LABOUR MANAGEMENT:** [08]

Welfare-efficiency-Training-System of wages-Incentive plans.

**7. CONSTRUCTION MATERIAL MANAGEMENT:** [06]

Material planning-storage - inventory control systems advantages material accounting - order quantity- Different concept of analysis - Determination of safety stock level

**8. Management Information Systems and Safety in**

C

**onstruction:** [05]

Time concept, Calculations-frequency distribution curves

## C. LEARNING OUTCOMES

At the end of this course, the students will have the knowledge about the construction planning & scheduling procedures for a project. The students will gain knowledge about the type of contract systems to be selected for construction projects.

## D. RECOMMENDED TEXTBOOKS

1. Construction Project Management by K K Chitkara, Tata McGraw-Hill publication.
2. Construction Project Management – Theory and Practice by Kumar Neeraj Jha, Pearson publication.

## E. REFERENCE BOOKS

1. Construction Planning, Equipment and Methods by Robert Peurifoy, William Ledbetter and Clifford Schexnayder
2. Construction Engineering & Management by Seetharaman, S., Umesh Publications
3. Project Planning and Control with PERT and CPM by B. C. Punamia and Khandelwal, Laxmi Publications

## F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)

NIL

## (CL-714) Highway Engineering

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

### A. OBJECTIVES OF THE COURSE

To establish the understanding of fundamental concepts of highway engineering.
To build the necessary theoretical background for the design and construction of highway.

### B. DETAILED SYLLABUS

**1. INTRODUCTION:** [03]

Importance of transportation, Modes of transportation, Roles of Transportation, Scope of highway engineering

**2. HIGHWAY ALIGNMENT:** [03]

Highway Alignment, Engineering Surveys & Preparation of detailed report

**3. GEOMETRIC DESIGN OF HIGHWAYS:** [12]

Importance of geometric design, highway cross sectional elements, sight distance, design of horizontal and vertical alignment, highway capacity

**4. HIGHWAY MATERIALS:** [04]

Physical and Mechanical Properties of Soil, Stone aggregates, Bitumen binders, and Bitumen paving mixes; Bituminous mix design

**5. HIGHWAY CONSTRUCTION:** [04]

General features, Stages of construction, Earthwork, Soil stabilization, Bitumen Pavement Construction & Cement Concrete Pavement construction

**6. PAVEMENTS:** [03]

Types of Pavements, Factors affecting Pavement Performance and Design

**7. FLEXIBLE PAVEMENT DESIGN:** [07]

Design criteria, Design parameters, Design Methods-Empirical, Semi empirical and Theoretical methods, IRC recommendations

**8. RIGID PAVEMENT DESIGN:**

Design criteria, Design parameters, Stresses in Rigid Pavements, Design of Joints, Rigid Pavement Design, IRC recommendations

**9. DISTRESSES IN PAVEMENTS AND ITS MAINTENANCE:**

Introduction, Types of failures in flexible pavements and rigid pavements, Pavement evaluation – Structural and Functional, Maintenance techniques

## C. LEARNING OUTCOMES

After completion of this course, students will have adequate knowledge of design of pavements and perform experiments to analyse and interpret the data.

## D. RECOMMENDED TEXTBOOKS

1. Highway Engineering by S K Khanna, CEG Justo & A Veeraragavan; Nem Chand & Bros. publication

## E. REFERENCE BOOKS


1. Principles of Highway Engineering by L R Kadiyali; Khanna Publishers
2. Principles of Transportation Engineering by Partha Chakroborty & Animesh Das; PHI Learning publication
3. Principles of Pavement Design by E J Yoder & M W Witczak; John Willey & Sons Inc. publication
4. IS:1201-1978 to IS:1220-1978, Methods for Testing Tar and Bituminous Materials
5. IS:2386-1-1963 to IS:2386-8-1963, Methods of Test for Aggregates for Concrete
6. IRC:37-2012, Tentative Guidelines for the Design of Flexible Pavements
7. IRC:115-2014, Guidelines for Structural Evaluation and Strengthening of Flexible Road Pavements Using Falling Weight Deflectometer (FWD) Technique
8. IRC:73-1990, Geometric Design Standards for Rural (Non-Urban) Highways
9. IRC:15-2017, Standard Specifications and Code of Practice for Construction of Concrete Roads


## F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)

| Experiment No. | Name of Experiment |
|---|---|
| **11.** | Aggregate Impact Test |
| **12.** | Aggregate Crushing Test |
| **13.** | Shape Test |
| **14.** | Los Angeles Abrasion Test |
| **15.** | Specific Gravity & Water Absorption Test of Aggregate |
| **16.** | Soil CBR Test |
| **17.** | Bitumen Penetration Test |
| **8.** | Bitumen Softening point Test |
| **9.** | Bitumen Ductility Test |
| **10.** | Bitumen Viscosity Test |
| **11.** | Bitumen Flash & Fire point Test |

**ELECTIVE-2**

**CL 715 EARTH QUAKE ENGINERING**
**CL 716 PROJECT PLANNING AND CONTROL**
**CL 717 ADVANCED CONCRETE TECHNOLOGY**
**CL 718 DESIGN OF SPECIAL STRUCTURES**

## (CL-715) EARTHQUAKE ENGINEERING

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 2 | 0 | 60 | 40 | 25 | 0 | 125 | 3 | 2 | 0 | 5 |

### A. OBJECTIVES OF THE COURSE

To make students familiar with the basics of Structural Dynamics, Seismic Analysis and Earthquake Resistant design of structures.

### B. DETAILED SYLLABUS

1. **INTRODUCTION TO EARTHQUAKE** [02]
Geology of earth, influence of geology on earthquake, causes of earthquake and their characteristics. Earthquake parameters, magnitude, intensity, scales.

2. **THEORIES OF VIBRATION FOR SINGLE DEGREE OF FREEDOM (SDOF) SYSTEMS:** [12]
Vibration, definition, causes, classifications, Introduction to single degree of freedom vibrations. Free and Forced Vibrations of SDOF System subjected to Harmonic Loading, Numerical Evaluation of Dynamic Response

3. **THEORIES OF VIBRATION FOR MULTI DEGREE OF FREEDOM (MDOF) SYSTEMS:** [04]
Classical Modal Analysis for MDOF Systems, Calculation of Base Shear and Lateral Force on MDOF Systems

4. **SEISMIC ANALYSIS OF STRUCTURES AS PER IS 1893 (Part-1): 2016:** [12]
Introduction to codal provisions, Calculation of Seismic Coefficient, Equivalent Static and Dynamic Analysis of Structures, Effect of Unreinforced Masonry Infill on analysis of Reinforced Concrete Frames, Effect of unsymmetrical geometry and masses, estimation of story shears and torsional moments for unsymmetrical buildings, Calculation of Liquefaction Potential

5. **CAPACITY DESIGN AS PER IS 13920: 2016:** [06]
Concept of ductile detailing. IS:13920 code provisions for different RCC elements viz. Beams, Columns and Shear Walls.

## C. LEARNING OUTCOMES

At the end of this course, students will have fundamental knowledge of dynamic analysis and earthquake resistant design.

## D. RECOMMENDED TEXTBOOKS

1. Dynamics of Structures – Theory and Application by Anil K Chopra, Pearson Publishers
2. Earthquake Resistant Design of Structures by Manish Shrikhande and Pankaj Agrawal, Prentice-Hall India Pvt. Ltd.,

## E. REFERENCE BOOKS

1. Structural Vibrations – Theory and Computation by Mario Paz, CBS Publishers
2. Structural Dynamics by Clough and Penzin, McGraw Hill Int.
3. The Seismic Design Handbook by Farzad Naeim, Springer Publishers
4. IS 1893 (Part 1): 2016, Criteria for Earthquake Resistant Design of Structures (Part 1: General Provisions and Buildings)
5. IS 13920: 2016, Ductile Design and Detailing of Reinforced Concrete Structures subjected to Seismic Forces – Code of Practice
6. IS 456:2000 (Reaffirmed 2005), Plain and Reinforced Concrete - Code of Practice (Fourth Revision)
7. SP16, Design Aids for Reinforced Concrete Structures.

## F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)

NIL

| | | | | |
|---|---|---|---|---|
| | **3** | **Dynamics of Structures: Theory and Applications to EQ Engineering-2nd Editon** | **Pearson Publishers Asia** | **Anil K. Chopra** |
| **Reference Books** | **1** | **Structural Vibrations: Theory & Computations** | **CBS Publishers** | **Mario Paz** |
| | **2** | **Structural Dynamics** | **McGraw Hill Int.** | **Clough & Peinzin** |
| | **3** | **The Seismic Design Handbook** | **Springer** | **Farzad Naeim** |

# MS 134 - ADVANCED STRUCTURAL MECHANICS

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Review of concepts: basic concepts of structural analysis; basis for principal of virtual work; principal of virtual force-standard and matrix formulation; force method for analyzing skeletal structures; principle of virtual displacements – standards and matrix formulation; displacement method for analyzing skeletal structures; Extension of displacement method to the generalized stiffness method; basic concepts associated with computer implementation of stiffness method.
One dimensional beam element: Basis for cross-sectional level formulation of flexibility and stiffness: Guass-Quadrature Numerical Integration scheme: Flexibility approach for determining elements stiffness; Stiffness approach for determining element stiffness; special consideration of shear effects in stiffness approach; Consideration of torsional effects for thin walled member – inclusive of torsional bending; special considerations for finite joints (both rigid and flexible);consideration of local load (inclusive of temperature) effects; formulation of geometric stiffness due to axial force; linearised buckling analysis.
Simplification to reduce computational efforts in analysis: sub-structure analysis (static condensation) symmetry considerations in structures.

Books:


1. Matrix Analysis of Framed Structure - Gere & Weaver
2. Structural Analysis - Ghali & Nevelle
3. Computer Analysis of Structural Systems - Fleming J.F.
4. Non-linear Structures - Majid

# MS 109 - ADVANCED FOUNDATION ENGINEERING

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 0 | 60 | 40 | 0 | 0 | 100 | 3 | 0 | 3 |

Planning of subsoil exploration of mojor civil engineering projects, sampling methods interpretation on field and laboratory data, plate load and pile load tests, exploration of test data for actual foundations, shallow and deep footings, design of isolated and combined footing, proportioning of footings for equal settlement, various methods of craft design, floating foundations, analysis and design of pile foundation, raker piles, bored piles. Negative skin friction in piles, group action in piles, design of piles cap foundation subjected to eccentric loads, pull-out resistance of foundation structures, theory of subgrade reaction, anchored bulkheads, cassions and cofferdams, well foundation.

Books:


1. Analysis and design of foundation - J. Bowles
2. Soil mechanics & foundation engg. vol-II - V.N.S. Murthy
3. Principles of foundation Engg. - Braj Das
4. Foundation Engineering - M.J. Tomlinson

# MS 140 - FINITE ELEMENT METHOD

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 0 | 60 | 40 | - | - | 100 | 3 | 0 | 3 |

Linear elasticity; stress, strain ,constitutive relations; Boundary conditions; Description of an elasticity problem as a boundary value problem, Plane stress, strain, axial symmetric problems. Introduction to plasticity, Yield condition; ideal elasto-plastic material. Principles of Discretization, element stiffness mass formulation based on direct, variation principles, hybrid stress and mixed approaches, shape functions and numerical integration, convergence; Displacement formulations for rectangular and isoperimetric elements for two dimensional and axi-symmetric stress analysis.

Reference Books:


1. Finite Element Analysis - Krishnamurthy
2. Finite Element Method - Desai & Ables
3. The Finite Element Method - Rockey, Evans & others
4. The Finite Element Method - Zienkiewicz
5. Concepts and Application of Finite Element Analysis - Cook

# MS 138 - STRUCTURAL DESIGN PRACTICE – I

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 1 | 4 | - | - | 50 | 100 | 150 | 1 | 2 | 3 |

**Loads on structures:** Earthquake forces on Frames.

**Reinforced concrete:**

Complete design and structural detailing of structures, viz.

Design of grid floors, deep beams, Design of shear wall, Design of material retaining structures, silos, bunkers, Water Tanks, Chimney, Multistory buildings, Earthquake Resistant Design, machine foundation

Check for serviceability limits, analytical calculations for deflection, crack width, fire resistance, Detailing of RC Structures.

Books:

- Manual of Limit State Design, Variyani and Radhaji, CBS Publishers, New Delhi
- Reinforced Concrete Design. – Pillai & Menon
- Elements of earthquake engineering - Jaikrishna & Chandrasekaran
- Illustrated Design of G + 3 Building - Shah & Karve
- Advanced R.C. Design - Krishna Raju
- Plain & Reinforced Concrete Vol. II - Jain & Jaikrishna

# MS 239 – THIN PLATES AND SHELLS AND STRUCTURAL STABILITY

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Thin plate: small deflection theory, plate equation. Applications of Navier's solution, Levy's solution, Tables & Charts for solution of rectangular and circular plates with,

Shell behaviour, shell surfaces and characteristics, classification of shells equilibrium equations in curvilinear co-ordinates. Stress-strain & force displacement relations. Membrane analysis of shells of revolution and cylindrical shells under different loads.
Applications of membrane solution of elliptic paraboloids and hyperboloids. Solution of some typical problems.

Concept of stability, static dynamic and energy criterion of stability, flexibility and stiffness criteria, buckling, snap-through and post-buckling, Applications of solutions for for stability of columns, beams, Beams – Column, plates and simple shells. Stiffness, methods applied tostability problems.

Books:

1. S.P.Timoshenko and Woinowsky-Krieger, Theory of Plates and shells. Mcgraw Hill Internal, New Delhi.
2. W.T. Marshall, Design of cylindrical shell roofs, E and N Spon, London
3. Design & construction of concrete shell roofs - Ramaswamy, G. S.
4. Buckling of bars, plates and shells Don O. Brush and B. O. Almorth
5. Theory of elastic stability S. P. Timoshenko and J.M. Gere
6. Buckling of bars, plates and shells Don O. Brush and B. O. Almorth
7 Theory of elastic stability S. P. Timoshenko and J.M. Gere

## MS 234- DYNAMICS AND EARTHQUAKE ENGINEERING

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

SDOF Systems: Equation of motion, free vibration, harmonic load, evaluation of damping, periodic load, general load (time-domain, frequency domain) response spectrum load.
MDOF systems: Structural matrices, undamped free vibrations; generation of damping matrix; mode superposition analysis; practical considerations.
Characterisation of ground motion; earthquake intensity and magnitude; recording instruments and baseline correction; predominant period and amplification through soil; Earthquake spectra for elastic and in-elastic systems, idealization of structural systems for low, medium and high rise building; effect of foundation/soil on earthquake response; Codal provisions.

Books:


1. Dynamics and Vibration of Structures - Demeter G.Fertis
2. Introduction to Structural Dynamics - John M.Biggs
3. Structural Vibrations - Theory and - Mario Paz Computation
4. Structral Dynamics - Clough & Penzien
5. Elements of earthquake engineering - Jaikrishna & Chandrasekaran

# MS 243 - SOIL STRUCTURE INTERACTION

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 0 | 60 | 40 | - | - | 100 | 3 | 0 | 3 |

Critical study of conventional methods of foundation design; Nature of complexities of soil structure interation; Application of advanced techniques of analysis such as the finite element method, finite differences, relaxation and interation for the evalution of soil-structure interaction for different types of structures under various conditions of loading and subsoil characteristics; Preparation of comprehensive design oriented computer programs for specific problems. Interaction problems based on the theory of sub-grade reaction such as beams, footings, rafts bulkheads etc, Analysis of different types of framed structures founded on stratified natural deposits with linear and non-linear stress-strain characteristics.
Determination of axial and lateral pile capacities; group action of piles considering stress-strain characteristics of real soils.

Books:

1 Analysis and design of foundation - J. Bowles
2 Numerical Methods in Geotechnical Engg. - Desai & Christian

# MS 210 – DESIGN DETAILING OF STRUCTURAL DESIGN PRACTICE – II

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 1 | 4 | - | - | 50 | 100 | 150 | 1 | 2 | 3 |

Connection design, Beam Columns,
Complete design and structural detailing of structures, viz. Water tanks, Chimney, Steel bridges, Multi-storeyed buildings, Industrial building, Godowns, cantilever sheds, platform roofs, Towers, Transmission Line Towers etc.
Plastic design of continuous beam and portal frames,
Introduction and applications of Cable Structures
Use of cold form sections, Castellated beams, light metal structures, stability of portal frames

Books:


1. K. Mukhanov, Design of Metal structures.
2. B.Bresler, T.Y lin and JB Scalzi, Design of steel structure.
3. Design of Steel Structures – Arya Ajmani
4. Design of Steel Structures Vol-1 & 2 – Ramchandran
5. Design of Steel Structures – N. Subramanian

# MS 242 - PRESTRESSED CONCRETE

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Prestressing concepts, materials, systems of prestressing and losses. Introduction to working stress method, limit state analysis and design of members for bending. Shear torsion and forces. End block design. Deflections, use of relevant codes of practice.

Books:

1. Design of Prestressed Concrete Structures.
2. Design of Prestressed Concrete Structures – Krishna Raju
3. Limit State Design of Prestressed Concrete Structures – Mallick & Gupta

# MS 239 - ADVANCED CONCRETE TECHNOLOGY

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

**Cement :**Hydration, chemistry and microstructure of cement paste, special cement
**Microstructures of concrete :**Interfacial transition zone, Structure-property relationships.
**Chemical and mineral admixtures in concrete :**
Types, Mechanism, Application.
**Properties of hardened concrete :**
Strength, stress-strain behaviour, Dimensional stability, Fracture mechanics and concrete failure mechanisum.
**Mix Design :**
Concrete mix design (IS,ACI, BS)
**Concrete Durability :**
Physical deterioration(abrasion, erosion, cracking) Chemical attack (sulfates/seawater/acid), Corrosion, Durability improvement measures.
**Testing and quality assurance of concrete :**
Testing of fresh concrete, Destructive and non-destructive evaluation of hardened concrete, statistical quality control.
**Special concrete :**
Cement and polymer concrete compositions, Self-compacting concrete, Ready mixed concrete, High performance concrete.

Books:

1. Concrete technology, ELBS Punlication A,N. Nevile, J.J. Brooks
2. Micro Concrete – P. Kumar Mehta

# MS 240 - BRIDGE ENGINEERING

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Loading Standards.
Design of Balanced Cantilever Bridge.
Design of Bow String Girder Bridge.
Design of prestressed concrete girder and box girder bridges considering only primary torsion.
Design of end block.
Bridge Bearing: Types of Bearings, Elastomeric bearing.
Piers, Abutments, Wing walls factors effecting and stability. Well foundations. Design of well, Construction, open sinking of walls, Plugging, sand filling and casting of well cap.

Books:

1.V.K. Raina, Concrete Bridges practice Analysis. Design and Economics, Shroff Publishers, New Delhi, 2nd Ed. 2005.
2.Vazirani, rarwani and Aswani, Design of Concrete Bridges, Khanna Publishers, 2nd Es. 2008.

## MS 241 - STRUCTURAL OPTIMIZATION AND RELIABILITY

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Introduction to optimization, optimization techniques for unconstrained and constrained optimization problems, Classical Optimization, Lagrange Multiplier technique and Kuhn – Tucker conditions, Solution of NLP by direct methods and by series of unconstrained optimization problems, formulation of different types of structural optimization problems.
Computation of derivatives of response quantities with respect to design variables.
Minimum weight design of trusses, frame, etc.

Concept of Structural safety, design methods, basic statistics, probability Theory, statistics for concrete and steel properties, probabilistic analysis of loads
Basic structural reliability Monte Carlo method, level 2 reliability, reliability based design and reliability of simple structural systems

Books:


1. Arora J.S , Introduction to optimization, MGH(Int,Ed.),1989
2. Rao S.S, Optimization: Theory and applications , Wiley Eastern,1992
3. Optimization theory & application S. S. Rao
4. Structural optimization Majid
5. Advanced mathematics Kresysig
6. Foundation of structural optimization Marris

# MG 110 - SOIL ENGINEERING-I

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Idealized concept soil based on practice size, orientation, crystal structure, electrical imbalance etc. Soil water, consistency, viscosity, Stock's law, Concept of effective diameter, Basic concept of flow through porous media; Darcy's law its limitation for use in real soils; Threshold gradient, governing differential equation for anisotropic media; Effective stress and neutral stress concepts; Suction potential and capillary flow; Description of state of stress and strain at a point; Development of rheological models and equation of state for soils. Stress distributions, Problems in elastic half-space; Familiarity with Westergard's Burmister's and Midline's problems; Distribution of contact pressure; Fundamental concepts of consolidation; Primary and secondary compression, One two and three dimensiopnal problems; Consolidation of partially saturated soils; Settlement computations.

Books:


1. Soil Mechanics – D. W. Taylor
2. Soil Engieering – M. G. Spangler
3. Soil Mechanics – Means & Parcher
4. Advanced Soil Mechanics – B. M. Das

# MG 113 – NUMERICAL METHODS & APPLICATIONS TO GEOTECHNICAL ENGINEERING

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 1 | 4 | - | - | 50 | 100 | 150 | 1 | 2 | 3 |

Advanced Matlab Applications for :

Solution of non – linear algebraic equations, , numerical solutions of ordinary differentialequations and partial differential equations, its applications to structural engineering problems. Solution of Eigen value problems, iterative methods & transformation methods. Use of software for transformation methods. Computer oriented algorithms

Correlation and regression, Principles of least squares
Euler's equation -Functional dependant on first and higher order derivatives

Laplace transform methods, Laplace equation -Properties of harmonic functions -Fourier transform methods for Laplace equation.

Application : Excel spread sheets for the design of shallow foundations, laboratory testing applications, settlement calculations, pile foundations etc.
Use of software for Report preparation in subsurface explorations.
Software Usage: Applications of Geo4, Z-soil, Plaxis, STAAD, STRAP etc. for Soil Structure Interaction and foundation design problems.

Reference Books:


1) Numerical methods in Engineering — Salvadori & Baron
2) Numerical Methods in Finite Element Analysis — Bathe & Wilson
3) Numerical Analysis — Scarborough
4) Numerical Methods in Geotechnical Engg. — Desai C.s. and Christian
5) Foundation Design — Bowles J. E.

## MG 108 - SUBSURFACE EXPLORATION AND GEOTECHNICAL TESTING PRACTICE

| Sr. No. | WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 1 | 1 | 4 | - | - | 50 | 100 | 150 | 1 | 3 | 4 |

For Soil as well as Rock : Problems and phases of foundation investigations, Soundings and drilling, sample requirements, sampling, methods and equipments, Handling, preservation and Transportation of samples, sample preparation, laboratory tests, Insitu testing, analysis of the data and interpretations, Reporting.

Books:

1. Head, H.K Manual of laboratory testing: Vol: 1 to 3,1981
2. Compedium of Indian standards on soil Engineering part I and II, 1987,1988.

# MG 207 - SOIL ENGINEERING-II

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Shear strength of cohesionless and cohesive soils, physic-chemical aspects, experimental determination of shear strength, failure theories yield criteria. Influence on failure conditions of intermediate principal stress, history, drainage; rate of stress applications ets; Platic equilibrium in soils, Mohr diagram, active and passive states, theories of earth pressure on retaining walls, effect of wall friction on the shape of sliding surface, theories of arching, bearing capacity, concepts of general and local shear failure, critical height of vertical banks, various methods of computation of slope stability, earth pressure on temnering of cuts and on free and anchored bulkheads.

Books:


1 Theoretical Soil Mechanic – Karl Terzaghi
2 Advanced Soil Mechanics – B. M. Das
3. Soil Mechanics - Whitlow

# MG 217 - SOIL DYNAMICS AND GEOTECHNICAL EARTHQUAKE ENGINEERING

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Elements of Soil Dynamics, Free and forced vibrations with and without damping for single degree of freedom. Natural frequency of foundation soil system – Barken, Pressure bulb concept,Pauw's analogy and Vibration isolation.

Wave Propagation: Waves in elastic half space, Elements of seismic methods, Steady state vibrations, Influence of soil condition on shaking intensity and associated structural damage and land slides.

Elastic Properties of Soil: Field and laboratory methods, Stress strain characteristics of soil under dynamic loads, damping properties, bearing capacity of soil under dynamic loads by pseudo static analysis.

Liquefaction and Ground Improvement: Mechanism, Laboratory methods, Evaluation of liquefaction in the field, Factors affecting liquefaction, Anti liquefaction measures, Ground improvement in cohesionless soils – Dynamic compaction, Vibrofloatation, Blasting, Compaction piles and Grouting.

Seismic bearing capacity of foundations and seismic earth pressure.

Books:


1. Richart, F.E., Wood, R. D. and Hall, J. R., Vibrations of Soils and Foundations, Pentice Hall, 1970
2. Steven, Kramer, Geotechnical Earthquake Engineering, Pearson Education, 2003
3. Day, Robert, W, Geotechnical Earthquake Engineering Hand Book, Mc Graw Hill – 2002.

## MG 221 - REINFORCED EARTH AND GEOTEXTILES

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 0 | 60 | 40 | - | - | 100 | 3 | 0 | 3 |

Basic introduction to the elements of ground engineering characteristics of reinforcing materials, definition of reinforced and advantage of RE, Soil reinforcement interaction, behaviour of reinforced earth walls, basis of wall design, the coulomb force method, the rankine force method, internal and external stability condition, field application of RE, randomly reinforced earth and analysis of reinforced soils, testing of soil reinforcements.

Definitions, functions, properties and application of geotextiles, design of geotextile applications, definations, functions, properties and application of geo membranes, design of geo membranes applications, geo textiles associated with geo membranes, testing on geo textiles, environmental efforts, ageing and weathering.

Books:

1. Reinforced Earth & Geotextiles : Koerner
2. Reinforced Earth & Geotextiles : G. V. Rao

## MG 218 - ENVIROMENTAL GEOTECHNOLOGY

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Introduction to environmental geotechniques, source, production and classification of wastes; soil-pollution interaction, effects of pollutant on soilproperties, foundation problems on contaminated clays, hazardous waste management, criteria for selection of sites for waste disposal facilities, subsurface disposal techniques, passive containment systems, monitoring and performance of waste facilities.

Books:

Proceeding of the Workshop on Geotechnical Hazardous Waste Management at DDU Nadiad

# MG 219 - ROCK MECHANICS

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Classification of inferential testing, transitional materials, engineering property evaluation; laboratory methods and insitu tests, friction in rocks, elasticity and strength of rocks, insitu stress determination, application of rock mechanics in engineering and underground openings, slope stability and foundation problems.

Books:

1. Goodman, F. E., Rock Mechanics, John Wiley & sons, 2nd Ed, 1982
2.Ohn, A. Franklin and Maurice B. Dusseault, Rock Engineering, Mc Graw Hill – N.Y., 1989.

# MG 220 - GEOPHYSICAL EXPLORATIONS

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Unit 1: Introduction,
An overview of geophysical methods of exploration; classification – major /minor; artificial / natural; applications and limitations, need for integrated surveys.
Physical properties, rocks-density, susceptibility, resistivity and elastic wave velocities, factors controlling the properties, numerical values for important rock types, concept of physical property contrast.
Role of geophysics in understanding the internal structure of the earth and plate tectonics.

Unit 2: Gravity Methods
Earth's gravity field, origin, variation with elevation and depth, temporal and transient variations, international gravity formula, geoid, spheroid.
Principle of gravity exploration, concept of gravity anomaly; gravimeters, gravity surveys, reduction of data, free air, Bougrer and topographic correlations; concepts of regional and residuals; contamination and derivative maps.
Quantitative interpretation of anomaly maps, identification of faults, folds and contacts, principles of quantitative interpretation with reference to spheres, cylinders and thin horizontal sheets; concepts of modeling and inversion.

Unit 3: Magnetic Methods
Earth's magnetic field, origin; magnetic elements, interrelationships, transient and temporal variations; IGRF; principle of magnetic method, origin of anomalies, induced and remanant magnetizations; magnetometers, proton precession and fluxgate; plan of magnetic surveys, reduction of data; anomaly maps, identification of structures; familiarization of magnetic anomalies over spheres, sheets and dykes; interpretation of magnetic anomalies of sheets and dykes.
Airborne magnetometry, plan of surveying and presentation of results.

Unit 4: Electrical and Electromagnetic Methods
Self potential method, origin of SP; resistivity method, concept of apparent resistivity, Werner, Schlumberger and Dipole-dipole configurations; electrical sounding, interpretation through curve matching, electrical profiling; elements of electromagnetic methods, in phase, out of phase components, identification of conductors from EM anomalies.

Telluric and magneto methods, application in oil exploration.

Unit 5: Seismic Methods
Elastic propagation in rocks, Hooke's Law, acoustic impedance; Snell's Law, principles of seismic refraction method, travel time curves over horizontal interfaces and faults, interpretation of results; principles of seismic reflection method, travel time curves, over horizontal and dipping layers, interpretation; concept of RMS interval and average velocities; seismic data acquisition on land and sea, sub-bottom profilers, seismic sources, air gun, etc., processing of seismic reflection data, single channel and multi channel seismic data interpretation methods, pitfalls, seismic stratigraphy, velocity pull ups, bright spots etc.,
Technological advances in seismic data processing, modern survey techniques; GPS; reservoir characterization.

Books:
1. M.B.R.Rao, (1993). Outlines of geophysical prospecting, English Book Depo, Dehradun.
2. Radhakrishna Murthy, I.V., (1998). Gravity and magnetic interpretation in exploration geophysics. Geol. Soc. India, Bangalore.
3. Jhon, Milsom (2003). Field Geophysics, 3rd Edn. John Wiley, London.
4. Dobrin, M.B. and Savit, C.H. (1988). Introduction to geophysical prospecting, 4th Edn., McGraw Hill, New York.
5. Saha, J. G. Seismic data processing manual, ONGC Pub. Dehradun.
6. Coffeen, J.A. 1986. Seismic exploration fundamentals and seismic techniques for finding oil, 2nd Edn. Pennwell Pub. Co., Tulsa, Oklahoma.
7. Domenico, S.N. 1983. Modern Seismic Exploration concepts. Tulsa, Oklahoma.
8. Macquillin, R. Bacon, M.(eds). 1984. An introduction to seismic interpretation, reflection seismics in petroleum exploration, Grahmam, Trot.

# MG 214 - EARTHDAM ENGINEERING

| WORK LOAD | | MARKS | | | | | CREDIT STRUCTURE | | |
|---|---|---|---|---|---|---|---|---|---|
| Th | T/L | Th | Sess | TW | Pract | Total | L | P | TOTAL |
| 3 | 1 | 60 | 40 | 25 | 25 | 150 | 3 | 0.5 | 3.5 |

Factors influencing design of earthdams, types of earthdams, Control of pore pressure within the dam and foundation, critical study of earthdam failures, embankment settlement during and after construction, differential settlement and cracks, construction pore pressures and control, seepage analysis, various methods of construction of flownets, methods of foundation treatment, critical evaluation of methods of stability analysis, dams with impervious membranes of manufactured materials like reinforced concrete, steel plates and asphaltic conctrete, embankment construction procedures, equipment, methods of quality control, measuring instruments, performance observations, aseismic design, slope protection, rockfill construction.

1. Earth Dam Engg. – Sherrared

## DIPLOMA CHEMICAL SEMESTER – I
## SUBJECT: APPLIED CHEMISTRY (DK-102)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

## A. COURSE OVERVIEW

The course is devised to introduce fundamental aspects of Applied Chemistry. Students will learn about some very basic concept of chemistry, fundamentals of atomic structures, electronic configuration, properties and periodic trends of elements, bonding in molecules, chemical and ionic equilibrium, solution and its properties and also water and its treatments with its industrial application, problem solving knowledge and different types of problem and its solution that are used for future higher studies and in industries as well.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Basic Concept: -** Matter, elements, compounds, atoms, molecules, molecular formula, mole concept, Avogadro's number, gram-atomic weight, gram-molecular weight, equivalent weight, STP, Avogadro's hypothesis and its application, derivation of general gas equation PV=nRT, Dalton's law of partial pressure | **CO1 CO2** |
| [2] | **Atomic structure: -** Thomson's model its limitation, Rutherford's model and its limitation, Brief introduction to Bohr's model and its limitation, Concept of shells and subshells , Dual nature of matter and light,,De-broglie relationship, Heisenberg uncertainty principle, Modern concept of atomic structure, atomic number, mass number, orbital concept, quantum numbers, shape of orbital, electron configuration of elements using Auf-bau principle, Hund's rule and Pauli's exclusion principle, isotopes, isobars. | **CO1 CO3** |
| [3] | **Modern periodic table: -** Brief introduction to Mandeleev's periodic table and its drawback, Classification of element on the basis of their electronic configuration, periodic trend of ionization energy, electron affinity and electron negativity of elements in periodic table | **CO1 CO4** |
| [4] | **Chemical Bonding: -** Ionic bonds, co-valent bonds, co-ordinate co-valent bonds, H-bonds, valence, electronic theory of valence, Dot & Lewis formula of elements, Valence bond theory(VBT) and geometry of some simple molecules having hybridization of $sp^3$, $sp^2$, sp, Valence shell electron repulsion pair theory(VSEPR) with shape of some simple molecules like $BeF_2$,,$BF_3$, $CH_4$, $PCl_5$, Molecular Orbital Theory(MOT) of homo nuclear diatomic molecules like $H_2$,$He_2$,$O_2$, $N_2$. | **CO1 CO3** |
| [5] | **Chemical equilibrium: -** Reversible & irreversible reaction, rate of reaction, law of mass action, equilibrium state, equilibrium constant Ke for homogeneous and heterogeneous systems, relationship between Ke and $K_P$, Le-Chatelier principle and its application | **CO1 CO5** |
| [6] | **Ionic equilibrium: -** Ionization of strong and weak electrolytes in water, ionic equilibrium, acid and base theories, dissociation constant of weak acid, Ka, weak base $K_b$ and Ksp Self-ionization of water $K_W$, pH scale, determination of pH of solution from its strength, buffer solutions, Common ion effect with | **CO1 CO5** |

| | | |
|---|---|---|
| | illustrative example | |
| [7] | **Solutions: -** Types of solutions, different methods of expressing strength of solutions, viz. molarity. molality, normality, formality, weight percent, preparation of standard solutions, Vapour pressure and Rault's law, ideal and non-ideal solution, positive and negative deviation of non-ideal solution from Rault's law | **CO1 CO2** |
| [8] | **Water and its treatment: -** Sources of water, hard and soft water, kinds of hardness, effect of hardness, removal of hardness of water by soda-lime, permutite and ion-exchange process. | **CO1 CO6** |

## C. TEXT BOOKS

1. Arun Bahl, B.S. Bahl,G.D.Tuli, *Essential of Physical chemistry*. New Delhi: S. Chand publication; 2009.

## D. REFERENCE BOOKS

1. David E Goldberg., *Chemistry foundation.* New york McGraw-Hill; 1991
2. Brown,Theodore Lemay, H Eugene, *Chemistry: the central science*, N.J. PHI; 1985
3. Dr. A. S. Patel, Dr. K. M. Shah, *Applied Science I : Chemistry*, Ahemedabad, Atul Prakashan; 2000
4. V.P. Mehta., *Polytechnique chemistry*, New Delhi, Jain Brothers; 2017

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understanding | Acquire knowledge of different basic terms included in chemistry like atomic structure, periodic properties, chemical bonding, equilibrium and water hardness treatment etc. |
| **CO2** | Understanding | Relate the formula of mass, moles, atoms, molecules & different way of expressing concentration of the solution & their preparation. |
| **CO3** | Understanding | Acquire the knowledge of various models of atomic structure, principles of electronic configuration and hybridization & its theories. |
| **CO4** | Applying | Identify a period & group on the periodic table as well as compare the periodic properties of elements. |
| **CO5** | Understanding | Understand & explain the essential aspects of chemical as well as ionic equilibrium & get knowledge of basic acid base concepts. |
| **CO6** | Understanding Applying | Get the idea about type of water sample & its treatments. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| **CO6** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Avg** | 3 | 2.5 | 2.8 | 2.8 | 2.8 | 2.8 | 3 | 2.8 | 2.5 | 2.8 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – I
## SUBJECT: COMPUTER APPLICATION (DK109)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 0 | 0 | 3 | 3 | 0 | 0 | 25 | 50 | 75 |

## A. COURSE OVERVIEW

The course is introducing general knowledge of computer, computer system and Microsoft office. In Microsoft office students try to understand how to work in word file, excel sheet, power point presentation and application of this system for different section. Also understanding of Standard formatting of different files, windows version and basic operation with short cuts.

## B. COURSE CONTENT

| NO | TOPIC |
|---|---|
| [1] | Introduction to computer system and software |
| [2] | Introduction to operating system, file identification, bytes, directory |
| [3] | Introduction to word processing, data entry, save, quit. |
| [4] | Basic setting like left and right margin, footnotes, headers, justification, tabulation |
| [5] | Editing text using detailing character, word lime, search, replace directory |
| [6] | Cut\paste, move, copy, sort, file read, file write |
| [7] | Mail merge, print, index, book mark, tables of content |
| [8] | Introduction to worksheet, workbook, cell, row, column, data entry, open, save, quit, help |
| [9] | Editing data, clean, insert, delete cell, row, column |
| [10] | Work sheet settings, width of column, color, heading, wide and display, align data, bold, italics, orientation |
| [11] | Freeze rows, columns split sort, legend |
| [12] | Multiple worksheets, copy, move, linking data between worksheets |
| [13] | Prepare worksheet to print, page break |
| [14] | Discipline wise Engineering Application |

## DIPLOMA CHEMICAL SEMESTER – IV
## SUBJECT: CHEMICAL ENGINEERING EQUIPMENT DRAWING (DK-412)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Total** | **Ext** | **S** | **TW** | **P** | **Total** |
| -- | -- | 3 | 3 | -- | -- | 25 | 50 | **75** |

## A. COURSE OVERVIEW

The course imparts drawing and understanding fundamental symbols, equipment's & their parts and flow diagrams in process industries.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Symbols of Chemical Engineering Equipment's**<br>Refer and draw the standard code/decodes and symbols for Chemical Engineering equipment's. | **CO1** |
| [2] | **Diagrams of mounting and fitting parts**<br>Prepare sketches of various types of Valves, Pipe fittings, Joints etc. | **CO2** |
| [3] | **Diagrams for Chemical Engineering Unit Operations**<br>Free hand sketch drawing of various Chemical Engineering Unit Operation equipment's like Heat Transfer equipment's, Mechanical Operation equipment's, Mass Transfer equipment's etc. | **CO3** |
| [4] | **Flow diagrams**<br>Drawing preparation of block flow diagram and process flow diagrams using different equipment symbols for a process. | **CO1**<br>**CO4** |
| [5] | **Piping & Instrumentation Diagrams**<br>Piping & Instrumentation symbols and P & ID diagram for a process. | **CO1**<br>**CO5** |

## C. TEXTBOOKS


1. Treybal, Robert Ewald. Mass-Transfer Operations. New York: McGraw-Hill, 1980.


## D. REFERENCE BOOKS


1. M. Gopala Rao, Marshall Sittig. Dryden's Outline of Chemical Technology for 21st Century (3rd Edition). East-West Press.
2. McCabe, Warren L., and Julian C. Smith. Unit Operations of Chemical Engineering. New York: McGraw-Hill, 1967.
3. Walter L. Badger and Julius T. Banchero. Introduction to Chemical Engineering. New York: McGraw-Hill, 1955.
4. Recommendations on Graphical Symbols for Process Flow Diagram, IS: 3232 – 1965.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | To draw and understand symbols of chemical engineering equipment's. |
| CO2 | Understanding | To draw diagrams of various mounting and fitting parts |
| CO3 | Understanding | To draw diagrams and understand various unit operation equipment's for chemical engineering. |
| CO4 | Understanding | To draw flow diagrams for a process. |
| CO5 | Understanding | To draw symbols and flow diagram for pipping & instrumentation. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 2.8 | 2.6 | 3 | 3 | 3 | 3 | 2.6 | 2.6 | 2.6 | 3 | 3 | 3 |

## DIPLOMA SEMESTER – II
## SUBJECT: CHEMICAL ENGINEERING MATERIAL (DK208)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | -- | 4 | 60 | 40 | -- | -- | 100 |

## A. COURSE OVERVIEW

The course imparts study of various process technologies and fundamental types of various engineering materials. Chemical Engineering Materials involves transforming raw materials into valuable end-products, the development of high-performance materials for our modern society, and understanding its various properties & applications.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Introduction & properties of material: -** General principles of selection of materials. Definition & explanation of melting point, boiling point, specific heat, thermal conductivity, thermal expansion, thermal insulation, stresses, strain. | CO1 |
| [2] | **Corrosion: -** Definition, mechanism of corrosion, types of corrosion, dry & wet corrosion, direct corrosion, electro-chemical corrosion galvanic corrosion, high-temperature corrosion, atmospheric corrosion. Factors affecting/influencing corrosion rate, brief description, different methods for corrosion control and prevention. | CO1<br>CO3 |
| [3] | **Metals: -** General comparison of ferrous, non-ferrous & alloys. Properties of metals Cast iron, wrought iron, steel, Aluminium, zinc, chromium, nickel, tin, titanium, tungsten, platinum, silver, lead. Properties of alloy duralumin, Y-alloy, brass, bronze, Inconel, invar, Hastelloy, alloy steel. Types of furnaces for metal purification, blast furnace, arc furnace. | CO1<br>CO2<br>CO3 |
| [4] | **Ceramic materials: -** Definition of ceramic materials. Clay-chemical composition China clay, fire clay, bentonite. Refractories- definition, properties & classification of refractories. Bricks- manufacture, properties, uses & types of bricks. Glasses- definition, raw materials used & their effect on glass product, manufacture of glass in brief, types of glass, their properties & uses, soda lime, borosilicate, high silica, fibre, wool & foam glass. Porcelain- properties, composition & uses. | CO1<br>CO2<br>CO4 |
| [5] | **Inorganic and other materials: -** Polymers & their structure, addition & condensation polymerization. Plastic- definition, properties & classification. Rubber/Elastomers- definition, classification, sources, properties & uses of natural and synthetic rubber, vulcanization. Wood- properties, seasoning types, its advantages & limitations | CO1<br>CO2<br>CO5 |
| [6] | **Coatings: -** Protective coatings, Metallic coating, chemical conversion coating, organic coating, ceramic coating, Paints-classification, ingredients of paints, their properties and importance, special types of paints & their application. Varnishes- definition, ingredients & classification. | CO1<br>CO5 |
| [7] | **Materials for special application: -** Lubricants- definition, importance, types, properties & application, method of applying lubricants. Insulation- definition, types of insulating materials, electrical, thermal & sound insulation. Adhesive-definition, classification, advantages & limitations, mechanism of their effect | CO1<br>CO4 |

on surface.

## C. TEXTBOOKS

1. S.K. Hajra Choudhury., Materials Science and Processes, Indian Book Distributing Co., 1978.
2. S.C. Rangwala., *Engineering Materials.*, 3rd Edition, Charotar Book Stall, Anand, India., 1976.

## D. REFERENCE BOOKS

1. Frank Rumford., Chemical Engineering Materials, Nabu Press., 2011.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remembering | General Introduction, knowledge, and definition of various materials and their basic properties. |
| CO2 | Understanding , Remembering | Methods, processes, and working of equipment's for obtaining various material. |
| CO3 | Understanding , Remembering | To understand types of corrosion, its classification, mechanism, and factors affecting as well needed precaution methods. Also, to know types, properties, and application of Metals. |
| CO4 | Remembering | To know types, properties, effect, and application of Ceramic Materials, Lubricants, Insulators and Adhesions. |
| CO5 | Remembering | To know types, properties, effect, and application of Polymers, Plastics, Rubber, Wood, Coatings, Paint and Varnish. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 2.8 | 2.8 | 3 | 3 | 3 | 3 | 2.6 | 3 | 2.6 | 3 | 3 | 3 |

## DIPLOMA CEHMICAL SEMESTER – III
## SUBJECT: CHEMICAL PROCESS INDUSTRIES (DK-308)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

## A. COURSE OVERVIEW

The course imparts study of various process technologies and fundamentals of various organic and inorganic process industries. It helps in understanding manufacturing, various process parameters, basic functioning of equipment's and engineering problems for various industries.

## B. COURSE CONTENT

| NO | TOPIC | Cos |
|---|---|---|
| [1] | **Introduction:** -General Survey of Chemical Industries, Importance contribution to human life & classification of chemical industries. **Fuels: -** Classification of fuels, Fuel gases. | **CO1**<br>**CO2** |
| [2] | **Chlor-Alkali Industry: -** Manufacture of Soda ash, Caustic Soda, Chlorine & Hydrogen.<br>**Cement Industries: -** Types of cement, classification of cement, manufacturing of cement & major engineering problems of cement industries. | **CO1**<br>**CO2**<br>**CO3**<br>**CO4** |
| [3] | **Marine chemicals: -** Chemicals from seawater, manufacture of common salt and. bromine.<br>**Pharmaceuticals: -** Classification of drugs, manufacture of penicillin and aspirin. | **CO1**<br>**CO2**<br>**CO3**<br>**CO5** |
| [4] | **Oil & Fats Industries: -** Classification of oil & fats, Extraction of vegetable oil, Hydrogenation of oil, manufacture of soap and glycerine, major engineering problems of all such industries. | **CO1**<br>**CO2**<br>**CO3**<br>**CO5** |
| [5] | **Electrochemical Industries: -** Types of electrochemical Indus., electroplating and refining of Aluminium. | **CO1**<br>**CO3**<br>**CO5** |
| [6] | **Carbohydrate Industries: -** Manufacture of sugar and starches. Ethanol from molasses by fermentation, major engineering problems.<br>**Pulp and Paper Industries: -** Methods of pulp production, manufacture of pulp by Kraft process, recovery of chemicals from black liquor & major engineering problems. | **CO1**<br>**CO2**<br>**CO3**<br>**CO6** |
| [7] | **Dyes & Intermediates: -** Classification of dyes, manufacture of H-acid and B-naphtha.<br>**Pesticides**: - Classification of pesticides, manufacture of parathion, 2-4-D, BHC. | **CO1**<br>**CO2**<br>**CO3**<br>**CO6** |

## C. TEXTBOOKS

1. M. Gopala Rao, Marshall Sittig., *Dryden's Outlines of Chemical Technology*, 3rd Edition, East West press private limited, New Delhi.

## D. REFERENCE BOOKS

1. George T. Austin., Shreve's Chemical Process Industries, 3rd Edition, Tata McGraw Hill.

2. W. L. Faith, Donald B. Keyes, Ronald L. Clark., Industrial chemicals, John Wiley and Sons, New York, 1950.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remembering | To know the basics of various chemical industries and to know various unit operation and unit processes for manufacturing. |
| CO2 | Evaluating | To identify and solve engineering problems during production. |
| CO3 | Understanding | To develop the comprehensive understanding about the fundamental knowledge and manufacturing process for various chemical products. |
| CO4 | Understanding | To understand the treatment, reaction, and separation steps in a flow diagram of chemical production processes for fuel gases, chlor-alkali, and cement industries. |
| CO5 | Understanding | To understand the treatment, reaction, and separation steps in a flow diagram of chemical production processes for marine chemicals, pharmaceuticals, oil & fat, and electrochemical industries. |
| CO6 | Understanding | To understand the treatment, reaction, and separation steps in a flow diagram of chemical production processes for carbohydrate, pulp & paper, pesticides, and dyes & intermediate industries. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.8 | 3 | 2.3 | 3 | 2.5 | 3 | 2.5 | 2.5 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – I
## SUBJECT: COMMUNICATION SKILLS (DK-103)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | - | 04 | 60 | 40 | - | - | 100 |

## A. COURSE OVERVIEW

The course is devised to introduce fundamental aspects of good writing skills as well as speaking. Students will learn how to have discussions, letter writing, IPA, importance of speaking at a workplace, technical communication and its importance. Students will improve their intellectuality through classroom discussion and can polish their grammatical mistakes through the grammatical exercises held in the classroom.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | Basics of Communication: Introduction, the process of communication, importance of communication at a workplace, Language a tool of communication, level of communication, upward and downward communication, the flows of communication, communication Networks, the importance of technical communication. | CO1<br>CO2<br>CO3<br>CO4 |
| [2] | Barriers to communication: definitions of noise/barrier to effective communication, Classification of the barrier to effective communication: Intrapersonal, interpersonal and Organisational. Verbal and non-verbal communication and its advantages and drawbacks.<br>Letter writing: introduction, types, formats, business letter writing, types, purposes: request, complaint, order, congratulation, sales quotation etc. Exercises. | CO1<br>CO2<br>CO5 |
| [3] | Grammar: Sentence structure, clauses: Definite and indefinite, nouns, pronouns. Articles: A, An, and The; definite and indefinite differentiations between the grammatical terminologies like articles, clauses and nouns. Paragraph development, techniques of development. Exercises | CO1<br>CO2<br>CO3<br>CO5 |
| [4] | Oral Forms: Active listening: Introduction, types of listening, traits of a good listener, Active versus Passive listening, Six stages of Listening, implications of Effective listening. Group Discussion: Objectives, introduction, group discussion, organizational Group Discussion, Group Discussion as a part of Selection Process, Meetings, Conferences. Practical: classroom discussion. Exercises. | CO1<br>CO2<br>CO3<br>CO6 |
| [5] | Presentation: Introduction, types of presentation, importance of presentation, importance of business presentations. Effective presentation strategies: defining purposes, Analysing audience and local, organizing content, preparing an outline, visual aids, and nonverbal elements: Kinesics, Proxemics, Haptics, Artefacts, paralinguistics. Practical exam: presentation and Exercises.<br>IPA: The Phoneme, the Syllable. The sounds of English: Vowels, the production of speech, description of sounds. | CO1<br>CO2<br>CO3<br>CO6 |

## C. TEXT BOOKS

1. Shoba KN, Sam Praveen. *Technical English: A Work book. Cambridge University*

*Press. 2019.*

## D. REFERENCE BOOKS

1. Raman Meenakshi, Sharma Sangeeta. Technical Communication: principles and Practice. Oxford University Press. 2007.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | To understand the methodology of communication. |
| CO2 | Understanding | To understand the barriers and flows of communication, interconnection of the flow, the basics of writing technical, purposes of writing letters. To develop efficiency in writing. |
| CO3 | Understanding | Understand the vocabulary and their root forms to enhance vocabulary level. Grammatical tests, to rectify their mistakes/errors while writing and speaking. |
| CO4 | Applying | Rectify common errors in their speaking and writing, Acquire proficiency in all four skills of language. |
| CO5 | Understanding | Be competent at a public speaking and Interviews. |
| CO6 | Applying | To deconstruct the challenges of delivering effective presentation, to develop strategies to make effective presentations. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO6 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.6 | 2.8 | 2.8 | 2.8 | 2.8 | 3 | 2.8 | 2.6 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA SEMESTER – II

# SUBJECT: ENGINEERING GRAPHICS (DK205)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 50 | - | 150 |

## A. COURSE OVERVIEW

The objective for this course is to learn about various aspects of Technical Drawing. To learn and make use of the use of drawing equipments. The aspects of Orthographic Projection and Isometric projection are very useful in industries to have understanding of size, shape and geometry of any object. To understand various machine parts, Graphs and Charts used in day to day life and industries.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Introduction: -** Drawing equipments, material & their uses, Planning & Layouts of the Drawing Lines, Letters and dimensioning Plane geometrical drawing: Simple geometrical construction such as construction of plain figure, drawing of arcs and other construction. | **CO1 CO3** |
| [2] | **Plane Geometry: -** Construction of curves used in engineering such as Conics (Ellipse, Parabola, Hyperbol) Cycloidal curves (Cycloid, Epi-cycloid, Hypocycloid) Involutes, Archemedian spirals. | **CO1 CO4** |
| [3] | **Solid Geometry: -** Projection of points, Projection of lines (without H.P & V.P), Projection of planes, Projection of right and regular solids (Prism, Pyramids, Cylinder and Cones) | **CO1 CO4 CO6** |
| [4] | **Orthographic Projection: -** Conversion of pictorial views into orthographic views, | **CO2 CO3 CO4** |
| [5] | **Isometric projection: -** Various Projection methods, First angle method of projection, Third angle method of projection, Rules for dimensioning, Conversion of pictorial view into orthographic views. | **CO1 CO5** |
| [6] | **Sectional Orthographic Projection: -** Conversion of pictorial views into orthographic projection with section type of sections-Full section, Half section, interpretation of orthographic views. | **CO1 CO5 CO6** |
| [7] | **Machine parts: -** Types of threads, Bolts & Nuts, Locking devices for Nuts Rod connections (cotter joints & knuckle joint, shaft couplings, bearings, welded joints. | **CO1 CO3** |
| [8] | **Graphs and Charts: -** Concept of representation of data on graphs & Charts | **CO2 CO3** |

## C. TEXT BOOKS

1. Elementery Engineering Drawing by N.D.Bhatt,
2. Engineering Graphics by P.J.Shah

## D. REFERENCE BOOKS

1. Machine Drawing by P.S.Gill

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remembering | The general introductions and concept of Engineering Drawing. |
| CO2 | Analysing | To choose appropriate devices for any given conditions. |
| CO3 | Applying | To apply basic concepts of drawing in industrial devices. |
| CO4 | Understanding | To understand the importance of technical drawing |
| CO5 | Remembering | Types of drawings used in industries. |
| CO6 | Understanding | To Understand basic methods of drawing. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.6 | 2.5 | 2.6 | 2.5 | 3 | 3 | 3 | 2.5 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA SEMESTER – I
## SUBJECT: ENGINEERING MEASUREMENTS (DK111)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 0 | 0 | 3 | 3 | 0 | 0 | 25 | 50 | 75 |

## A. COURSE CONTENT

| NO | TOPIC |
|---|---|
| [1] | Introduction to Physical Quantities and Units |
| [2] | Linear Measurements: - Length & Diameter by Scale, inside- outside callipers |
| [3] | Precision Measurements: - Length & Diameter by Vernier callipers, Micrometre screw, Depth gauge |
| [4] | Measurement of Area Regular & Irregular shapes |
| [5] | Measurement of Electrical Energy |
| [6] | Measurement of frictional coefficient |
| [7] | Measurement of volumetric flow rate & Mass flow rate |
| [8] | Measurement of Ph |
| [9] | Measurement of hardness of water |
| [10] | Measurement of Specific Gravity |
| [11] | Measurement of Viscosity |

Sr.No.1 to 6 will be conducted by Mech. Engg. Department while rest will be by Chemistry department.

## DIPLOMA SEMESTER – I

# SUBJECT: ELEMENTS OF MECHANICAL & ELECTRICAL ENGG. (DK115)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| **L** | **T** | **P** | **Total** | **Ext** | **S** | **TW** | **P** | **Total** |
| 3 | 1 | - | **4** | 60 | 40 | - | - | **100** |

## A. COURSE OVERVIEW

The course is introducing general concept and their controls of basic concepts of Mechanical Engineering and Electrical Engineering. Students will learn about Steam boilers, Prime movers, IC Engines, Material Handling Equipments, Welding Processes, and Power Transmission Systems. Also the concepts about Basic electrical engg, AC Circuits, Electrical Machines etc.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Boilers: -** Definition, Function, Classification, working principles of Babcock & Wilcox boiler & Cochran Boiler, Introduction to Boiler mountings & accessories, Different types of mountings & accessories-their application & working principle. | **CO1 CO4** |
| [2] | **Prime movers: -** Introduction, Function, Classification of prime mover, Working principle of Internal combustion engines, Four stroke (Petrol & Diesel) Two stroke (Petrol & Diesel), Introduction to Recent trends eg. MPFI (Multi Point Fuel Injection), DTS-I (Digital Twin System. Ignition) | **CO1 CO3 CO4** |
| [3] | **Power transmission & Safety: -** Introduction to power transmission, Modes of power transmission, Belt drives and its Numerical, Rope drives, Gear drives, Chain drive system, Causes of accidents & their remedies. | **CO1 CO4** |
| [4] | **Material Handling Equipments: -** Introduction, Classification of material handling equipments, Factors affecting the selection of Material Handling Equipments Hoisting equipments, conveying equipments, Selection of suitable material handling equipments for the given situation. | **CO2** |
| [5] | **Fundamentals of Electrical engineering: -** Modern electron theory, Basic electrical quantities (Current, Voltage, Resistance etc), Ohm's law, Farade's law of Electromagnetic Induction. | **CO1 CO5 CO6** |
| [6] | **Welding: -** Introduction to metal joining processes, Classification, Definition of Welding, Classification of welding, Arc welding: definition, working principle, types, equipments, electrode codification; Gas welding : definition, working principle, types, equipments, Types of welding flames, Flux, Brazing, Soldering, Safety precaution during welding process. | **CO1 CO3 CO6** |
| [7] | **A.C. and D.C. Circuits: -**Introduction to electrical circuits, Fundamentals of A.C./ D.C. Circuits, Parallel and Series Connections, Examples, Star and Delta connection, Examples. | **CO1 CO3 CO6** |
| [8] | **Electrical Machines: -** Motor, Generator, Transformer- Introduction, Working principles, construction, Application, Specifications, Introduction, External connections of Electrical appliances (Single phase energy meter, A' meter, Voltmeter, Fan, Fluorescent tube) | **CO1 CO5 CO6** |

## C. TEXT BOOKS

1. Elements of Mechanical Engineering by N.M. Bhatt,
2. Elements of Electrical Engineering by R.P. Ajwalia

## D. REFERENCE BOOKS

1. Basic Mechanical Technology by P.S. Desai, S.B. Soni

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remembering | The general introductions and concept of Mechanical & Electrical Engineering. |
| CO2 | Analysing | To choose appropriate devices for any given conditions. |
| CO3 | Applying | To apply basic concepts in industrial devices. |
| CO4 | Understanding | To understand and importance of Mechanical & Electrical Engineering. |
| CO5 | Remembering | Types of Mechanical & Electrical Devices used in industries. |
| CO6 | Understanding | To Understand working principles, operations of various machines. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.6 | 2.5 | 2.6 | 2.5 | 3 | 3 | 3 | 2.5 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – V
## SUBJECT: ELEMENT OF THERMODYNAMICS AND REACTIONENGINEERING (DK-512)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | -- | 4 | 60 | 40 | -- | -- | 100 |

### A. COURSE OVERVIEW

The course imparts fundamentals of thermodynamics and reaction engineering. It introduces chemical engineering thermodynamics theory, thermodynamic properties with their evaluation, it's various applications, reaction kinetics for homogeneous reactions, types of reactors with their performance and their derivations.

### B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Introduction and First law of thermodynamics: -** Scope of thermodynamics, Internal energy, the first law of thermodynamics, Thermodynamics State and static function, Enthalpy, The steady state flow process Equilibrium, The phase rule, the reversible process, Constant volume and constant pressure process, Heat capacity. | **CO1 CO2** |
| [2] | **Second law of thermodynamics: -** Statement of the second law of thermodynamics, thermodynamics temperature scale, Entropy, Entropy changes of an ideal gas, Mathematical statement of the second law, the third law of the thermodynamics | **CO1 CO2** |
| [3] | **Introduction to refrigeration and liquefaction: -** The Carnot refrigeration, the vapor compression cycle, Compression of refrigeration cycle, the choice of refrigerant, Adsorption refrigeration, heat pump Liquefaction process | **CO1 CO3** |
| [4] | **Introduction to reaction engineering: -** Thermodynamics, Chemical kinetics, Classification of reactions, Variable affecting the rate of reaction, Definition of rate. | **CO1** |
| [5] | **Kinetics of homogeneous reaction: -**<br>**(1) Concentration dependent term of a rate equation: -** Single and multiple reaction, Elementary and nonelementary reaction, Kinetic view of equilibrium for elementary reaction, Molecularity and order of reaction, Representation of reaction rate, Testing of kinetic model<br>**(2) Temperature dependent term of a rate equation: -** Arrhenius law, Collision theory, Transition state theory, Comparison of theory, Comparison of theory with Arrhenius law, Activation energy and temperature dependency, Rate of reaction prediction by the theories (No derivation for all topics) | **CO1** |
| [6] | **Interpretation of batch reactor data: -** Constant volume batch reactors, Temperature and rate of reaction, the search of rate equation. | **CO1 CO4** |
| [7] | **Introduction to reactor: -** Batch reactor; plug flow reactor, continuous stirred tank reactor. | **CO1 CO5** |

### C. TEXTBOOKS

1. K.A. Gavhane., *Chemical Engineering Thermodynamics-I*, Nirali Prakashan.

2. K.A. Gavhane., *Chemical Reaction Engineering-I*, Nirali Prakashan.
3. J.M. Smith, Hendrick Van Ness, Michael Abbott, Mark Swihart., *Introduction to Chemical Engineering Thermodynamics*, McGraw-Hill Education.

## D. REFERENCE BOOKS

1. K.V. Narayanan., *A textbook of Chemical Engineering Thermodynamics*. PHI.
2. Octave Levenspiel., *Chemical Reaction Engineering*, John Wiley & Sons, Singapore, 3rd edition, 1998.
3. H.S. Fogler., *Elements of Chemical Reaction Engineering*, Prentice-Hall, NJ, 4th edition, 2006.
4. J. M. Smith., *Chemical Engineering Kinetics*, McGraw Hill, 3rd edition, 1981.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | To understand the basic concepts of thermodynamics, thermodynamic properties and its role, reaction engineering, type of reactions, reaction kinetics, the kinetics of homogeneous reactions, and its related theory. |
| CO2 | Applying | To develop the understanding about the fundamental knowledge about laws of thermodynamics and their developed mathematical equations. |
| CO3 | Understanding | To develop the understanding working of refrigeration and liquefaction cycles/processes. |
| CO4 | Understanding | To understand interpretation of batch reactor, develop rate expression and role of temperature. |
| CO5 | Understanding | Enhance the knowledge on types of reactors, working of reactors and developing rate equations. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 2.6 | 2.6 | 3 | 2.8 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – IV
## SUBJECT: FLUID FLOW OPERATION (DK-407)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

## A. COURSE OVERVIEW

The course is devised to introduce fundamental aspects of fluid flow behaviour. Students will learn to develop a steady state mechanical energy balance equation for fluid flow systems, estimate pressure drop in fluid flow systems and determine performance characteristics of fluid machinery.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Fluid Statics: -** Definition of fluid, fluid mechanics, static pressure, head, gauge pressure, absolute pressure, dynamic pressure, vacuum. Pressure measuring devices, Simple U tube manometer, differential U tube manometer, inclined tube manometer, measurement of absolute and gauge pressure by manometer, manometric liquids, purpose of pressure measurement. Mechanical pressure gauges, Bourdon tube, diaphragm & bellow gauges. Derivation & Calculation of pressure drop. | **CO1 CO2** |
| [2] | **Fluid dynamics: -** Purpose of flow measurement, definition of average mass & volumetric flow rates, Classification of flow meters, orifice meter, venturi meter, pitot tube, flow nozzle, rotameter, open weirs. Comparison & merits-demerits of flow meters. Calculation of flow rates by direct use of formulas | **CO2** |
| [3] | **Behaviour of different types of fluids: -** Definitions of ideal & real fluids, Newtonian & non-Newtonian fluids, behaviour of non-Newtonian fluids, definitions of different viscosities, viscosity measurement by Hagan Poiseuille's method, steady state & unsteady state flow. Reynold experiment, conclusions, definition of laminar flow, turbulent flow, and Reynold number, critical velocity, transition flow, assumptions of simple & modified Bernoulli's equation and its applications. Friction factor chart, significance, roughness parameter, relative roughness, skin friction, form friction comparison. Derivation of Fanning's friction equation. Head loss & pressure drop through pipe calculation. net head developed by pump, fluid HP, BHP calculation. | **CO1 CO3** |
| [4] | **Transportation of fluids: -** Pipes, tubes, pipe size, pipe fittings, their uses & sketches, joints-flange, expansion, Different types of valves, their construction, function & uses. Classification of pumps. Centrifugal pumps- volute & turbine type. Positive displacement pumps & gear, sliding vane, lobe, piston, plunger & diaphragm types fans – centrifugal forward & backward curved blades type. Blowers & compressors – reciprocating & rotary types (all fluid moving machineries are in brief) characteristic curves of centrifugal pump. Derivation of NPSH & calculation. Cavitation – causes & remedies. | **CO4** |
| [5] | **Conveying: -** Pneumatic type – vertical & horizontal types, Hydraulic type – vertical & horizontal types homogeneous flow & Industrial applications. | **CO5** |
| [6] | **Fluidization: -** Aggregative & particulate types. Mechanism, applications, calculation of pressure drops through fluidized bed. Comparison of packed & | **CO1** |

| | | |
|---|---|---|
| | fluidized beds, their merits, demerits & applications. | |
| [7] | **Level measurement: -** Direct level measurement – tape, sight glass & float methods. Indirect level measurement – Air trap box, diaphragm box, bulbar system, differential U tube manometer methods. | **CO5** |

## C. TEXT BOOKS

1. Gavhane K.A., Unit Operation-I; 21st ed.; Nirali Prakashan; Pune, 2011.
2. McCabe, W., Smith, J. Unit Operations of Chemical Engineering; 5th ed.; McGraw Hill Incorporation: New York, 2004.

## D. REFERENCE BOOKS

1. Badger, W. L., Banchero, J.T., *Introduction to Chemical Engineering;* McGraw Hill Incorporation: New York, 1955.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remembering | Understand the Various Fluid properties and their behaviour. |
| CO2 | Understanding | Demonstrate the Knowledge of fluid static and dynamics to understand the fluid flow problems. |
| CO3 | Understanding | Comprehension of fluid flow problems with the application of mass, momentum and energy equations. |
| CO4 | Understanding | Summarise the performance of the fluid flow operations in industries. |
| CO5 | Understanding | Classify various instruments relevant to fluid flow operation. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.6 | 2.8 | 2.6 | 2.8 | 2.8 | 2.6 | 2.6 | 2.6 | 2.8 | 2.6 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – V
## SUBJECT: FERTILIZER TECHNOLOGY (DK-514)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

### A. COURSE OVERVIEW

To inculcate the knowledge of various processes and operations of the chemical industries, among the diploma students of chemical engineering.

### B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Introduction: -** Need of fertilizer, type of fertilizer, mends and dements of fertilizer, fertilizer industries at glance. | CO1 |
| [2] | **Nitrogenous fertilizer: -** Roll of Nitrogenous fertilizer, sources and properties of hydrogen, nitrogen and ammonia, manufacture of synthesis gas by steam hydrocarbon, reforming and partial oxidation methods, synthesis of ammonia, types of converters, storage and handling of ammonia.<br>A. Urea: properties and uses, manufacture of urea by total recycle process with Montecatini and Toyokotsu process.<br>B. Ammonium nitrate: properties, manufacturing process and uses.<br>C. Ammonium sulfate: properties, manufacturing processes and uses.<br>D Ammonium chloride properties, manufacturing processes and uses | CO2 |
| [3] | **Potassium fertilizer: -** Roll of potassium as fertilizer, properties, and sources of potash and production of KCl. | CO3 |
| [4] | **Phosphatic fertilizer: -** Roll of Phosphorus as fertilizer, types of rock phosphate, production of elemental phosphorus (yellow or red) manufacture. of phosphoric acid by wet method, electric arc furnace method, production of normal and super triple phosphate, ammonium phosphate, major engineering problem of such industries. | CO4 |
| [5] | **Mixed fertilizer: -** Manufacture and granulation of mixed fertilizer and bulk blending. | CO6 |
| [6] | **Environmental aspects of fertilizer industry: -** Brief idea about air pollution, methods of controlling the air pollution and effluent treatment for fertilizer industries. | CO5 |

### C. TEXT BOOKS

1. Dryden's Outlines of Chemical Technology, 2nd Ed. By M. Gopala Rao & Marshall Sitting, East West Press Pvt. Ltd., New Delhi.

### D. REFERENCE BOOKS

1. Shreve's Chemical Process Industries, 5th Ed. By, George F. Austin McGraw Hill International Edition.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | To use relevant fertilizer on the basis of different properties to improve fertility of soil. |
| CO2 | Analyse | Analyse the roll of nitrogen and flow of raw materials to finished products in process flow diagrams of nitrogenous fertilizer industries and to understand the various associated engineering problems. |
| CO3 | Explain | Identify process flow diagrams of potassium fertilizer industries and to understand the various associated engineering problems. |
| CO4 | Explain | Explaining the production processes of Phosphorus Fertilizer products. |
| CO5 | Create | Create awareness among students for the research and innovation in the field of Fertilizer industries for environmental issues and sustainability. |
| CO6 | Understand | To understand manufacturing of mixed fertilizer and calculate different grade of fertilizer. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| Avg | 3 | 3 | 3 | 2.8 | 2.6 | 3 | 3 | 2.6 | 2.6 | 2.6 | 2.5 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – IV
## SUBJECT: HEAT TRANSFER (DK-403)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

### A. COURSE OVERVIEW

The course covers the fundamental aspects of Heat Transfer through convection, conduction and radiation. Derivation of heat loss for different shapes. Understanding of Heat Exchanger and Evaporation by their industrial application.

### B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Fundamentals of Heat Transfer: -** Introduction, Engineering heat transfer and analogies between various transport processes, modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzmann law, Thermal conductance and resistance, Convective and radiative conduction, Combined heat transfer process. | CO1 |
| [2] | **Steady State Heat Transfer by conduction: -** Concept of heat conduction, Linear one-dimensional Heat conduction through wall, through cylinder and through sphere, Conduction through composite plane wall, conduction through composite cylinder, conduction through composite sphere, critical insulation thickness for pipes.<br>**Heat Transfer by Convection: -** The nature of heat convection, The Nusselt Number, Determination of Nusselt Number, Forced convection (No derivation), Free convection (No derivation) | CO1<br>CO2 |
| [3] | **Heat Transfer by Phase Change: -** Heat transfer accompanied by phase change, Phenomenon of boiling, Regimes of pool boiling, Nucleate boiling & film boiling, Phenomenon of condensation. | CO5 |
| [4] | **Thermal Radiation: -** Nature of thermal radiation, Absorption, Transmission, Reflection and Emission of Radiation, Emissive power of black body, Plank's distribution, Total emissive power, Stefan-Boltzmann law, Emissivity, Kirchoff's law, Black body, Wien's displacement law, radiation shields. | CO1<br>CO2 |
| [5] | **Heat Exchangers: -** Introduction, types of heat exchangers, overall heat transfer coefficient, Effect of scale formation, logarithmic mean temperature difference, L.M.T.D. correction factors, Extended surfaces. | CO3 |
| [6] | **Evaporation: -** Introduction, Liquid characteristics, types of evaporator, Duhring rule & boiling point elevation, economy & capacity, method of feeding, examples based on single effect evaporator. | CO4 |

### C. TEXT BOOKS


1. K A Gavhane, Unit Operation II; 3rd ed.; Nirali Prakashan, Pune, July 2017
2. McCabe and Smith, Unit Operations of Chemical Engineering; 4th ed.; McGraw Hill Book Company; New York, 1986


### D. REFERENCE BOOKS


1. D.Q. Kern *Process Heat Transfer;* 3rd ed; Wiley Global Headquarters: USA 2019.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remembering | How conduction, convection and radiation proceed in daily life and in chemical industries. |
| CO2 | Understanding | Compare and understand Fourier's law, Newton's law, and Stefan Boltzmann law for mode of heat transfer with derivation of heat loss. |
| CO3 | Understanding | Demonstrate terminology of heat exchanger. |
| CO4 | Understanding | Understand the role of evaporator in industries. |
| CO5 | Understanding | Demonstrate condensation and boiling phenomena. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 3 | 2.8 | 3 | 2.6 | 3 | 2.8 | 2.6 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – IV
## SUBJECT: INSTUMENTATION (DK-402)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | - | 4 | 60 | 40 | -- | -- | 100 |

## A. COURSE OVERVIEW

This course covers the fundamentals of instrumentation used in industry and apply the key concepts of automatic control and instrumentation to process plants.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Introduction to Instrumentation:** - Concept and importance of instrumentation, classification of instruments, basic elements of instruments, characteristics of instruments in detail, brief explanation of first order system and second order system | CO1 |
| [2] | **Temperature Measuring Devices: -** Definition of thermometer, temperature scale, mercury in glass thermometer, Bimetallic & pressure spring thermometers, Principle of thermo electricity, Seebeck effect, Peltier effect & Thomson effect, Industrial thermocouple, lead wire thermowells, Resistance thermometer, Single wheatstone bridge circuit & Null bridge resistance thermometer, Deflection resistance thermometer circuit, Radiation & Optical pyrometers. | CO1<br>CO2 |
| [3] | **Measurement of Pressure & Vacuum: -** Pressure, Vacuum & Head measuring elements for gauge pressure & Vacuum, indicating elements for pressure gauges, Brief explanation about measurement of absolute pressure, Measuring pressures in corrosive fluids, Static accuracy of pressure gauges, Response of Mechanical Pressure gauges. | CO1<br>CO3 |
| [4] | **Measurement of Head & Level: -** Head, density & Sp. Gravity, Direct measurement of liquid level, Pressure (Level) measurements in open vessel, level measurement in pressure vessels, Measurement of Interface level, Density measurement, level measurement by weighing, level of dry materials. | CO1<br>CO3 |
| [5] | **Process Recording Instruments: -** Recording Instruments, Indicating & Signalling Instruments, and Transmission of instrument readings, Control centre, and Instrumentation diagram. | CO4 |
| [6] | **Distributed Control Systems: -** Principle of working, important control modes with simple diagram, Comparison of PLC & DCS system, Principle of modem | CO5 |

## C. TEXT BOOKS

1. Ekman D.P., *Industrial Instrumentation;* New Delhi: Wiley Eastern, 1985.

## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | Understand the importance of Instruments in process industry. |
| CO2 | Comprehension | Demonstrate the mechanical and electrical aspects of instruments used to measure temperature of process. |
| CO3 | Understand | Recognize the mechanical and electrical aspects of pressure and level measurement devices and their suitability for process dependent application. |
| CO4 | Understand | Understand Recording Instruments and Prepare Instrumentation diagrams. |
| CO5 | Understand | Understand the principle, working of PLC and DCS. |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 2.6 | 3 | 3 | 3 | 3 | 2.8 | 2.6 | 2.8 | 2.8 | 3 | 3 | 3 |

## DIPLOMA CEHMICAL SEMESTER – III
## SUBJECT: INDUSTRIAL SAFETY & ENVIRONMENTAL ENGINEERING (DK - 319)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

## A. COURSE OVERVIEW

The course is introducing general concept and their controls of safety, environment, and pollution. Students will learn to safety objects, role of chemical engineers, chemical hazards, mechanical hazards, electrical hazards, fire hazards and their controls and prevention methods and some pollution like water pollution, noise pollution, miscellaneous pollution, and solid waste disposal methods,

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **General introduction & concepts of safety: -** Safety of organization industrial plant lay out of safety, safety measures concept & importance of safety in chemical industries. | **CO1 CO4** |
| [2] | **Chemical & fire Hazards & their control: -** Definition, source, & classification of hazards like chemical, fire, different methods for controlling chemical & fire hazards, objective & importance of fire prevention, fire extinguishing agents & device with their working. | **CO1 CO4** |
| [3] | **Other hazards & occupational diseases: -** Concept of mechanical, electrical & noise hazards with their precaution. & notified dangerous occupational diseases with their cause and their prevention | **CO1 CO4** |
| [4] | **Personal Protective Devices: -** Protective devices for head, ears, eyes, face, respiratory system, hand, feet etc. | **CO2** |
| [5] | **Introduction to pollution: -** Introduction to environmental pollution, sources of pollutants, effects of pollution on human health, vegetation, animal life & effect on environment. & Miscellaneous Pollution: Sources types of effect of noise pollution, radiation etc. | **CO1 CO5 CO6** |
| [6] | **Air Pollution: -** Sources & Types of air pollutant, classification, properties of air pollutant, effect of air pollution, Air pollution control methods like gravitational settling, Diffusion, Electrostatic precipitation, Centrifugal impaction, Direct interception etc. Air pollution controlling equipments like gravity settler, cyclone separator, fabric filter, electrostatic precipitator, wet scrubber etc.. | **CO1 CO5 CO6** |
| [7] | **Water pollution: -** Introduction, characterization of water, BOD, COD, VM, SM, classification of sources. Water pollution, sewage treatment processes like primary, secondary of final treatment, Brief idea about CETP of design criteria for Industrial effluent treatment plant. | **CO1 CO5 CO6** |
| [8] | **Solid waste of disposal methods: -** Sources of classification, Methods of disposal like dumping, sanitary land filling, incineration, composting etc. | **CO1 CO5 CO6** |

## C. TEXT BOOKS

1. S. Rao, Environmental Pollution control engineering, 2nd edition, New age

International (P) Ltd.,Hyderabad, January, 2006.

## D. REFERENCE BOOKS

1. Danieal A. Crowel & Joseph. F, 2nd edition, Prentice hall PT, New Jersey, 2002.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remembering | The general introductions and concept of safety. |
| CO2 | Analysing | To choose appropriate protective devise for any given conditions. |
| CO3 | Applying | To apply hazard & pollution analysis techniques for risk assessment. |
| CO4 | Understanding | To understand fire hazards, objective, source and importance of safety and their objects. |
| CO5 | Remembering | Types of Pollutions And Sources... |
| CO6 | Understanding | To Understand Control methods, and disposal management. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.6 | 2.5 | 2.6 | 2.5 | 3 | 3 | 3 | 2.5 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – VI

# SUBJECT: INDUSTRIAL TRAINING / PROJECT WORK (DK601)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| - | - | - | - | - | - | 50 | 100 | 150 |

## A. COURSE OVERVIEW

A student will undergo in-plant training for about 16 weeks and submit a training report which covers following aspects **or** he will prepare a complete project report comprising product properties, various manufacturing processes, process selection, material balance energy balance, plant location and layout etc. under the guidance of concerned faculty.

## B. COURSE CONTENT

| NO | TOPIC |
|---|---|
| [1] | **Factory Organizations:**<br>Operation, Supporting, Engineering Services, Plant Location, Layout, Waste management, Utility Supply. |
| [2] | **Operation of Chemical Plant:**<br>Key activities, Technology absorption, Process control, Safety Awareness/Emergency Handling, Troubleshooting, and In-process Quality Control. |
| [3] | **Construction/Working/Operation/Inspection of**<br>Pipes/Pipe fittings, Instruments, Distillation Tower, Filtration, Centrifuges, Heat Exchanger, Evaporator, Drier, Cooling Towers, Pumps etc. |
| [4] | **Concept of Startup / Shutdown / Emergency handling / Maintenance etc.** |

## DIPLOMA CHEMICAL SEMESTER – I
## SUBJECT: MATHEMATICS-I (DK-101)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 0 | 4 | 60 | 40 | - | - | 100 |

## A. COURSE OVERVIEW

The course is devised to introduce fundamental aspects of Mathematics. Students will learn to solve different kinds of problems in different aspects of Mathematics with its application, problem solving knowledge.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | Concept and Rules, Examples on indices, Definition and concept, Simple examples on surds, Square root of Surds, Examples on square root of Surds, Definition and concept, Logarithms rules, Examples based on rules and calculations, Formula for nth term of an A.P., Sum of n terms of an A.P., Definition of Arithmetic mean, Definition, Computation of nth term of a G.P, Sum of n term of G.P., Definition of geometrical mean, Examples, Formula for $r+1$ term of $(x+a)^n$. | CO1 CO2 CO3 |
| [2] | Examples of finding any term of middle term of $(x+a)^n$, Finding constant term and coefficient of $(x)^r$, Examples of $(1+x)^n$ .Introduction and Types of Matrices, Algebra of Matrices, Adjoint and Transpose of matrices, Inverse of a matrix, Solution of simultaneous linear equation by matrix method, Definition of a vector, scalar and Types of vectors. | CO3 CO4 |
| [3] | Geometric representation of vector, Addition and Subtraction, Unit vectors, Magnitude and Direction of vector, Product of vector and scalar, Dot product and Cross [product of two vectors. Concept of Angles. Degree and Radians, Area of sector and arc-length. | CO3 CO4 |
| [4] | Concept of allied angles, Definition and concept of periodic function, Graphs of Sine and Cosine, Concept of addition and Subtraction formula, Sum and difference formula, Formula for 2A and 3A and their multiples. | CO5 CO6 |
| [5] | Definition and concept, Product formulae, A/2 formulae, simple examples, Sine and cosine rules, Projection formulae, solution of triangle using formulae, Inverse trigonometric function definition and examples, Height and Distance and examples. | CO5 CO6 |

## C. TEXT BOOKS

1. Dr. N. R. Pandya. Polytechnic Mathematics – I. Mahajan publishing house, Ahmedabad.

## D. REFERENCE BOOKS

1. Prof. R. P. Rethaliya. Polytechnic Mathematics – I. Nirav and Roopal prakashan, Ahmedabad.
2. B. M. Patel, Dr. Ajay V. Shah, Mehul B. Patel. Diploma Engineering Mathematics –I.

Nirali prakashan, Mumbai.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | Understand effective mathematical rules and definition for the concept of indices, surds. |
| CO2 | Understanding | Understanding rules of logarithm and Extending the concept learning of Arithmetic Progression and Geometric Progression and examples. |
| CO3 | Analysing | Analyse and evaluate binomial expansion and understand to get middle and constant term of expansion. |
| CO4 | Evaluate | To understand how to derive the solution of addition or multiplication of Matrices with examples and understand the types of the matrices and to get the solution of the equation by matrix and discuss vectors. |
| CO5 | Evaluate | Evaluate and Differentiate Measurement of angles, Trigonometric ratios, allied angles compound angles and to sketch the graph of periodic function. |
| CO6 | Evaluate | Able to Investigate Inverse Trigonometric function, Properties of triangle and solution of triangle and measure, height and distance and examples. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 |
| Avg | 2.8 | 2.7 | 2.7 | 2.8 | 2.3 | 2.3 | 2.3 | 2 | 1.8 | 2 | 2 | 2 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – II
## SUBJECT: MATHEMATICS-II (DK-201)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 0 | 4 | 60 | 40 | - | - | 100 |

## A. COURSE OVERVIEW

The course is devised to introduce fundamental aspects of Mathematics. Students will learn to solve different kinds of problems in different aspects of Mathematics with its application, problem solving knowledge.

## B. COURSE CONTENT

| NO | TOPIC | Cos |
|---|---|---|
| [1] | **Concept and Rules of Point: -** Distance formula, circumcentre and in centre of triangle, Examples based on distance formula, Area of triangle, Examples of Area of Triangle, Concept of division of line segment. Internal and External Division, Examples of division of line segment, Locus of point concept and definition and examples, Different types of equation of straight line, slope, intercepts. | **CO1** |
| [2] | **Straight Line: -** Equation of straight line passing through two points or slope and one point, Parallel and perpendicular straight lines, and Examples, Angle between two lines and examples,<br>**Circle**: - Definition, Equations of circle and examples, Tangent and normal to the circle. | **CO2**<br>**CO3** |
| [3] | **Function and limit: -** Definition, Types of Functions. One one, onto function, Concept and rules, examples, Differentiation: Concept Definition, Basic Examples by definition, Formula for $x^n, \sin x, \cos x$ etc, Examples based on formulae. | **CO4**<br>**CO5** |
| [4] | **Definition and concept of Differentiation: -** Rules for addition, subtraction, product and division of functions, Examples based on rules, Chain rule and Examples, Derivation of parametric and implicit functions and Examples, Higher order differentiation, Application of derivative (velocity, acceleration, maxima-minima), Examples. | **CO5**<br>**CO6** |
| [5] | **Definition and concept of Integration: -** simple basic rules, Formulae of integration, Example based on formula, Indefinite and definite integrals, Examples, Integration by parts, Method of Substitution, Application of integration. (Area, volume) and examples. | **CO5**<br>**CO6** |

## C. TEXT BOOKS

1. Dr. N. R. Pandya. Polytechnic Mathematics – II. Mahajan publishing house, Ahmedabad.

## D. REFERENCE BOOKS

1. Prof. R. P. Rethaliya. Polytechnic Mathematics – II. Nirav and Roopal prakashan, Ahmedabad.
2. B. M. Patel, Dr. Ajay V. Shah, Mehul B. Patel. Diploma Engineering Mathematics – II. Nirali prakashan, Mumbai.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | Understand definition and concept of points like distance between two points, collinear points. Area of triangle, Internal and External Division and examples. |
| CO2 | Understanding | Understanding definition of Circle, equation of tangent and normal and examples. |
| CO3 | Analysing | Analyse and evaluate slope and intercept of straight line, slope and equation of line passing through two points, parallel and perpendicular lines. |
| CO4 | Evaluate | Derive and evaluation limit of function, rules and examples. |
| CO5 | Evaluate | Evaluate and Differentiate concept of Differentiation, chain rule, and higher order derivation. |
| CO6 | Evaluate | Investigate and understand rules of Integration, formulae based examples, Integration by parts and examples. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 |
| CO5 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 |
| Avg | 2.8 | 2.7 | 2.7 | 2.8 | 2.3 | 2.3 | 2.3 | 2 | 1.8 | 2 | 2 | 2 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – III
## SUBJECT: MECHANICAL OPERATION (DK-301)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

## A. COURSE OVERVIEW

The course covers the fundamental aspects of size reduction, different equipment that use for size reduction. Also cover different mechanical operations like mixing, agitation, sedimentation and filtration.

## A. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Introduction of Mechanical Operation**: - Definition of Unit Operation and Unit Process, Difference between Unit operation and Unit Process, Examples of Unit Operation & Unit Process. | CO1 |
| [2] | **Properties of particulate solids: -** Specific properties of solids, Density & Bulk density. Definition and calculation of particle diameter, Sphericity, equivalent diameter, specific surface area, volume surface mean diameter, mass mean diameter, shape factor, Calculation of no. of particles. | CO1<br>CO2 |
| [3] | **Screen Analysis: -** Need of screen analysis, Types of screen analysis, Application of screen analysis, Types of screens, trommel, grizzlies, Vibrating screen etc. Ideal & actual screen, Capacity & effectiveness of screen (With derivation). Calculation of capacity and effectiveness of screen, faults in screening. | CO1<br>CO3 |
| [4] | **Size Reduction: -** Definition and need of size reduction, Principles of size reduction, characteristics of comminuted products, Energy & power requirements in communition, laws of size reduction, work index, Types of size reduction equipment with their principle, construction & working, derivation of equation of angle of nip and critical speed. Calculation of angle of nip, capacity & Ribbon factors. Open & close circuit grinding. | CO1<br>CO2<br>CO3 |
| [5] | **Sedimentation**: - Definition of sedimentation, theory of bath sedimentation, Interphase height and time curve, Flocculation principle, Gravity thickener. Explanation of free and hindered settling, cyclone separator, efficiency of cyclone separator. Definition of Stoke's law and Newton's law for terminal settling velocity. | CO1<br>CO4 |
| [6] | **Filtration: -** Definition and applications of filtration, Equipments for liquid – solid separation., Filter press, Rotary vacuum filter, filter media and its required characteristics, filter aids and method of application, calculation of special cake resistance, filter media resistance, porosity for constant rate, constant pressure system and vacuum drum, constant rate filtration and constant pressure filtration, classification of centrifugal equipment, batch centrifuge, Advantages and disadvantages of centrifuge over filter press. | CO1<br>CO4<br>CO5 |
| [7] | **Agitation and Mixing: -** Classification of Impellers, vortex formation and swirling, methods of vortex prevention, factors affecting agitation, Purpose of mixing solids and paste, Principle construction & working of Ribbon blender, Muller mixer, Banbury mixer & Kneaders. | CO1<br>CO6 |

## C. TEXT BOOKS

1. MaCabe & Smith, *Unit Operation in Chemical Engineering;* 5th ed.; McGraw Hill Book Company; New York, 1993
2. K A Gavhane, *Unit Operation I;* 3rd ed.; Nirali Prakashan, Pune, July 2015

## D. REFERENCE BOOKS

1. Coulson and Richardson *Chemical Engineering Vol. I;* 7th ed; Landon: 1999.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | To impart the basic concepts of mechanical operations in chemical process industries. |
| CO2 | Remembering | To develop understanding about size analysis with the help of equipments and properties of particulate solids. |
| CO3 | Understanding | Understanding of different equipments and laws of size reduction and deriving the equation for angle of Nip and Critical Speed. |
| CO4 | Understanding | To get knowledge for mixing and agitation operation and classify and explain solid-solid, solid-fluid related operations. |
| CO5 | Understanding | Understand mechanical separation methods such as filtration, and sedimentation by using different equipments. |
| CO6 | Understanding | Understanding of theory and derivation for filtration process and sedimentation process. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 3 | 2.8 | 3 | 2.6 | 3 | 2.8 | 2.6 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – IV
## SUBJECT: MASS TRANSFER - I (DK-406)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

## A. COURSE OVERVIEW

The course imparts understanding of fundamental concepts of mass transfer, various mass transfer operations and their equipment's.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Introduction: -** Importance of mass transfer operations, classification of mass-transfer operations, methods of conducting mass transfer operations, fundamental design principles. | CO1 |
| [2] | **Molecular Diffusion Of Fluids: -** Concept of molecular and eddy diffusion, Fick's law for diffusion, Steady state molecular diffusion in fluids in laminar flow, simple problems on diffusion by direct use of formula. | CO1<br>CO2 |
| [3] | **Interphase Mass Transfer: -** Concept of equilibrium, diffusion between phases, mass transfer coefficients, local and average overall mass transfer coefficient, film theory, penetration theory, surface renewal theory, analogy between mass, heat and momentum transfer, concept of stage, stage efficiency, cascade etc. | CO1<br>CO2<br>CO3 |
| [4] | **Gas Absorption: -** Definition and application of absorption, equilibrium solubility of gases in liquids, effect of temperature and pressure on solubility, characteristics of ideal liquid solutions of Raoult's law, nonideal liquid solutions of henry's law, choice of solvent, material balance for the component transfer in counter current and concurrent flow, concept of HETP and simple problems on absorption. | CO3<br>CO5 |
| [5] | **Liquid-Liquid Extraction: -** Definition and application of liquid extraction, liquid equilibrium for three component system, equilibrium triangular coordinates, system of three liquids one pair partially soluble and system of three liquids two pairs partially soluble, effect of temperature and pressure on the solubility curve, choice of solvents for the operation, simple problems using direct formula. | CO3<br>CO5 |
| [6] | **Leaching: -** Definition and industrial application of leaching, preparation of solid, temperature of leaching, methods of operations and equipment for inplace leaching, heap leaching and percolation tanks, counter current multiple contact shanks system, filter-press leaching, agitated vessel, leaching during grinding, equipment like Dorr agitator, Rotocel, Kennedy extractor and Balloman extractor. | CO4<br>CO5 |
| [7] | **Equipment For Gas-Liquid Operation: -** Construction and working of gas dispersed equipment's like bubble column (Sparged vessel), agitated vessel, tray tower, mechanically agitated vessels, tray efficiencies, liquid dispersed equipment's like venturi scrubbers, wetted wall column, spray tower, packed tower and comparison between tray and packed tower. | CO4 |

## C. TEXTBOOKS

1. Treybal, Robert Ewald. *Mass-Transfer Operations*. New York: McGraw-Hill, 1980.
2. Dr. Kiran D Patil. *Principles and Fundamentals of Mass Transfer Operations-I.* Pune: Nirali Prakashan, 2002.
3. K A Gavhane. *Unit Operations-II (29th Edition)*, Pune: Nirali Prakashan, 2014.

## D. REFERENCE BOOKS

1. McCabe, Warren L., and Julian C. Smith. Unit Operations of Chemical Engineering. New York: McGraw-Hill, 1967.
2. Walter L. Badger and Julius T. Banchero. Introduction to Chemical Engineering. New York: McGraw-Hill, 1955.
3. Richardson, J. F., J. H. Harker, J. R. Backhurst, and J. M. Coulson. Coulson and Richardson's Chemical Engineering. Vol. 2, Vol. 2. Oxford: Butterworth-Heinemann, 2002.
4. Perry, Robert H., and Don W. Green. Perry's Chemical Engineers' Handbook. New York: McGraw-Hill, 2008.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | Understand mass transfer for same phase as well as different phases and basic principles for design in process industries |
| CO2 | Understanding | Understand Fick's law and mass transfer coefficient for diffusion in fluids |
| CO3 | Understanding | Understand theory & analogy for mass transfer and solubility of desired components in solvents |
| CO4 | Understanding | Demonstrate Equipment's for mass transfer in gas-liquid and solid-liquid phases. |
| CO5 | Understanding | Demonstrate mass transfer phenomena in gas-liquid, liquid-liquid and solid-liquid phases. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 3 | 2.8 | 3 | 2.6 | 2.8 | 2.6 | 2.6 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – V
## SUBJECT: MASS TRANSFER II (DK-502)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

### A. COURSE OVERVIEW

The course is devised to introduce fundamental aspects of Mass Transfer units operations. Students will learn distillation, humidification, drying, crystallization and adsorption unit operation with its industrial application, problem solving knowledge and different equipment that are used in industries.

### B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Distillation: -** Importance of distillation as separation method, vapor-liquid equilibrium, relative volatility, ideal solutions with Raoult's law, Henry's law, maximum & minimum liquid azeotropes, flash vaporization with material balance calculation, calculations of vapor- liquid equilibrium, Differential distillation with Rayleigh's equation of simple calculation, steam distillation, continuous rectification – binary system based on McCabe & Thiele methods with calculation, Extractive & Azeotropic distillation. | **CO1 CO2 CO3 CO4** |
| [2] | **Humidification: -** Concept of partial pressure & vapor pressure, definitions & simple calculations for absolute humidity, relative saturation & percentage saturation, concept of wet bulb temperature, dry bulb temperature, dew point, humid volume, humid heat, psychrometric chart, construction & working of different types of cooling tower, spray pond. | **CO1 CO2 CO5** |
| [3] | **Drying: -** Applications, understanding of various definitions, types and classification of drying operations, equipments, freeze drying, drying test and derivation of equations for drying time and simple calculations. | **CO1 CO2 CO3 CO5** |
| [4] | **Adsorption and Ion Exchange: -** Concept and application, types of adsorption, hysteresis, characteristics and nature of adsorbents, effect of temperature, Freundlich equation and it's applications for single stage operation, heatless adsorber, major applications and factors affecting ion-exchange. | **CO1 CO2 CO3 CO6** |
| [5] | **Crystallization: -** Concept and application, methods for supersaturation, classification of crystallizer, Meir's theory, concept of nucleation and crystal growth, effect of seeding and simple calculations for percentage yield, construction and working of Swenson Walker, tank, DTB, Krystal and Vacuum crystallizes. | **CO1 CO2 CO3 CO6** |

### C. TEXT BOOKS


1. Treybal, Robert Ewald. *Mass-Transfer Operations*. New York: McGraw-Hill, 1980.
2. Dr. Kiran D Patil. *Principles and Fundamentals of Mass Transfer Operations-I.* Pune: Nirali Prakashan, 2002.
3. K A Gavhane. *Unit Operations-II (29th Edition)*, Pune: Nirali Prakashan, 2014.

## D. REFERENCE BOOKS


1. McCabe, Warren L., and Julian C. Smith. *Unit Operations of Chemical Engineering*. New York: McGraw-Hill, 1967.
2. Walter L. Badger and Julius T. Banchero. *Introduction to Chemical Engineering*. New York: McGraw-Hill, 1955.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | To understand mass transfer with suitable operations. |
| CO2 | Understanding | To study the different equipment's used in mass transfer operations with its advantages, Limitations & applications. |
| CO3 | Understanding | Able to compare and select different mass transfer operations with respect to applications. |
| CO4 | Applying | To understand VLE data and also calculate theoretical number of trays required in distillation column. |
| CO5 | Understanding | To understand humidification and drying operation with its different terminology. |
| CO6 | Understanding | Able to understand adsorption, crystallization and ion-exchange operations. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.8 | 3 | 2.8 | 2.8 | 2.8 | 3 | 2.8 | 2.6 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – II
## SUBJECT: ORGANIC CHEMISTRY (DK-202)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

## A. COURSE OVERVIEW

The course is devised to introduce fundamental aspects of Organic chemistry. Students will learn about some very basic concept of chemistry like distillation technique, other purification technique, qualitative and quantitative analysis, IUPAC and stereo isomers, organic synthesis and preparation of organic compounds with their chemical and physical properties, and also with its industrial application, problem solving knowledge and different types of problem and its solution that are used in industries.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Purification of organic compounds: -** Purification of organic compounds by crystallization, distillation, sublimation | **CO1 CO2** |
| [2] | **Detection and estimation: -** Detection and estimation of C, H, N, O, S and halogens | **CO1 CO2** |
| [3] | **IUPAC Nomenclature: -** IUPAC Nomenclature of aliphatic, aromatic and hetero-cyclic compounds | **CO1 CO3** |
| [4] | **Stereo-chemistry: -** Stereo isomerism, optical isomerism, geometrical isomerism, Walden-Inversion | **CO1 CO3** |
| [5] | **Study of Aliphatic compounds: -** Study of chemical reaction involving & IUPAC Nomenclature involving in important methods of preparation and chemical properties of following compounds with their uses. Ethane, ethylene, acetylene, ethyl chloride, ethanol, acetaldehyde, acetone, chloroform, acetic acid, ethyl acetate, diethyl ether. Ethylamine, Granger reagent | **CO1 CO4** |
| [6] | **Coal-tar: -** Fractional distillation and production of coal tar, isolation of its components | **CO1 CO5** |
| [7] | **Study of Aromatic compound: -** Study of Aromatic compound & chemical reaction involving in important methods of preparation and their chemical properties of following aromatic compounds. Benzene, toluene, benzene halides, styrene, nitro-benzene, sulphonic acids, aniline, phenol, benzaldehyde, benzoic acid, salicylic acid | **CO1 CO4** |
| [8] | **Orientation: -** Electronic theory of orientation of benzene substitution reactions | **CO1 CO4** |
| [9] | **Carbohydrates: -** Classification of carbohydrates, brief information with their structural formula | **CO1 CO6** |
| [10] | **Polymers: -** Types of polymers, Illustration with their monomers and polymers | **CO1 CO6** |

## C. TEXT BOOKS


1. B.S. Bahl, Text book of organic chemistry. New Delhi: S. Chand publication, 1968.
2. H.M. Chawla, P.L. Soni Text book of organic chemistry. New Delhi: S. Chand publication, 1992.

## D. REFERENCE BOOKS

1. John L. Kice, Elliot N. Marvell, Modern principles of organic chemistry and introduction. New Delhi, Amerind; 1972

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remembering | Acquire knowledge of different basic terms included in organic chemistry related to purification technique, qualitative and quantitative analysis, different types nomenclature, organic synthesis, chemical and physical properties of organic compounds, carbohydrates, polymers etc. |
| CO2 | Applying | Understand the Various methods of purification of organic compounds. Analyze systematic knowledge of qualitative analysis and quantitative analysis of organic compounds. |
| CO3 | Understanding | Evaluate the IUPAC nomenclature and structure of simple and complex organic compounds. Understand three dimensional structures of organic compounds and their importance in organic chemistry |
| CO4 | Understanding | Can illustrate the different chemical reaction and mechanism of organic compounds and also orientation of group on aromatic ring. |
| CO5 | Understanding | Understand the isolation of various compounds from coal and coal tar. |
| CO6 | Understanding | Can explain the different biomolecule and polymers with their structures and properties. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.8 | 2.8 | 2.7 | 2.7 | 2.8 | 2.7 | 3 | 2.5 | 3 | 2.8 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – IV
## SUBJECT: PROCESS CALCULATION (DK-405)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 0 | 4 | 60 | 40 | -- | -- | 100 |

## A. COURSE OVERVIEW

The course is devised to introduce fundamental aspects of Process calculation. Students will learn to develop steady state material and energy balance equations for different unit operations.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Introduction: -** Dimensions & Units, Different systems of units, Conversion of units & simple problems on such topics.<br>**Basic Chemical Calculation: -** Composition of solids, Liquid mixtures, Ideal gas law, Gas constant, Composition of gaseous mixtures, Dalton's & Amaget's law and simple problems on above topics. | CO1 |
| [2] | **Material Balance: -** Concepts and importance of material balance, Classification of material balance Problems, Problems based on tie material, Inert material balance & simultaneous equation involving various unit operations, Concepts of recycle, purge and bypass.<br>**Material Balance with chemical reaction: -** Simple steady state material balance problems with chemical reaction. | CO2<br>CO3<br>CO4<br>CO5 |
| [3] | **Energy Balance: -** Forms of energy, Concepts of Cp, Cv, Calculation of enthalpy change, Thermo chemistry involving concepts & simple calculations of $H_c$, $H_R$ & $H_f$, Simple energy balance problems. | CO2<br>CO4<br>CO5 |
| [4] | **Combustion: -** Types of fuels, calorific value, Simple problems to find out the air requirement & composition of exit gases etc. | CO2 |

## C. TEXT BOOKS

1. KA Gavhane, *Unit Operation II;* 3rd ed.; Nirali Prakashan, Pune, July 2017

## D. REFERENCE BOOKS

1. Himmelbau. *Basic principles of calculation in chemical engineering;* 5th ed.; New Jersey 1989.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understanding | Understanding different systems units and dimensions. |
| CO2 | Understanding | Classification of material balance problems, Fuels and Energy. |
| CO3 | Understanding | Comprehension of material balance equations for different unit operations. |
| CO4 | Understanding | Understanding chemical reactions and calculating energy balance and material balance (with chemical reaction). |
| CO5 | Understanding | Discuss material and energy balance with industrial examples. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.6 | 2.8 | 2.6 | 2.8 | 2.8 | 2.8 | 2.8 | 2.6 | 2.8 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – III
## SUBJECT: PLANT DESIGN, MANAGEMENT & ECONOMICS (DK-318)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 0 | 4 | 60 | 40 | 0 | 0 | 100 |

## A. COURSE OVERVIEW

The course is devised to introduce fundamental aspects of fluid flow behaviour. Students will learn to develop steady state mechanical energy balance equation for fluid flow systems, estimate pressure drop in fluid flow systems and determine performance characteristics of fluid machinery.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Organization Structure and organizational Dynamics: -** Definition, scope organization Structure, Definition, Goals of Organization Structure Line Organization basics, application, Functional Organization basics, application, Line & staff Organization basics, Committee Organization basics, Principles of Organization, Principles of Organization, differences between various types of Organization, Organization culture & factors affecting it. | **CO1 CO4** |
| [2] | **Material, Finance, Production & Marketing Management: -** Definition, Function, Importance & brief idea about all these kinds of management. | **CO1 CO3 CO4** |
| [3] | **Production, Planning and Control: -** Concept of Production, planning and control, Objectives, functions of production, planning and control etc. | **CO1 CO4** |
| [4] | **Introduction of Plant Design: -** Importance of Chemical Engg. Plant Design, Role of chemical engineer in Plant Design, Need for Plant Design, Basis for good design, Relation of Plant Design with sales. | **CO2** |
| [5] | **Development of Chemical Plant Project: -** Objectives for development of project, Process evaluation stages with description, Technical factors, Economic factors, Legal phase, and sources of information. | **CO1 CO5 CO6** |
| [6] | **Process Design for Chemical Plant: -**Choice of process, selection of process cycle, continuous versus batch process, shift-operating time schedules types of flow diagrams. | **CO1 CO3 CO6** |
| [7] | **Selection of Chemical Process equipments, Auxiliaries & Material: -** Selection of process equipment, Standard vs. special equipment, Selection of various equipments like size reduction, material handling, heat transfer, mass transfer equipments etc., selection of pumps, Piping, - ferrous pipe and tubes, non- metallic pipe, Selection of pipes & Tubes, Insulation, types of insulation, factors governing selection of insulation, application of pipe insulation | **CO1 CO3 CO6** |
| [8] | **Layout & Location of Chemical Plant: -** Importance of plant layout, factors in planning layout, methods of layout planning, unit area concept, two-dimensional layout, scale models, principles of plant layout, site location, Primary and secondary factors considered in the plant location. | **CO1 CO5 CO6** |
| [9] | **Plant Economics: -** Estimation of total product cost, fixed capital investment, working capital investment, over-head charges, payout period, | **CO1 CO4** |

| | | |
|---|---|---|
| | Break-even point, Causes of Depreciation, types and methods of determining depreciation | **CO6** |

## C. TEXT BOOKS:

1. Plant design & Economies for Chemical Engineers - M.S. Peters and K.D. Timmerhaus
2. Chemical Engineering Plant Design - F.C. Vilbrandt and C.E. Dryden.
3. Industrial Management. – Atul Prakashan.

## D. REFERENCE BOOKS:

1. Modern production Management - Butta.
2. Material Management - N. Nair.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Remembering | The general introductions and concept of Economics, Plant Design and Management. |
| **CO2** | Analysing | To choose appropriate devices for any given conditions. |
| **CO3** | Applying | To apply basic concepts in industrial management concepts. |
| **CO4** | Understanding | To understand and study of Plant Design, Industrial aspects. |
| **CO5** | Remembering | Types of Economics Aspects, Design Aspects used in industries. |
| **CO6** | Understanding | To Understand principles, calculation, flow diagrams in Plants. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| **CO6** | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| **Avg** | 3 | 2.6 | 2.5 | 2.6 | 2.5 | 3 | 3 | 3 | 2.5 | 3 | 3 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – V
## SUBJECT: PETROLEUM REFINING AND PETROCHEMICAL TECHNOLOGY (DK-513)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

### A. COURSE OVERVIEW

To familiarize the students with characteristics of Crude, it's refining to get commercially important fractions and products. To help the students in understanding the unit operations and unit processes in manufacture of various petrochemicals and their downstream products.

### B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Origin, Formation & Composition of Petroleum: -** Origin & formation of petroleum, Reserves & deposit of world, Indian petroleum refineries with their location & capacity, composition of petroleum. | CO1 |
| [2] | **Petroleum Processing Data: -** Classification of crude oil, Crude Assay Analysis, ASTM Distillation, Thermal properties of petroleum | CO1<br>CO2 |
| [3] | **Fractionation of Petroleum: -** Dehydration & Desalting of crude, pipe still heaters, Distillation of crude oil, Important products, properties & test methods, additives for various petroleum products. | CO1<br>CO3 |
| [4] | **Treatment Techniques: -** Physical & Chemical Impurities, Treatment of gasoline, Kerosene & lubes by various methods. Removal of sulfur and sulfur compound. | CO4 |
| [5] | **Thermal & Catalytic Processes: -** Objective of cracking & Reforming operations, effect of temperature & pressure on cracking, advantages of cracking, Reforming & Platforming. | CO6 |
| [6] | **Introduction of Petrochemical Industry: -** Definition, History, Major Petrochemical products and their producers in India, Raw materials for Petrochemicals, Characteristics of Petrochemical Industry. | CO1 |
| [7] | **Manufacture of $C_1$ compound: -** Manufacture of Methanol, Formaldehyde.<br>**Manufacture of $C_2$ compound: -** Ethylene & Polyethylene, Vinyl chloride, Ethanol, Ethylene di-chloride, Ethylene oxide.<br>**Manufacturing of $C_3$ compound: -** Propylene & Polypropylene, Cumene, Acylonitrile,<br>**Manufacture of $C_4$ Compound: -** Butadiene, Iso butylene, Butanol,<br>**Aromatics Chemicals: -** Styrene LAB, Phenol, Terphthalic Acid & DMT, Phthalic anhydride and Malaik anhydride | CO5 |

### C. TEXT BOOKS


1. Bhaskara Rao, B.K., *Modern Petroleum Refining Processes*, 6th Ed. Oxford & Ibh, New Delhi, 2017.
2. Bhaskara Rao, B.K., *A Text on Petro Chemicals*, 5th Ed, Khanna Publisher, New Delhi, 2010.


### D. REFERENCE BOOKS


1. G.N. Sarkar, *Advanced Petroleum Refining;* Khanna Publishers: New York, 1955.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember | Understand the basics of Petroleum Crude and Petrochemical products and its composition. |
| CO2 | Understand | Explain the knowledge of different refining processes. |
| CO3 | Apply | Understand the Properties and Implement the Test methods of Petroleum Products. |
| CO4 | Analyse | Examine the different Treatment Process for Petroleum Products. |
| CO5 | Create | Develop the production processes of various Petrochemical products. |
| CO6 | Understand | Understand Cracking and Reforming operation and explain different processes for cracking and reforming operation. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2.5 | 2.5 | 3 | 2.8 | 3 | 3 | 3 |

## DIPLOMA CHEMICAL SEMESTER – V

# SUBJECT: POLYMER TECHNOLOGIES [DK-517]

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | - | 4 | 60 | 40 | - | - | 100 |

## A. COURSE OVERVIEW

The course is introducing general concept of polymer & polymerization techniques Students will learn to what is polymerizations and their productions methods, classifications of polymerization techniques. And and also to gain the knowledge of chemistry of polymerization, plastics, fibers, rubbers, Resins for Adhesives and Protective Coating, Fiber and Film, Polymer processing etc….

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Introduction to polymers: -** Brief history, About polymers, Classification of polymers according to chemical and geometrical structure of polymer molecules, General remarks on polymer microstructure, Microstructure based on the chemical structure – Organic and inorganic polymers, Homochain and heterochain polymers, Homopolymers and copolymers, Microstructure based on the geometrical structure – Linear, branched and cross-linked polymers, Random, alternating, block and graft co-polymers, Stereo-regular polymers – Optical isomerism, Geometrical isomerism, glass transition temperature. | **CO1 CO2** |
| [2] | **Chemistry of Polymerisation: -** Introduction, Chain polymerisation – Free radical polymerisation, Ionic polymerisation, Introduction to catalytic polymerisation, Step polymerization. | **CO1 CO2** |
| [3] | **Polymerization Techniques: -** Bulk polymerisation, Solution polymerisation, Suspension polymerisation, Emulsion polymerisation, Melt polycondensation, Solution Polycondensation, Interfacial polymerization | **CO2 CO3** |
| [4] | **Plastics: -** Introduction, Classification of Plastics, Raw Materials, Preparation, properties, and applications for the Addition Polymerization Products like Poly Ethylene, LDPE, HDPE, PVC, Poly Styrene, Alloys, blends, and composites, Engineering Plastics like Nylon, ABS, Poly Carbonates, TEFLON etc, Recent trends in plastics like bio degradable plastics etc. | **CO1 CO4 CO5** |
| [5] | **Rubbers: -** Introduction and classification of rubber, vulcanization, reinforcement with carbon black, Natural rubber, Preparation, properties, and applications of synthetic rubbers like SBR, Poly Butadiene, Poly Ethylene-Propylene & Butyl Rubber, Brief of some important rubber like Nitrile rubber , Neoprene, Reclaim Rubber. | **CO1 CO4 CO5** |
| [6] | **Resins for Adhesives and Protective Coating: -** Introduction, Condensation polymerization products like Phenol Formaldehyde (Phenolic Resins), Amino Resins, Polyester Resins, Alkyl Resins and Epoxy Resins, Polyurethane Resins, Poly Amide Resins | **CO1 CO4 CO5** |
| [7] | **Fiber and Film: -** Introduction to fibre, Properties of fibre, Cellulosic fibre: Viscose Rayon and Cellulose Acetate, Polyamide fibres, Polyester fibre, Acrylic fibres, carbon fibres, Films: Viscose & Cellulose Acetate, Poly olefins, Poly Vinyl Chloride | **CO1 CO5 CO4** |

| | | |
|---|---|---|
| [8] | **Polymer processing: -** Extrusion, injection moulding, compression moulding, blow moulding, film extrusion, spinning, extrusion film blowing, etc. | **CO1**<br>**CO3** |

## C. TEXT BOOKS

1. V R Gowarikar, Polymer Science, 6th edition, New Delhi 1986.
2. R Sinha, Outlines of polymer Technology, Esten Economy Edition, New Delhi, 2000.

## D. REFERENCE BOOKS

1. Fred W Billmeyer Jr, Text Book of Polymer Science, 3rd edition, New York, 1984.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Remembering | To Remembering of general introduction of polymers, polymerizations, polymerizations techniques, Rubbers, Plastics, Resins, Fibers and film, polymers processing. |
| **CO2** | Remembering | To Remembering of types of polymers, polymerizations, polymerisation techniques, Rubbers, plastics. |
| **CO3** | Understanding | To Understanding of polymerization techniques & polymer processing. |
| **CO4** | Analyse | To Analyse different applications of polymerizations products like Rubbers, Plastics, Resins, Fibers & Films. |
| **CO5** | Remembering | To Remembering of properties of Plastics, Fibers & Films. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 2 | 2 | 2 | 2 | 2.5 | 2 | 3 | 3 | 2.5 | 3 | 2.5 | 3 | 3 | 3 |
| **Avg** | 2.8 | 2.6 | 2.6 | 2.6 | 2.5 | 2.6 | 2.8 | 3 | 2.5 | 3 | 2.5 | 3 | 3 | 3 |

## DIPLOMA CEHMICAL SEMESTER – III
## SUBJECT: PLANT UTILITIES & ENERGY ENGINEERING (DK-320)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| 3 | 1 | 3 | 7 | 60 | 40 | 25 | 50 | 175 |

## A. COURSE OVERVIEW

The course is devised to introduce fundamental aspects of fluid flow behaviour. Students will learn to develop steady state mechanical energy balance equation for fluid flow systems, estimate pressure drop in fluid flow systems and determine performance characteristics of fluid machinery.

## B. COURSE CONTENT

| NO | TOPIC | COs |
|---|---|---|
| [1] | **Introduction: -**Types of energy, energy crisis, Renewable sources of energy, conventional & non-Conventional sources of energy, energy conservation. | **CO1**<br>**CO2** |
| [2] | **Conventional fuels: -** Classification, types, sources, properties, uses, storage, handling & selection factors of various conventional fuels in the form of<br>a. Solid: Coal, Lignite, Coke<br>b. Liquid: Gasoline, Kerosene, Naphtha, Fuel oil, Diesel<br>c. Gaseous: N.G., Refinery gas, Water gas, Producer gas, Coke oven gas, LPG, Oil gas, Industrial Gases etc | **CO2** |
| [3] | **Non-conventional sources of energy: -**<br>**Solar energy:** Solar radiation, collectors, storage & applications<br>**Wind energy:** Introduction, nature of wind & wind farm<br>**Biomass energy**: Introduction, Biomass conversion technology by wet & Dry process<br>**Geothermal energy:** Introduction & Sources of geothermal energy.<br>**Nuclear energy**: Introduction, Nuclear Fuels & Nuclear reactions, types of Propellant & moderators | **CO1**<br>**CO3** |
| [4] | **Water & Steam: -** Importance, Consumption & source of water, water analysis, types of hardness, methods of softening of water like lime soda, zeolite, ion exchange methods etc., Purification of water by screening, sedimentation, coagulation, filtration & sterilization, treatment for boiler feed water, Reuse & Recycling of process water, definition of enthalpy, wet steam, superheated steam, specific volume, Types-classification & comparison of steam generators, Factors affecting the selection of steam generator | **CO4** |
| [5] | **Air & Refrigeration: -** Introduction, use of air as chemical raw material & utility, concept of compressed air, blower air, fan air, instrument air etc., various methods of refrigeration in brief like ice, evaporate, vapor, steam jet refrigeration etc, types of refrigerating agent like ammonia, carbon dioxide, methylene chloride, water brine etc., selection of refrigerating agents | **CO5** |

## C. TEXT BOOKS

1. Dryden's Outlines of Chemical Technology, 2nd Ed. By M. Gopala Rao & Marshall Sitting, East West Press Pvt. Ltd., New Delhi.

## D. REFERENCE BOOKS

1. Shreve's Chemical Process Industries, 5th Ed. By, George F. Austin McGraw Hill International Edition.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember | Gain sufficient knowledge about the various fuels and energy sources with applications in industrial processes. |
| CO2 | Understand | Classify Conventional sources of energy requirements and give their importance in present day. |
| CO3 | Understand | Able to acquire the knowledge on various alternate energy technologies and their importance in fulfilling the present-day energy needs |
| CO4 | Apply | Select appropriate utility for heating and cooling application. |
| CO5 | Understand | To study requirement of different utilities for the process, along with its generation and it's effective utilization. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 2.6 | 2.8 | 2.6 | 2.8 | 2.8 | 2.6 | 2.6 | 2.6 | 2.8 | 2.6 | 3 | 3 | 3 |

## DIPLOMA SEMESTER – II

# SUBJECT: WORK SHOP (DK207)

| Teaching Scheme (Hours/Week) | | | | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|
| L | T | P | Total | Ext | S | TW | P | Total |
| - | - | 2 | 2 | - | - | 50 | 50 | 100 |

## A. COURSE CONTENT

| NO | TOPIC |
|---|---|
| [1] | **Introduction to work-shop:-** Work-shop layout, Importance of various sections/shops of workshop, Type of jobs done in each shop, General safety rules and work-procedure of work-shop. |
| [2] | **Fitting: -** Fitting tools like – files, vice, chisels, panch, scriber, hammers, surface plate, try square, calipers etc., fitting operations such as chipping, filling, scraping, grinding, sawing, marking, drilling, reaming, tapping, safety precaution, Demonstration of various operations, Preparation of male-female joints. |
| [3] | **Smithy: -** Smithy tool like - hammer, tongs, Anvil, flattener etc., Smithy operations such as upsetting, drawing down, bending, setting down, for welding, cutting, punching and fullering etc., Safety precautions, Demonstration of various smithy operations. |
| [4] | **Tin smithy: -** Tin smith tools like – hammers, stakes, scissors etc., sheet metal operations such as shearing, bending, joining, safety precautions, demonstration of various operations. |
| [5] | **Carpentry: -** Carpentry tools like – saw, planner, chisels, hammers, pallet, marking gauge, vice, tee square, rule etc., carpentry operations such as marking, sawing, planning, chiseling, grooving, boring, joining, type of woods and carpentry hardware, safety precaution, demonstration of various operations by using hardware. |
| [6] | **Pipe fitting: -** Pipe fitting tools, pipe fitting operations such as marking, cutting, bending, threading, assembling, dismantling etc., types of various spanners such as flat, fix, ring, box, adjustable etc., safety precautions, demonstration of various operations. |
| [7] | **Metal joining: -** Metal joining hand tools and equipments, permanent and temporary methods for metal joining such as screw, nuts bolts and washers, rivets, keys, pins and welding soldering brazing, demonstration of metal joining operations, safety precaution. |
| [8] | **Turning: -**Turning operations such as facing, centering and turning, demonstration of different lath parts and demonstration of above operations. |
| [9] | **Maintenance: -** Demonstration of dismantling, overhauling, aligning and assembling of pump and motors, demonstration of disassembly, overhauling and assembly of motor, alignment of pump and motor. |

**B. TECH. SEMESTER – VIII (EC)**

**SUBJECT: (AF801) INDUSTRIAL TRAINING PROJECT**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 0 | 0 | 28 | 28 | 14 | - | - | 100 | 300 | 400 |

**COURSE OBJECTIVES**

Assist the student's development of employer-valued skills such as teamwork communication and attention to detail. Students should design/develop & fabricate the hardware and/or software system. They may also undertake project involving study and analysis of existing electronics systems in the industry and suggesting modifications for revamping the system.

**DETAILED SYLLABUS**

Not applicable

**RECOMMENDED TEXT / REFERENCE BOOKS**

Not applicable

**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Enhance capability to acquire and apply fundamental principles of engineering.
CO2. Aware the development in technologies in recent trends in respective fields.
CO3. Correlate theoretical knowledge in practical to integrate any system.
CO4. Provide an opportunity to implement their ideas for the designing of various system.
CO5. Enhance presentation skills of work done.
CO6. Capability and enthusiasm for self-improvement through continuous professional development and life-long learning
CO7. Enhance teamwork and communication skills in professional fields.
CO8. Communicate efficiently.
CO9. Identify, formulate and model problems and find engineering solution based on a systems approach.
CO10. Awareness of the social, cultural, global and environmental responsibility as an engineer.

**COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 1 | 2 | 1 | | | 2 | 1 | 1 | 2 | 2 | 3 | 1 |
| CO2 | | 3 | 3 | 1 | 2 | 2 | 1 | | 2 | 2 | 3 | 1 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | | 2 | 2 | 3 | 1 |
| CO4 | | 3 | 3 | 2 | | 2 | 1 | | 2 | 2 | 3 | 1 |
| CO5 | 1 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 1 |
| CO6 | 3 | 3 | 2 | | 1 | 2 | 1 | | 2 | 2 | | 1 |
| CO7 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO8 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 1 |
| CO9 | 3 | 3 | 3 | | | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO10 | 3 | 3 | 3 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VIII (EC)**
**SUBJECT: (AF802) SEMINAR**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 0 | 0 | 2 | 2 | 2 | - | - | 50 | 50 | 100 |

**COURSE OBJECTIVES**

Assist the student's development of employer-valued skills such as teamwork communication and attention to detail. Students should design/develop & fabricate the hardware and/or software system. They may also undertake project involving study and analysis of existing electronics systems in the industry and suggesting modifications for revamping the system.

**DETAILED SYLLABUS**

Not applicable

**RECOMMENDED TEXT / REFERENCE BOOKS**

Not applicable

**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Enhance capability to acquire and apply fundamental principles of engineering.
CO2. Aware the development in technologies in recent trends in respective fields.
CO3. Correlate theoretical knowledge in practical to integrate any system.
CO4. Provide an opportunity to implement their ideas for the designing of various system.
CO5. Enhance presentation skills of work done.
CO6. Capability and enthusiasm for self-improvement through continuous professional development and life-long learning
CO7. Enhance teamwork and communication skills in professional fields.
CO8. Communicate efficiently.
CO9. Identify, formulate and model problems and find engineering solution based on a systems approach.
CO10. Awareness of the social, cultural, global and environmental responsibility as an engineer.

**COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 1 | 2 | 1 | | | 2 | 1 | 1 | 2 | 2 | 3 | 1 |
| CO2 | | 3 | 3 | 1 | 2 | 2 | 1 | | 2 | 2 | 3 | 1 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | | 2 | 2 | 3 | 1 |
| CO4 | | 3 | 3 | 2 | | 2 | 1 | | 2 | 2 | 3 | 1 |
| CO5 | 1 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 1 |
| CO6 | 3 | 3 | 2 | | 1 | 2 | 1 | | 2 | 2 | | 1 |
| CO7 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO8 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 1 |
| CO9 | 3 | 3 | 3 | | | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO10 | 3 | 3 | 3 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – III (EC)**

**SUBJECT: (BS307) MATHEMATICAL COMPUTING LABORATORY (w. e. f. 2022-23)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 0 | 0 | 2 | 2 | 1 | - | - | 25 | 25 | 50 |

## COURSE OBJECTIVES

Availability of simulation tools help students to visualize mathematical concepts studied as part of in Mathematics subjects and understand its relevance to their core engineering. Considering wide spread use of Python as a programming language, students should have hands on practices on this language at early stage of engineering studies. The objective of the course is to fulfil the requirements by implementing the mathematical formulas and concepts through Python programming.

## DETAILED SYLLABUS

**[1] INTRODUCTION TO PYTHON**

Introduction to syntax & programming environment, Functions, Looping and plotting.

**[2] SIMULATIONS**

AC analysis of circuit, Power factor calculations, Matrix operations, Linear equations solving using matrix operations, Fourier Series, Limit and Partial derivative solutions and KCL and KVL application on network circuits are included.

## TEXT / REFERENCE BOOKS


**1)** Principles of Electronics, V. K. Mehta &Rohit Mehta, 11th Edition, S. Chand & Company.

**2)** Electrical & Electronic Measurement & Measuring Instruments, A.K. Sawhney, 17th Edition, Dhanpat Rai Publishing.

**3)** Digital logic and Computer Design, M. M. Mano, Pearson Education India.


## COURSE OUTCOMES

At the end of the course, students should be able to

CO1. Write python codes including necessary features such as looping and functions, run and troubleshoot the same.

CO2. Write python code to implement mathematical formulas and show the results with single and multiple graphs in single and / or multiple plots

CO3. Find circuit parameters and response in the Resistive network using KVL and KCL using python.

CO4. Write python code to execute mathematical formula for derivative and limit of a given function and synthesize the periodic waveform for given Fourier series representation of a signal.

**COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 2 | - | 1 | 1 | 3 | 1 | 1 | 1 | - | 1 | - | - |
| CO2 | 2 | - | 1 | 1 | 3 | 1 | 1 | 1 | - | 1 | - | - |
| CO3 | 2 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | - | 1 | - | - |
| CO4 | 2 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | - | 1 | - | - |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – III (EC/IC)**
**SUBJECT: (CI310) DIGITAL ELECTRONICS (w. e. f. 2022-23)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## COURSE OBJECTIVES

The objective of this course is to provide the concepts associated with the digital logic and circuit design that are basic building blocks of a digital computer system. To apply the laws involved in the Boolean algebra for the simplification of logic functions and minimization of hardware requirements. To design and analyze of combinational and sequential circuits involved in the different digital circuits and systems.

## DETAILED SYLLABUS

**[1] INTRODUCTION TO LOGIC CIRCUITS**
Logic Gates & Networks, Truth Tables, Boolean Algebra, Synthesis using AND, OR and NOT Gates, NAND – NOR Logic Networks, Sum of Products and Product of Sums Forms, Introduction to Verilog.

**[2] IMPLEMETATION TECHNOLOGY**
Transistor Switches, NMOS & CMOS Logic Gates, Negative Logic Systems, Introduction to PAL, PLA, CPLD & FPGAs, Voltage Levels in Logic Gates, Noise Margin, Dynamic Operation & Power Dissipation in Logic Gates, Fan-in and Fan-out, Transmission Gates, Transistor-Transistor Logic, Emitter - Coupled Logic.

**[3] OPTIMIZED IMPLEMENTATION OF LOGIC FUNCTIONS**
Karnaugh Map Strategy for Minimization, Minimization of POS Forms, Multiple Output Circuits, Multilevel Synthesis, Analysis of Multilevel Synthesis.

**[4] COMBINATIONAL CIRCUITS**
Multiplexers, Decoders, Encoders, Code Converters, Arithmetic Comparison Circuits

**[5] SEQUENCIAL CIRCUITS**
Basic Latch, Gated SR Latch, Gated D Latch, Master Slave & Edge Triggered D Flip-Flops, T & JK Flip Flops, Registers, Counters, Reset Synchronization, BCD- Ring –Johnson Counters.

**[6] SYNCHRONOUS SEQUENCIAL CIRCUITS**
Basic Design Steps, Mealy State Model, Design of Counter, FSM as an Arbiter Circuit, Analysis of Synchronous Sequential Circuits.

**TEXT / REFERENCE BOOKS**


**1)** Fundamentals of Digital Logic with Verilog Design, Stephen Brown &ZvonkoVrenesic, Tata McGraw Hill
**2)** Digital Logic and Computer Design, Morris Mano, Prentice Hall of India
**3)** Fundamental of Digital Circuits, Anand Kumar, Prentice Hall of India


**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Analyse and calculate parameters such as noise margin, input –output voltages, fan-out, and speed power product, power dissipation for ECL and TTL logic families. Implement the Boolean functions using CMOS gates.

CO2. Attempt SOP to POS conversion (& vice versa) for implementation of Boolean expressions using AND-OR-INVERT functions as well as universal gates. Also to optimize the Boolean expressions either by applying Boolean algebra or by using minimization techniques as K-Map method and Tabulation Method with "don't care" conditions up to 6 variables.

CO3. Implement various combinational circuits like Multiplexers, Decoders, Encoders, Code Converters, and Arithmetic Comparison Circuits using basic gates. Design and Implement basic combinational blocks of a digital computer using multiplexers, decoder, PLA, PAL and verify the circuit implementations with the help of simulation tool.

CO4. Implement a basic memory element using flip-flops and understand the characteristics of various flip-flop designs and compare them with respect to their timing relationship, hardware requirement and limitations.

CO5. Differentiate Combinational and Sequential circuits. Design and analyse FSMs using sequential circuits. Reduce hardware requirement of FSMs by minimizing state table. Analyse Mealy and Moore machine designs using timing waveforms.

CO6. Construct sequential circuits like asynchronous/ synchronous counters, shift registers and counters for timing signal generation.

**COURSE MATRIX**

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 2 | 3 | 2 | | 1 | 1 | | | | | |
| CO2 | 3 | 3 | 3 | 2 | | 1 | 3 | | | | 1 | 1 |
| CO3 | 3 | 3 | 2 | 1 | | 1 | 3 | | | | 1 | 1 |
| CO4 | 3 | 3 | 3 | 1 | | 1 | 1 | | | | 1 | 1 |
| CO5 | 3 | 1 | 3 | 3 | 3 | 2 | 3 | | 1 | | 1 | |
| CO6 | 3 | 3 | 3 | 2 | 3 | 1 | 3 | | 1 | | 2 | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – IV (EC)**
**SUBJECT: (EC408) LINEAR ELECTRONICS – II (w. e. f. 2022-23)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## COURSE OBJECTIVES

This course involves the in-depth understanding of the analog electronics circuits which can enable students to interpret, analyses, design, and apply electronics and communication-based circuits. This core subject understanding is useful to the students in the projects and in the field of Power Electronics, Electronics Communication, and audio-video engineering. The objective of this course is to offer in-depth understanding of the analysis, design, and applications for analog electronics circuits.

## DETAILED SYLLABUS

**[1] POWER CIRCUITS AND SYSTEMS**
Amplifier Classification, Distortion in Amplifiers, Large-Signal Amplifiers, Harmonic Distortion, Efficiency of a Class A Amplifier, Push-Pull Amplifiers, Class B amplifiers, Class AB Operation, Regulated Power Supplies, Series Voltage Regulator.

**[2] FEEDBACK AMPLIFIER CHARACTERISTIC**
Classification of Amplifiers, The Feedback Concept, The Transfer Gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Input Resistance, Output Resistance, Method Analysis of a Feedback Amplifier, Voltage-Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback.

**[3] OSCILLATORS USING TRANSISTOR**
Sinusoidal Oscillators, The Phase-Shift Oscillators, Resonant-Circuit Oscillators, A General Form of Oscillator Circuits, Colpitt's Oscillator, Hartley's Oscillator, Clapp's Oscillator, Crystal Oscillators.

**[4] OPERATIONAL AMPLIFIER CHARACTERISTICS**
Differential Amplifier, DC and AC Analysis of Bipolar Differential Amplifier, The ideal Operational Amplifier, Inverting and Non-Inverting Amplifiers, Op-Amp Parameters, Measurement of Op-Amp Parameters, General Description of Various Stages of Op-Amp, Open-Loop and Closed-Loop Frequency Response, Op-Amp Stability, Frequency Compensation.

**[5] LINEAR APPLICATIONS OF OP-AMP**
Summing and Difference Amplifiers, Integrator and Differentiator, Current-to-Voltage Converters, Voltage-to-Current Converters, Current Amplifiers, Voltmeters and Current Meters, Instrumentation Amplifiers, Transducer Bridge Amplifiers, Ideal and Realistic Frequency Response of Various Filters, Basic First-Order Low-Pass and High-Pass Filters, First Order Wideband Band Pass Filters (Phase-Shifter), Second-Order Low-Pass Filters, Second-Order High-Pass Filters, Second-Order Band-Pass Filters, Second-Order Band-Reject Filters.

**[6] NON-LINEAR APPLICATIONS OF OP-AMP**

Precision Half-Wave Rectifiers, Precision Full Wave Rectifiers, Log Amplifiers, Antilog Amplifiers, Zero Crossing Detector, Level Detectors, Voltage Magnitude Comparator and Window Detector, Basic Peak Detectors Using Op-Amps and Comparators, Basic Sample and Hold Circuits, Digital to Analog (D/A) Converters, Analog to Digital (A/D) Converters.

**[7] WAVE SHAPING & WAVEFORM GENERATORS**

The Op-Amp as Voltage Comparator, Some Applications of a Comparator using Op-Amp, Schmitt Trigger Circuit, Basic Triangular Wave Generator, Astable and MonostableMultivibrator Using Op-Amp, Introduction to 555 Timer, Timer 555 Used in Astable and Monostable Mode.

**TEXT / REFERENCE BOOKS**


**1)** Integrated Electronics, Millman&Halkians, Tata McGraw Hill

**2)** Op - Amp and Linear Integrated Circuits, RamakantA. Gayakwad, 4th Edition, Pearson Education

**3)** Integrated Circuits, K. R. Botkar, 9thEdition, Khanna Publications


**COURSE OUTCOMES**

At the end of the course,students should be able to

CO1. Compute transfer gain, input and output impedance of various types of negative feedback amplifier.

CO2. Analyse class A, Class B, Class AB and Push-Pull amplifier in terms of operating characteristics, harmonic distortion and power efficiency.

CO3. Design regulated power supply, sinusoidal oscillator circuits and Multivibrator circuits using IC555 timer for the given specifications.

CO4. Develop analog circuits using OPAMP to achieve desired/given basic parameters like gain, BW,CMRR and SR as well as to perform mathematical operations like addition, subtraction.

CO5. Develop analog circuits like integrator, differentiator, logarithm, antilogarithm, comparators, instrumentation amplifier, voltmeter, current meter and analog computers using OPAMP.

CO6. Design and develop different types of rectifier circuits, waveform generators, ADC, DAC and active filters using OPAMP.

**COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | | 2 | 2 | - | - | - | - | 1 | - | - |
| CO2 | 3 | 3 | | 2 | 2 | - | - | - | - | - | - | - |
| CO3 | 3 | 3 | 3 | 2 | 2 | 1 | - | - | - | 1 | - | 1 |
| CO4 | 3 | 3 | | 2 | 2 | 3 | - | - | - | 2 | - | 1 |
| CO5 | 3 | 3 | 1 | 1 | 2 | | 2 | - | - | 2 | - | 3 |
| CO6 | 3 | 3 | | 2 | 2 | 2 | 1 | - | - | 2 | - | 2 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – IV (EC)**
**SUBJECT: (EC409) CMOS VLSI DESIGN (w. e. f. 2022-23)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## COURSE OBJECTIVES

Very large scale integration (VLSI) is the process of creating an integrated circuit (IC) by combining millions of transistors together in a small silicon chip. In this subject, students learn to design, analyze and optimize the digital logic circuitry it in terms of PDA (Power, Delay and Area) and understand the architectural choices and performance trade-offs involved in designing and realizing the CMOS circuits. This course teaches the importance of testability and basic techniques for test vector generation. This course provides an overview of chip design techniques using programmable devices. This course offers a profound understanding of the design, simulations and functional verification of complex digital VLSI circuits (using EDA tools like ALTERA/XILINX).

## DETAILED SYLLABUS

**[1] LOGIC DESIGN WITH MOSFETS**
Complexity and Design, Basic Concepts, Types of IC, VLSI Design Flow, MOSFET as a Switching Element, Basic and Complex Logic Gates in CMOS, Transmission Gate Circuits, Clocking and Dataflow Control.

**[2] FABRICATION OF CMOS INTEGRATED CIRCUITS**
Physical Structure of CMOS Integrated Circuits, CMOS Patterning – Silicon Layout and Stick Diagrams, Fabrication of CMOS Integrated Circuits – Process Flow and Design Rules, Layout of Basic Structures, FET Sizing.

**[3] ELECTRICAL CHARACTERISTICS OF CMOS LOGIC**
MOS Physics,FET RC Model, DC and Transient Characteristics of CMOS Gates, Power Dissipation, Analysis of Complex Logic Gates.

**[4] DESIGNING HIGH SPEED CMOS LOGIC NETWORKS**
Driving Large Capacitive Loads, Delays Estimate for Logic Cascade, Delay Optimization Using Logical Effort, Branching Effort, Advanced Techniques in CMOS Logic Circuits.

**[5] ADVANCED CMOS CIRCUITS**
BiCMOS Drivers, Mirror Circuits, Pseudo-nMOS, Tri-state Circuits, Clocked CMOS, Dynamic CMOS Logic Circuits, Domino Logic Cell Dual-Rail Logic Networks. (DCVSL, CPL)

**[6] THE DESIGN OF VLSI SYSTEM**
Memories and Programmable Logic, Interconnect Delay Modelling, Crosstalk, Interconnect Scaling, Floor Planning and Routing, Input and Output Circuits, Power Distribution and Consumption, Low Power Design Considerations, VLSI Clocking and System Design, Reliability and Testing of VLSI Circuits.

**[7] INTRODUCTION TO HDL**

Introduction to Verilog & System Verilog, Basic Building Blocks &Datatypes, Randomization.

**TEXT / REFERENCE BOOKS**


1) Introduction to VLSI Circuits& Systems, John P. Uyemura, John Wiley & Sons Inc.
2) CMOS logic Circuit Design, John P. Uyemura, Springer Private limited
3) Digital Integrated Circuits - A Design Perspective, J.M. Rambaey, A. Chandrakassan& B. Nikolic, 2nd Edition, Prentice Hall of India.
4) Principles of CMOS VLSI Design - A System Perspective, N. H. E. Weste& K. Eshraghian, 2nd Edition, Prentice Hall of India.
5) Modern VLSI design - System On Chip Design, W. Wolf, 3rd Edition, Pearson Asia
6) Introduction to System Verilog, Ashok D Mehta, Springer.
7) Introduction to Verilog HDL, Samir Palnitkar, PHI


**COURSE OUTCOMES**

At the end of the course,students should be able to

CO1. Identify conduction state of given MOSFET and derive RC model by recognizing physical properties of MOSFET.

CO2. Prepare schematic and Si layout of CMOS digital logic circuitry and compare their physical design parameters with the reference Inverter design.

CO3. Describe pros & cons of various IC fabrications processes and also appraise requirements of various design rules. Assess switching performance & reliability of CMOS Digital Logic circuits.

CO4. Apply logical effort theory for improving the Speed of CMOS logic cascade and understand advanced techniques for logic implementation using FET & BJTs.

CO5. Designing of high density structure like memory array to enhance its performance. Understand system-level physical design of VLSI chip.

CO6. Test the CMOS based circuits using various testing methods to identify physical defects in a given chip.

**COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | | 2 |
| CO2 | 3 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | | 1 |
| CO3 | 3 | | 2 | | 2 | 3 | 2 | 1 | 1 | 2 | | 1 |
| CO4 | 2 | 1 | 3 | 3 | | 1 | 2 | 1 | 1 | 2 | | 2 |
| CO5 | 2 | 2 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | | 2 |
| CO6 | 3 | 1 | 2 | 2 | | 3 | 2 | 1 | 2 | 2 | | 2 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – V (EC)**
**SUBJECT: (  ) POWER ELECTRONICS (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## COURSE OBJECTIVES

This course involves understanding of the power electronics circuits which can enable students to interpret, analyse, design, and apply power electronics based circuits. The subject understanding is useful to the students for different power applications by offering deep insight into characteristics and functioning of various power semiconductor devices. This course aims to prepare students for analysis and designing power converter circuits for different power applications by offering deep insight into characteristics and functioning of various power semiconductor devices.

## DETAILED SYLLABUS

**NO TOPIC**

**[1] INTRODUCTION TO POWER ELECTRONICS**
Overview of Power Electronics, Power Semiconductor Devices, Control Characteristics of Power Devices, Characteristic & Specifications of Switches, Types of Power Circuits, Reverse Recovery Characteristics, Types of Power Diodes, Freewheeling Diodes, Structure and Volt-Current Characteristics of Power MOSFETS, COOLMOS, SITs, Structure and Volt-Current Characteristics of IGBTs, SiC – MOSFET, SiC – IGBT.

**[2] THYRISTORS**
Thyristor Characteristics, Two Transistor Model of Thyristor, Thyristor Turn-on, Thyristor Turn-off, Types of Thyristors, Series & Parallel Connection of Thyristors, di/dt& dv/dt Protection, Gate Drive Circuits.

**[3] UNCONTROLLED AND CONTROLLED RECTIFIERS**
Multiphase Star Rectifiers, Three-Phase Bridge Rectifiers, Three-Phase Bridge Rectifier With RL Load, 3-Phase Rectifier Design, Principal of Phase Controlled Converter, Single Phase Semi Converter, Single Phase Full Converter, Three Phase Half Wave Converters, Three Phase Semi Converter, Three Phase Full Converter. (Without Analysis for RL Load), Power Factor Improvement, Pulse Width Modulation using IGBT, Single Phase Sinusoidal PWM using IGBT, Three Phase PWM Control using IGBT.

**[4] INVERTERS**
Principal of Operation of Pulse Width Modulated Inverters, Performance Parameters, Single-Phase Bridge Inverters, Voltage Control of Single-Phase Inverters, Current Source Inverter, Multilevel Concept, Applications & Features of Multilevel Inverter.

**[5] DC-DC CONVERTERS**
Principal of Step Down Converter, Principal of Step Up Converter, Performance Parameters, Converter Classification, Switch Mode Buck, Boost, Buck-Boost &Cuk.

**[6] AC CONTROLLERS**

Principal of On-Off Control, Principal of Phase Control, Cycloconverters, PWM Controlled AC Voltage Controllers.

**[7] PROTECTION OF DEVICES & CIRCUITS**

Cooling and Heat Sinks, Snubber Circuits, Reverse Recovery Transients, Supply & Load Side Transients, Current & Voltage Protection, Magnetic Interference, Protection of IGBT.

**[8] POWER SUPPLIES**

Switched-Mode Power Supplies, UPS, CVT.

## RECOMMENDED TEXT / REFERENCE BOOKS


1) Power Electronics circuits, Devices and Applications, Muhammad H. Rashid, 3rd Edition, Pearson Education and PHI.
2) Power Electronics, M. D. Singh and K. B. Khanchandani, 2nd Edition, TheMcGrow Hill.
3) Power Electronics, Dr.P.S.Bhimbhara, 4th Edition, Khanna Publication.
4) Power Electronics, B. R. Gupta & V. Singhal, 2nd Edition, S. K. Kataria& Sons


## COURSE OUTCOMES

At the end of the course, students should be able to

CO1. Illustrate the construction, operation, working, and characteristics of various power semiconductor devices like MOSFET and IGBT.

CO2. Evaluate performance of single phase and three phase controlled rectifier circuits, three phase uncontrolled rectifier circuits.

CO3. Analyse the performance of PWM inverters, analyse and design various protection circuits.

CO4. Understand fundamentals and applications of SCR, DIAC, and TRIAC, and design triggering circuits

CO5. Design thyristor series and parallel network, design of gate triggering circuit, Evaluate AC voltage controller circuits

CO6. Evaluate DC - DC regulators and chopper circuits and develop power electronics applications.

## COURSE MATRIX

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 2 | 3 | | | 1 | 1 | 1 | | 1 | | 1 |
| CO2 | 3 | 2 | 2 | | | 1 | 1 | 1 | | 1 | | 1 |
| CO3 | 3 | 2 | 2 | | | 1 | 1 | 1 | | 1 | | 1 |
| CO4 | 3 | 3 | 3 | | | 1 | 1 | 1 | | 1 | | 1 |
| CO5 | 3 | 3 | 3 | | | 1 | 1 | 1 | | 1 | | 1 |
| CO6 | 3 | 3 | 2 | | | 1 | 1 | 1 | | 1 | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – V (EC)**

**SUBJECT: (  ) MICROCONTROLLER APPLICATIONS (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

**COURSE OBJECTIVES**

The objective of this course is to provide details of the 8051 microcontroller architecture, interfacing techniques and to be able to develop simple real-world microcontroller's applications with the help of accessing peripherals using lower level language and optimization to meet the system requirements.

**DETAILED SYLLABUS**

**NO TOPIC**

**[1] MICROPROCESSORSAND MICROCONTROLLERS**
Introduction, Microprocessors and Microcontrollers, The Z80 and the 8085, A Microcontroller survey, Development systems for Microcontrollers.

**[2] THE 8051 ARCHITECTURE**
Introduction, 8051 Microcontroller Hardware, Input/output pins, ports and circuits, External memory, Counter and timers, Serial data input/output, Interrupts.

**[3] MOVING DATA**
Introduction, Addressing Modes, External data moves, Code memory read only data moves, Push and Pop, Data exchanges.

**[4] LOGICAL OPERATIONS**
Introduction, Byte-level logical operations, Bit-level logical operations, Rotate and Swap operations.

**[5] ARITHMETIC OPERATIONS**
Introduction, Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Decimal arithmetic.

**[6] JUMP AND CALL INSTRUCTIONS**
Introduction, The jump and call program range, Jump types, Call and Subroutines, Interrupts and Returns, Enabling, Disabling & Priority in interrupts.

**[7] AN 8051 MICROCONTROLLER DESIGN**
Introduction, A Microcontroller specification, A Microcontroller Design, Testing the design, Subroutines, Lookup tables for the 8051, Serial data transmission.

**[8] APPLICATIONS**
Introduction, Keyboards, Displays, Pulse Measurement, D/A and A/D conversions, Case Study.

**[9] SERIAL DATA COMMUNICATION**
Serial I/O Modes of Operation, serial data input output programming.

**[10] 8006/97 OVERVIEW**
8096/97 (16-bit Microcontroller) Architecture overview and additional features.

## RECOMMENDED TEXT / REFERENCE BOOKS


1) The 8051 Microcontroller based Embedded Systems, Manish K. Patel, McGraw Hill Education.
2) The 8051 Microcontroller Architecture, Programming & Applications, Kenneth J Ayala,2nd Edition, Penram International Publication.
3) The 8051 Microcontroller & Embedded Systems, Muhammad A. Mazidi& Janice G. Mazidi, 2nd Edition, Pearson Education


## COURSE OUTCOMES

At the end of the course, students should be able to

CO1. Analyse assembly language instruction behaviour and execution with reference to the architecture of the 8051 microcontroller, peripheral support and the timing divisions
CO2. Develop assembly language programs to implement common algorithms and attempt optimization of the code
CO3. Utilize serial section of the 8051 to establish the communication between 8051 microcontroller external systems and also demonstrate multitasking environment using interrupt programming.
CO4. Determine requirement of hardware components and design memory subsystem as per given specifications.
CO5. Design applications related to real life needs using support of I/O ports and timers particularly in case of timing constraints
CO6. Design and implement the simple applications involving input devices like switches, keyboards, sensors, ADC and output devices like LED, 7-segment display, LCD, DAC

## COURSE MATRIX

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | 3 | 2 | 1 | | | 1 | 1 | 1 | | 1 |
| CO2 | 3 | 3 | 3 | 3 | 1 | | 1 | 1 | 1 | 1 | | |
| CO3 | 3 | 3 | 3 | 3 | 2 | | | 1 | 1 | 1 | | 1 |
| CO4 | 3 | 3 | 2 | 3 | | | 1 | | | | | |
| CO5 | 3 | 2 | 3 | 2 | 2 | | | 1 | 1 | 1 | | 1 |
| CO6 | 3 | 3 | 2 | 3 | 3 | | | 1 | 1 | 1 | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – V (EC)**

**SUBJECT: (  ) ELECTRONIC COMMUNICATION (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**COURSE OBJECTIVES**

Electronic communication is inevitable part of our day to day life. The objective of this course is tomake aware the students about fundamental concepts of communication technologies and itsapplications. To fulfill the objective, course covers detailed concepts of the circuits used for basiccommunications. It also covers various types of noise affecting to electronic communication.Further, it emphasis on the techniques of transmitting and receiving information signals usinganalog modulation techniques (AM, FM, PM). This course also includes in-depth understanding ofdifferent applications of Analog Communication systems such as Satellite Communication.

**DETAILED SYLLABUS**

**NO TOPIC**

**[1] RESONANT CIRCUITS**
Series and Parallel Equivalence, Series RLC Circuit, Parallel Tuned Circuit, Skin Effect, Mutual Inductance, Coupling Circuits.

**[2] NOISE**
Introduction, Thermal Noise, Shot Noise, Partition Noise, Low- Frequency or Flicker Noise, High frequency or Transmit Time Noise, Equivalent Noise Resistance, Signal to Noise Ratio, Noise Factor, Noise Temperature.

**[3] RF AMPLIFIER**
Tuned RF Amplifiers, Neutralization, Special RF Amplifiers, Frequency Conversion and Mixers.

**[4] RECEIVERS**
Introduction, Super heterodyne Receivers, Choice of Intermediate and Oscillator Frequencies, Image Rejection, Adjacent Channel Selectivity, Spurious Responses, Tracking Automatic Gain Control, Double Conversion Receivers, HF Communications Receivers.

**[5] AMPLITUDE MODULATION**
Introduction, Amplitude Modulation, Amplitude Modulated Transmitters, AM Receivers

**[6] SINGLE SIDEBAND MODULATION**
Introduction, Single Sideband Principles, The Balanced Modulator SSB Generation, SSB Reception, Modified SSB Systems.

**[7] ANGLE MODULATION**
Introduction, Frequency Modulation, Phase Modulation, Equivalence between FM and PM, Angle Modulator Circuits, Angle Modulation Detectors.

**[8] SATELLITE COMMUNICATION**

Introduction, Orbits, Antenna Look Angles, Elevation, azimuth angle and range calculations, Saturation Flux Density, Effective Isotropic Radiated Power, Uplink and down link power budget calculations.

**RECOMMENDED TEXT / REFERENCE BOOKS**

1) Electronic Communication, Dennis Roddy & John Coolen, 3rd Edition, Prentice Hall of India.
2) Electronic Communications, George Kennedy, 4th Edition, Tata McGraw Hill

**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Analyse Amplitude modulated signal in terms of frequency spectrum, average power, effective voltage and current as well as amplitude modulator, demodulator circuit and receiver.

CO2. Analyse LC tank circuit as well as RF amplifier in terms of resonant frequency, dynamic impedance and -3 dB bandwidth

CO3. Do detailed analysis of AM receiver, SSB transmission and reception

CO4. Determine the overall noise factor and noise temperature of the systems connected in tandem and choose the one which offers minimum noise factor.

CO5. Analyse Angle Modulation, demodulation and transmission.

CO6. Analyse signal transmission and reception in satellite communication system.

**COURSE MATRIX**

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 3 | 1 | 2 | 2 | 2 | | | 1 | 2 | | 1 |
| CO2 | 3 | 3 | | 2 | 2 | 2 | | | | | | |
| CO3 | 3 | 3 | 2 | 2 | | 3 | | | 1 | 2 | | 1 |
| CO4 | 3 | 3 | | | 2 | 1 | 3 | | | | | 1 |
| CO5 | 3 | 2 | 1 | 3 | | 2 | | | | | | 1 |
| CO6 | 3 | 3 | 1 | 1 | | 2 | | | | | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – V (EC)**

**SUBJECT: (  ) ELECTROMAGNETIC FIELDS (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | 50 | - | 150 |

## COURSE OBJECTIVES

The objective of this subject is to provide a platform for students to combine their knowledge in mathematics and relates in an electromagnetic engineering.This subject built a strong foundation of the static as well as time varying electromagnetic fields, to help the students identify, formulate and solve the problems related to electromagnetic fields and wave propagation. The concept of this subject is useful to the students for understanding the electromagnetic radiation in wireless communication.

## DETAILED SYLLABUS

**NO TOPIC**

**[1] VECTOR ANALYSIS& COORDINATE SYSTEMS**
Scalars and Vectors, Vector Algebra, The Cartesian coordinate system, Vector Components and Unit Vectors, The Vector Field, The Dot Product, The Cross Product, Other Coordinate Systems; Circular Cylindrical Coordinates, The Spherical Coordinate System.

**[2] COULOMB'S LAW AND ELECTRIC FIELD INTENSITY**
The Experimental Law of Coulomb, Electric Field Intensity, Field Due to a Continuous Volume Charge Distribution, Field of a Sheet of Charge.

**[3] ELECTRIC FLUX DENSITY, GAUSS'S LAW, AND DIVERGENCE**
Electric Flux Density, Gauss's Law, Application of Gauss's Law Some Symmetrical Charge, Distributions, Application of Gauss's Law, Differential Volume Element, Divergence, Maxwell's First Equation (Electrostatics)and Divergence Theorem.

**[4] CONDUCTORS, DIELECTRICS AND CAPACITANCE**
Current and Current Density, Continuity of Current, Metallic Conductors, Conductor Properties and Boundary Conditions, Boundary Conditions for Perfect Dielectric Materials and Magnetic Boundary Conditions.

**[5] THE STEADY MAGNETIC FIELD**
Biot-Savart Law, Ampere's Circuital Law, Curl, Stokes' Theorem, Magnetic Flux and Magnetic Flux Density, The Scalar and Vector Magnetic potential.

**[6] TIME-VARYING FIELDS AND MAXWELL'S EQUATIONS**
Faraday's Law, Displacement Current, Maxwell's Equations in Point Form, Maxwell's Equations in Integral Form, The Retarded Potentials.

**[7] THE UNIFORM PLANE WAVE**
Wave Motion in Free Space, Wave Motion in Perfect Dielectrics, Plane Waves in Lossy Dielectrics, The Poynting Vector and Power Considerations, Propagation in Good Conductors: Skin Effect, Reflection of Uniform Plane Waves, Standing-Wave Ratio.

[8] **TRANSMISSION LINES**

Equations of Voltage and Current on TX line, Propagationconstant and characteristic impedance, Basic Principles, Reflection co-efficient, Transmission co-efficient,VSWR and Equation of the impedance on the transmission line.

**RECOMMENDED TEXT / REFERENCE BOOKS**


1) Engineering Electromagnetics, William H. Hayt, 7th Edition, Tata McGraw Hill
2) Electronic Communication Systems, George Kenedy, 3rd Edition, Tata McGraw Hill
3) Theory and Problems in Electromagnetics, Joseph Edminister, Tata McGraw Hill
4) Principles of Electromagnetics, Mathew N.O. Sadiku, 3rd Edition, Oxford University Press
5) Electromagnetics, John D. Kraus, 3rd Edition, Tata McGraw Hill
6) Elements of Electromagnetics, Mathew N.O. Sadiku, 4thEdition, Oxford University Press
7) Electromagnetic Waves,R.K. Shevgaonkar, Tata McGraw Hill India, 2005


**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Compute vector functions, operators and use different methods of solving line, surface and volume integrals.

CO2. Use different coordinate systems, Coulomb's Law and Gauss Law for the evaluation of electric fields produced by different charge configurations.

CO3. Evaluate the static and time varying electromagnetic fields that satisfy the boundary conditions based on Maxwell's equation in wireless communication.

CO4. Compute magnetic vector potential and evaluate radiation in free space.

CO5. Initiate the design of a range of field theory applications such as transmission line, antennas, wave propagation so on.

CO6. Understand characteristics and wave propagation on high frequency transmission lines

**COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | 1 | 1 | 3 | | | | | | | |
| CO2 | 3 | 3 | 1 | 1 | 1 | | | | | | | |
| CO3 | 3 | 3 | 3 | 1 | 1 | | | | | 2 | | |
| CO4 | 3 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | | | 2 | |
| CO5 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | | | | 2 |
| CO6 | 3 | 3 | 3 | 3 | 3 | 1 | | | | | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – V (EC)**

**SUBJECT: (  ) ELECTRONIC CIRCUITS PROJECT (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 0 | 0 | 2 | 2 | 1 | - | - | 50 | - | 50 |

## COURSE OBJECTIVES

Students will select hardware based electronics project and be a self-learner. Project activities include design, construction, computer simulation, and analysis of the project's circuit. These activities assist students in obtaining a better understanding of the operation of transistor circuits, amplifiers, current drivers and other semiconductor circuits. Weekly presentation of project progress work improves Communication skill and overcome stage fear.

## DETAILED SYLLABUS

| NO | TOPIC |
|---|---|
| [1] | Plan, design and implement hardware projects or microelectronics circuits |
| [2] | Analyze and interpret output either on Testbed or through Simulations. |
| [3] | Implement hardware prototype |

## RECOMMENDED TEXT / REFERENCE BOOKS

## COURSE OUTCOMES

At the end of the course, students should be able to

CO1. Identify the problem statement that solve societal, health and safety issues, through literature survey for project work and Arrive at conceptual project design through brainstorming.

CO2. Develop design strategy for the project work& also acquire presentation and interpersonal communication skills.

CO3. Evaluate outcome and application of project work with appropriate societal, health and safety consideration.

## COURSE MATRIX

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | 1 | | | 3 | | | 3 | 2 | 1 | |
| CO2 | 3 | 2 | 3 | 3 | 2 | | | | 3 | 3 | | |
| CO3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VI (EC)**

**SUBJECT: (  ) COMMUNICATION SYSTEMS (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## COURSE OBJECTIVES

The main objective of this course is to provide fundamental knowledge of communication system which is necessary to understand recent communication technologies. This course helps student to analyze signal in time domain as well as frequency domain. It also develop understanding of sampling theorem, digital baseband and passband signal transmission and reception. This course also includes performance analysis of linear and non-linear modulation and demodulation techniques.

## DETAILED SYLLABUS

**NO TOPIC**

**[1] INTRODUCTION**

Overview of Communication System, Analog and Digital messages, Signal-to-Noise Ratio (SNR), Channel Bandwidth, Rate of Communication, Modulation, Randomness, Redundancy, and Coding.

**[2] ANALYSIS AND TRANSMISSION OF SIGNALS**

**Signal Analysis**

Periodic signal representation by Fourier Series, Exponential representation of non-periodic signals, Fourier Transforms and its properties, Sampling theorem.

**Signal Transmission**

Distortion less transmission through a linear system, Signal distortion over a channel, Bandwidth and the rate of pulse transmission, Energy Spectral Density(ESD) of a signal, Power Spectral Density(PSD) of a signal.

**[3] DIGITAL COMMUNICATION SYSTEMS**

Conversion of analog signal to digital form: Pulse code and Delta modulation, Digital multiplexing, Line coding, Pulse shaping, Scrambling of data, The regenerative repeater, Detection error probability, M-ary communication, Digital carrier systems.

**[4] DIGITAL MODULATION TECHNIQUES**

Coherent Binary Phase Shift Keying, Coherent Binary Frequency Shift Keying, Coherent Qudra-Phase Shift Keying, Coherent Minimum Shift Keying, Non-Coherent Orthogonal Modulation, Non-Coherent Binary Frequency Shift Keying, Differential Phase Shift Keying, Comparison of Binary and Quaternary modulation schemes, M-ary modulation techniques.

**[5] MODULATION**

**Amplitude (Linear) Modulation**

Amplitude Modulation: Single Side Band (SSB) signal equation, Hilbert's Transform of a signal, Effects of frequency and phase errors in synchronous demodulation, Digital carrier systems, Interference and noise in AM systems, Frequency-Division Multiplexing.

**Angle (Exponential) Modulation**
Interference and Noise in Angle-Modulated systems, Stereo FM receiver.

## RECOMMENDED TEXT / REFERENCE BOOKS


1) Modern Digital and AnalogCommunicationSystem, B. P. Lathi, 2nd Edition, Oxford Publication
2) Communication Systems, Simon Haykin, 3rd Edition, John Wiley&sons.
3) Electronic Communication System-Fundamental through Advance, Tomas W, 3rd Edition, Wisley.
4) Communication System Analog&Digital, R. P. Singh, TataMcGrawHill.


## COURSE OUTCOMES

At the end of the course, students should be able to

CO1. Analyze of digital pulse modulation techniques in terms of SNR and Bandwidth
CO2. Analyze digital baseband binary data transmission.
CO3. Analyze constellation diagrams and BER for digital passband transmission and reception.
CO4. Evaluate the essential bandwidth required for transmitting the binary pulse signal.
CO5. Analyze and compare DSBSC, SSBSC, AM and FM techniques in presence of noise and interference.
CO6. Analyze and compare DSBSC, SSBSC, AM and FM techniques in presence of noise, interference, phase error and frequency error.

## COURSE MATRIX

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 3 | 2 | 1 | | 1 | 1 | | | | | 1 |
| CO2 | 3 | 3 | 3 | 1 | | 2 | | | | 1 | | 1 |
| CO3 | 3 | 3 | 3 | 1 | 1 | 2 | | | | 1 | | |
| CO4 | 3 | 3 | 3 | 1 | 1 | 2 | 1 | 1 | | 2 | | 1 |
| CO5 | 3 | 3 | 2 | 1 | | 1 | | | | | | |
| CO6 | 3 | 3 | 2 | | | 1 | | | | | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VI (EC)**

**SUBJECT: (  ) MICROWAVE & ANTENNAS (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

**COURSE OBJECTIVES**

The objective of this subject is to provide a platform for students to apply their knowledge of electromagnetic fields in antenna and microwave system design. This subject built a strong foundation in designing and analyzing radiation parameters of antennas in numerous practical applications. Besides, the concept of this subject is useful to the students to enhance their knowledge in the area of microwave waveguides, devices, and tubes.

**DETAILED SYLLABUS**

**NO TOPIC**

**[1] INTRODUCTION TO MICROWAVES&ANTENNAS**

History of Microwaves, Microwave Frequency bands;Applications of Microwaves& Antennas

**[2] TRAMSMISSSION LINE**

Introduction, Concept of distributed elements, Equation of Voltage and Current, Standing Waves and Impedance Transformations, Loss less and Low loss Transmission lines, Analysis of Transmission lines in terms of Admittances, Graphical Representation of a Transmission line, Quarter Wave Transformer, The Smith Chart & its Applications, Applications of Transmission Lines as a Circuit element and Resonant Circuits, Microstrip Transmission Line.

**[3] WAVEGUIDES AND RESONATOR**

Rectangular Waveguides, Visualization of fields inside Rectangular Waveguides, Cavity Resonator, Introduction to Circular Waveguides.

**[4] MICROWAVE DEVICES**

Waveguide Microwave Junctions, Introduction to S Parameters, S parameters of Microwave components (E plane Tee, H plane Tee, Magic Tee), Microwave Passive components: Directional Coupler, Power Divider,Circulator, and Isolator, Microwave tubes: Two-Cavity Klystron, Reflex Klystron.

**[5] ANTENNAFUNDAMENTAL**

Physical concept of radiation, Radiation from the Hertz Dipole, Near and Far Field Analysis, Radiation pattern, Radiation Parameters of Antenna: Directivity, Gain, Side Lobe Level of Antenna, polarization, efficiency, Friis transmission equation, Thin Linear Antenna

**[6] ANTENNA ARRAYS**

Array of Point Sources, Broad side & End Fire Array, Array Synthesis, Schelkunoff Zero Placement Method, Binomial Array, Folded dipole, Yagi-Uda Array, Log Periodic Dipole Array Antenna

**[7] BASIC CONCEPTS OF SMART ANTENNAS**
Concept and benefits of smart antennas, fixedweight beam forming basics, Adaptive beam forming.

**[8] MICROWAVE FREQUENCY ANTENNA**
Micro strip Antennas, Design of rectangular and circular patch antennas, Horn Antennas, Parabolic Reflector Antenna.

## RECOMMENDED TEXT / REFERENCE BOOKS


1) Electromagnetic Waves, R. K. Shevgaonkar, Tata McGraw Hill.
2) Microwave Devices and Circuits, S. Y. Liao, 3rd Edition, Prentice Hall of India.
3) Electronic Communication systems, George Kennedy, 3rd Edition, Tata McGraw Hill.
4) Antennas, C. A. Balani, 3rd Edition, Tata McGraw Hill.
5) Antennas & Wave Propagation, K. D. Prasad, 2nd Edition, Khanna Publication.


## COURSE OUTCOMES

At the end of the course, students should be able to

CO1. Design microwave matching networks using single-double stub and quarter wave transformer in transmission lines.
CO2. Illustrate the basic philosophy of radiation parameters of antenna and the concept of radiation is introduced.
CO3. Study and analyze different types of metallic waveguides and their respective modes of propagation.
CO4. Analyzeand design various antenna parameters necessary for building an RF system.
CO5. Investigate the performance measures of microwave devices to identify their applications.
CO6. Recommend various antenna configurations according to the applications in radar and mobile communication.

## COURSE MATRIX

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | 1 | 1 | 3 | | | | | | | |
| CO2 | 3 | 3 | 1 | 1 | 1 | | | | | | | |
| CO3 | 3 | 3 | 3 | 1 | 1 | | | | | 2 | | |
| CO4 | 3 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | | | 2 | |
| CO5 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | | | | 2 |
| CO6 | 3 | 3 | 3 | 3 | 3 | 1 | | | | | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VI (EC)**

**SUBJECT: (  ) ADVANCED MICROPROCESSORS (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

## COURSE OBJECTIVES

The objective of this course is to introduce performance enhancement techniques for advanced processor architectures, interfacing techniques and real-world applications design using 8086 and ARM7 based microprocessors. To familiarize students with the assembly language and high level programming to optimize machine language code with reference to timing and resource constraints of the modern commonly battery-powered and portable systems.

## DETAILED SYLLABUS

**NO TOPIC**

**[1] THE MICROPROCESSOR AND ITS ARCHITECTURE**
Internal Architecture, Real mode memory addressing, protected mode memory addressing, memory paging.

**[2] ADDRESSING MODES**
Data addressing mode, program memory addressing mode, stack memory addressing mode

**[3] 8086/8088 HARDWARE SPECIFICATIONS**
Pin-outs, pin functions, clock generator, bus buffering and latching, bus timing, ready and the wait state, minimum mode versus maximum mode.

**[4] MEMORY INTERFACE**
Memory devices, address decoding, 8086 and 8088 memory interface

**[5] INTERRUPTS**
Basic interrupt processing, Hardware interrupts, Expanding the interrupt structure

**[6] THE PENTIUM MICROPROCESSOR**
Protected mode, paging mode, virtual 8086 mode, memory management mode with Pentium.

**[7] INTRODUCTION TO ARM**
Overview of ARM Processor, Fundamental of RISC & CISC, Evolution of RISC, Comparison of RISC & CISC, Design for LPC.

**[8] ARM ARCHITECTURE**
Architectural inheritance, Programmer's model, ARM development tools, Software Assembler (ARM), 'C' Language Complier, Simulator, Hardware Board, Board organization, Communication with external world. 3-stage pipeline ARM organization, ARM instruction execution, ARM implementation

**[9] ARM ASSEMBLY LANGUAGE PROGRAMMING**

Data processing instructions, Data transfer instructions, Control flow instructions, Programs based on assembly language. Introduction, Exceptions, Conditional execution, Branch and Branch with Link (B, BL), Branch, Branch with Link and eXchange (BX, BLX), Software Interrupt (SWI), Data processing instructions, Multiply instructions, Count leading zeros (CLZ), Single word and unsigned byte data transfer instructions, Half-word and signed byte data transfer instructions, Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to status register transfer instructions, Coprocessor instructions.

**[10] THE THUMB INSTRUCTION SET**

The Thumb bit in the Current Program Status Register (CPSR), The Thumb programmer's model, Thumb branch instructions, Thumb software interrupt instruction, Thumb data processing instructions, Thumb single register data transfer instructions, Thumb multiple register data transfer instructions, Thumb breakpoint instruction, Thumb implementation, Thumb applications.

**[11] INTRODUCTION TO VECTORED INTERRUPT CONTROLLER**

IRQ and FIQ using Vectored interrupt controller of LPC23xx

**RECOMMENDED TEXT / REFERENCE BOOKS**


1) The Intel Microprocessors 8086, 8088, 80186, 80188, 80286, 80386, 80486, Pentium, Pentium Pro Processors, Berry B Brey, 6th Edition, Prentice Hall of India.
2) ARM - System-On- Chip Architecture, Steve Furber, 2nd Edition, Prentice Hall of India.
3) Microprocessors and Interfacing-Programming & Hardware, Douglas V. Hall, 2nd Edition, Tata McGraw Hill.
4) IBM PC Assembly Language Programming, Peter Abel, 2nd Edition, Prentice Hall of India.
5) ARM System Developer Guide, AntrewSloss, Dominic Symes, Chris Wright, Morgan Kaufmann.
6) Technical Ref. Manual, ARM7TDMI (3) UM10211 LPC 2364/66/68/78 User Manual, NXP Ltd.


**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Being familiar and analyze the architectural aspects of 8086 like specifications, programming model, pipeline, prefetch queue, pin configuration and role of this features to build microprocessor based systems

CO2. Develop assembly language program to satisfy executional requirements as per given problem statement with reference to programming model of 8086, instruction set. Also simulate and analyse the assembly language and C programs simulation tools

CO3. Determine requirement of hardware components and Design 16-bit memory subsystem with the 8086 as per system specifications

CO4. Demonstrate multitasking environment using interrupt programming and vectored interrupt controller. Use protected mode memory addressing, memory paging to extend addressing capacity of the system.

CO5. Introduce architecture and programming model of ARM7 architecture and compare it with 8086 architecture..

CO6. Develop ARM7 based assembly language and C programs to implement common algorithms and attempt optimization of the code, also use the machine language code templates to generate machine codes for different types of instructions.

**COURSE MATRIX**

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 3 | 3 | 2 | | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO3 | 3 | 3 | 3 | 3 | | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO4 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO5 | 3 | 3 | 3 | 2 | | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO6 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VI (EC)**

**SUBJECT: (  ) MICROCONTROLLER & IOT PROJECT (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 0 | 0 | 2 | 2 | 1 | - | - | 50 | - | 50 |

## COURSE OBJECTIVES

To offer a profound understanding and implementation of Microcontroller based embedded systems in an elementary and integrated manner. The objectives of this course is to make students capable of developing a small-scale Microcontroller based embedded system to fulfill the requirements of hardware implementation with the necessary simulation (design, troubleshoot and optimization).

## DETAILED SYLLABUS

| NO | TOPIC |
|---|---|
| [1] | Identify the project definition |
| [2] | Design and implement hardware and software/ algorithm |
| [3] | Analyze, troubleshoot and interpret output |
| [4] | Presentation |
| [5] | Designing of PCB and implement hardware prototype |

## RECOMMENDED TEXT / REFERENCE BOOKS

Not applicable

## COURSE OUTCOMES

At the end of the course, students should be able to

CO1. Identify the problem statement that solve societal issues real life problems, through literature survey for project work and arrive at conceptual project statement. Develop presentation and interpersonal communication skills through project work

CO2. Decide design specifications, Design PCB and develop hardware prototype.

CO3. Analyze, test and troubleshoot designed circuits and codes for desired outcome. Evaluate outcome and application of project work with appropriate societal, health and safety consideration.

## COURSE MATRIX

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | 2 | | | 3 | | 1 | 3 | 2 | 1 | |
| CO2 | 3 | 3 | 3 | 3 | 2 | | | 1 | 3 | 3 | | |
| CO3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VI (EC)**

**SUBJECT: (  ) AUTOMATED ELECTRONICS (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 2 | 0 | 2 | 4 | 3 | 40 | - | 25 | 25 | 90 |

## COURSE OBJECTIVES

Automation is playing a key role in Industries. Industries rely heavily on automation for economic viability and mass production. It is important for the students to learn basic of automation, how system works and importance of PLC, SCADA and robotics in automation. This course will provide opportunity to learn industrial automation techniques to understand basic components of automation in Industries, to learn various industry automation techniques, to apply knowledge of automation components for practical application, and to study different systems based on PLC, SCADA and robots in automation.

## DETAILED SYLLABUS

**NO TOPIC**

**[1] PROGRAMMABLE LOGIC CONTROLLERS**

Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

**[2] AUTOMATION COMPONENTS AND COMPUTER AIDED MEASUREMENT**

Introduction of supervisory control and data acquisition (SCADA), Industrial bus systems: Modbus &Profibus, Sensors for temperature, pressure, force, displacement, speed, flow, level, Actuators, Data acquisition and Data transfer techniques, Internet of things (IoT).

**[3] DISTRIBUTED CONTROL SYSTEM AND INDUSTRIAL AUTOMATION**

Overview of DCS, DCS integration with PLC and Computers, Features of DCS, Basic construction and configuration of robots**,** Pick and place robot.

## RECOMMENDED TEXT / REFERENCE BOOKS


**1)** Industrial Instrumentation and Control, S. K. Singh, 3rd Edition, Tata McGraw Hill Companies.
**2)** PC based Instrumentation –Concepts and practice, N. Mathivanan, 3rd Edition, PHI Publications.
**3)** Programming Logic Controllers -Principles and applications, John W. Webb & Ronald Reis, 5th Edition, PHI Publications.
**4)** Process Control Instrumentation Technology, C. D. Johnson, 8th Edition, PHI Publications.
**5)** Programmable logic controller, Dunning & Delmar, 3rd Edition, Thomas Dilmar Publications.
**6)** Industrial control handbook, Parr & Newman, 3rd Edition, Industry Press.

**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Analysis and design of programmable logic controllers based programming for textual and graphical languages

CO2. Analyse the different sensors input, Signal conditioning, Control the plant automation process with the help of Elements of computer aided measurement, and Internet of things (IoT).

CO3. Illustrate basic distributed control system and its features. Describe Basic construction and configuration of robot, Pick and place robot.

**COURSE MATRIX**

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 3 | 3 | | | 2 | | 1 | | 1 | | 1 |
| CO2 | 3 | 3 | 1 | | | 2 | | 1 | | 1 | | 1 |
| CO3 | 3 | 2 | 1 | | | 2 | | 1 | | 1 | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VII (EC)**

**SUBJECT: (  ) DATA & COMPUTER COMMUNICATIONS(w. e. f. 2000-01)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

## COURSE OVERVIEW

Computer networks and data communications plays a major role in every aspect of day to day life. The course is designed to impart fundamental knowledge of computer network architecture and major communication protocols. On completion of this course, students are familiarize with the Transmission Media, Flow Control and Error Detection & Correction, understand fundamental concepts in Routing, Addressing & working of Transport Protocols, Administer and maintain a computer network and also gain the knowledge of application layer protocols.

## DETAILED SYLLABUS

**NO TOPIC**

**[1] INTRODUCTION**

Introduction to Data Communication System, Network Classification, Protocols and Standards. OSI & TCP Reference models– layered architecture, peer-to-peer processes, Services & Interface, layered architecture, services and responsibilities, addressing. Switching: circuit-switched network and packet.

**[2] THE DATA LINK LAYER**

Data Link Layer Design Issues, Elementary Data Link Protocols, Sliding Window Protocols., Data link control: framing, flow and error control for noiseless and noisy channels.

Multiple access: random access and contention - ALOHA, CSMA, CSMA/CD, vulnerable time and throughput. IEEE 802.3 Ethernet - frame format, addressing, access method, cabling, encoding, binary exponential back-off algorithm, Ethernet performance, IEEE 802.11

**[3] THE NETWORK LAYER**

Design issues, Logical addressing, Internet Protocol (v4), IPv4 addresses - classful and classless, transition from IPv4 to IPv6. Address resolution,Error reporting and multi-casting: ICMP (v4 and v6).

IP Delivery, forwarding and routing, Routing algorithms &protocols: distance vector routing – link state routing – path vector routing, Congestion Control Algorithms - congestion prevention, traffic shaping.

**[4] THE TRANSPORT LAYER**

UDP: datagram format, operation,TCP: services and features, segment format, connection management, error control, congestion control, TCP Sockets, Introduction to TCP over Wireless Networks - challenges & proposed approaches.

**[5] THE APPLICATION LAYER**

Introduction Domain Name System, DHCP, Socket Programming

**RECOMMENDED TEXT / REFERENCE BOOKS**

1) Computer Networks, Andrew S. Tanenbaum, 3rd Edition, Prentice Hall of India
2) Data and Computer Communications, William Stallings, 3rd Edition, Prentice Hall of India
3) Data Communications and Networking, BehrouzA.Forouzan, 3rd Edition, Tata McGraw Hill

**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Describe the elements of a data & communication network and their significance in building the physical network infrastructure.
CO2. Develop various protocols of data link layer for wired communication and also examine their performance under diverse channel conditions.
CO3. Appraise the need of logical addressing and the significance of various Network Layer protocols over Internet.
CO4. Analyse the performance of various routing algorithms based on different criteria like hope count, delay etc.
CO5. Evaluate network performance employing transport & flow control protocols, congestion control policies.
CO6. Understand the provisioning of various internet services and underlying protocols

**COURSE MATRIX**

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 2 | 1 | 1 | 1 | 1 | | | | | | | 1 |
| CO2 | 2 | 2 | 1 | 1 | 1 | | | | | | | 1 |
| CO3 | 3 | 1 | 2 | 1 | 1 | | | | | | | 2 |
| CO4 | 2 | 1 | 2 | 1 | 1 | | | | | | | 2 |
| CO5 | 3 | 2 | 2 | 2 | 1 | | | | | 1 | | 2 |
| CO6 | 3 | 3 | 2 | 2 | 2 | | | | | 1 | | 2 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VII (EC)**
**SUBJECT: (EC720) IMAGE PROCESSING**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

**COURSE OBJECTIVES**

This course offers a solid foundation to understand advanced applications such as Computer Vision, Medical image analysis, Surveillance and multimedia image processing. This subject covers the fundamental concepts & key stages of digital image processing including representation, sampling and quantization, image acquisition, image transforms, image enhancement, image filtering and image restoration. Students will also learn advance topics like Image Segmentation & Morphological Operations. They will implement all the techniques using Python language & OpenCV libraries.

**DETAILED SYLLABUS**

**NO TOPIC**

**[1] INTRODUCTION**
Digital Image Processing, The Origins of Digital Image Processing, Examples of Fields that use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components ofan Image Processing System.

**[2] DIGITAL IMAGE FUNDAMENTALS**
Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing andAcquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels,Linear and Nonlinear Operations

**[3] IMAGE ENHANCEMENT IN THE SPATIAL DOMAIN**
Background, Some Basic Gray-Level Transformations, Histogram Processing, Enhancementusing Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters,Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

**[4] IMAGE ENHANCEMENT IN THE FREQUENCY DOMAIN**
Background, Introduction to the Fourier Transform and the Frequency Domain, SmoothingFrequency-Domain Filters, Sharpening Frequency Domain Filters, Holomorphic Filtering,Implementation.

**[5] IMAGE RESTORATION**
A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Geometric Transformations.

**[6] COLOR IMAGE PROCESSING**
Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-ColorImageProcessing.

**[7] MORPHOLOGICAL IMAGE PROCESSING**
Preliminaries. Dilation and Erosion. Opening and Closing. The Hit-or-Miss Transformation.Some Basic Morphological Algorithms. Extensions to Gray-Scale Images

**[8] IMAGE SEGMENTATION**
Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding,

RegionBased Segmentation, Segmentation by Morphological Watersheds, The Use of Motion inSegmentation.

**[9] REPRESENTATION AND DESCRIPTION**

Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components forDescription, Relational Descriptors.

**RECOMMENDED TEXT / REFERENCE BOOKS**


1) Digital Image Processing, Rafael C. Gonzalez& Woods, 3rd Edition, Wesley Publishing Co.
2) Image Processing, Don Pearson, Tata McGraw Hill
3) Digital Picture Processing, AzrielResenfeld, Avinash C. Kak, Academic Press, New York
4) Digital Image Processing, Kenneth R. Castleman, Pearson Education
5) Fundamental of Digital Image Processing, Anil K. Jain, Pearson Education


**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Compare different methods for image acquisition, storage, processing and representation in digital devices having different color formats

CO2. Analyse an image in spatial domain and apply spatial enhancement techniques like point processing methods & Image Filtering.

CO3. Interpret & compare the mathematical principles of 2D transform methods for image analysis in frequency domain and apply them for image enhancement.

CO4. Discriminate various segmentation techniques for an image and separating image components for further analysis.

CO5. Compare various noise models for an image, evaluate restoration techniques to remove noise and degradation, and processing image using representation & description techniques.

CO6. Compare morphological image processing methods for various applications

**COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 2 | 1 | | 1 |
| CO2 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | | 1 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 1 | | 1 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 1 | | 1 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 1 | | 1 |
| CO6 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 1 | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VII (EC)**
**SUBJECT: (EC722) EMBEDDEDSYSTEMS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

**COURSE OBJECTIVES**

Embedded Systems have become ubiquitous with their important role in various domains ranging from small handheld/portable devices to automobile and other complex time critical systems including IoTs. The design and performance of embedded systems are challenged by resource constraints besides size restriction. Therefore, understanding of suitable processor/microcontroller architecture, means of data transfer along with the basic concepts of responsibilities of Operating Systems is essential in order to address the common design issues.

The offered subject covers ARM Cortex processor with its feature for efficient firmware development as a suitable candidate for the design of embedded systems and very commonly used data transfer protocols like I2C and SPI. Since the operating system is an unavoidable part of any sophisticated embedded system, the subject also includes the topics related to the core responsibilities of operating systems like, process management, scheduling and I/O management.

**DETAILED SYLLABUS**

**NO TOPIC**

**[1] INTRODUCTION TO ARM CORTEX-M PROCESSORS**
ARM Cortex-M processors, Advantages of the Cortex-M processors, Applications of the ARM Cortex-M processors, ARM ecosystem

**[2] CORTEX-M ARCHITECTURE**
Introduction to the architecture, Programmer's model, Behavior of the application program status register

**MEMORY SYSTEM**
Overview, Memory endianness, Bit-band operations, Memory access attributes

**[3] EXCEPTIONS AND INTERRUPTS**
Overview, Exception types, Interrupt management

**[4] OS SUPPORT FEATURES**
Overview of OS support features, Shadowed stack pointer, SVC exception, PendSV exception

**[5] I2C PROTOCOL**
Overview, I2C bus features, I2C bus hardware configurations, I2C Protocol, Driving I2C bus

**[6] SPI PROTOCOL**
Overview, SPI operation, Clock polarity and phase in SPI devices, SPI bus configurations

**[7] SOFTWARE INTERFACE STANDARD**
Overview, Areas of standardization in CMSIS-Core, Organization of CMSIS-Core, using CMSIS-Core Benefits of CMSIS-Core, Various versions of CMSIS

**[8] INTRODUCTION TO OPERATING SYSTEMS**
Operating System Concepts, System Calls

**[9] PROCESSES**

The Process Model, Threads, Interprocess Communication, Classical IPC Problems, Process Scheduling

**[10] INPUT/OUTPUT**

Principles of I/O Hardware & Software, Device Drivers, Device-Independent I/O Software, User-Space I/O Software, Deadlocks, RAM Disks, Disk Hardware and Software, Clock Hardware and Software, Terminal Hardware and Software.

**RECOMMENDED TEXT / REFERENCE BOOKS**


1) The Definitive Guide to ARM Cortex -M3 and Cortex-M4 Processors, Joseph Yiu, : 3rd Edition, Newness Press
2) Operating Systems: Design and Implementation, A. S. Tanenbaum, A. S. Woodhull, 3rd Edition, Prentice Hall of India
3) Operating Systems, William Stallings, Edition 6th, Pearson Education
4) The Designers guide to the Cortex-M processor family, Trevor Martin Edition 2nd, Newnes Press


**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Understand roles & responsibilities of operating systems and process model of time-sharing multiprogramming environment

CO2. Identify an appropriate approach for solving the problem of accessing shared resources based on busy waiting and/or hardware support

CO3. Analyse different approaches for solving the IPC problems based on programming language mechanisms like semaphores and monitors

CO4. Examine situations/conditions leading to deadlocks while acquiring hardware or software resources and identify an appropriate approach/algorithms to avoid them.

CO5. Compare different scheduling algorithms with reference to scheduling criteria. Also identify the characteristics and time critical requirements of real time tasks and relate with a right real time scheduling algorithm.

CO6. Classify the devices and understand features of the I/O software to effectively utilize the Operating system support. Study different block devices and compare disk arm scheduling algorithms for reducing disk transfer time.

CO7. Apply the fault and exception handling mechanisms of ARM Cortex-M processor to provide a well-defined response to unexpected situations for a robust embedded system. Also implement specific exceptions useful for real time systems. Use software interface standards CMSIS for writing firmware in user friendly environment for easier development and debugging.

CO8. Understand, compare and implement industry standard widely used serial bus protocols like I2C and SPI for application-level use with the help of EDA tool Keil5. Understand features and applications of various profiles of Cortex processors.

CO9. Understand the internal architecture, features and Programmer's model of ARM Cortex-M processor and implement its unique features using assembly language programming.

CO10. Understand memory system in terms of memory endianness and attributes for efficient interfacing with Cortex-M processor. Write optimized code for implementation of atomic operation using bit-band feature of ARM Cortex M

processor for efficient implementation of multitasking systems.

**COURSE MATRIX**

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 2 | 1 | | | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO2 | 3 | 3 | 3 | 1 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO4 | 3 | 3 | 3 | 2 | | 2 | 1 | | 2 | 2 | | 1 |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO6 | 3 | 3 | 2 | | | 2 | 1 | | 2 | 2 | | 1 |
| CO7 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO8 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO9 | 3 | 3 | 3 | | | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO10 | 3 | 3 | 3 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VII (EC)**
**SUBJECT: (  ) SUMMER INTERNSHIP PROJECT (w. e. f. 2023-24)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 0 | 0 | 2 | 2 | 2* | - | - | 50 | - | 50 |

* Student shall either undertake Summer Internship or Research Activity during the summer vacation after 3rd Year. The students shall develop the Complete Project as an extension/continuation of the activities carried out during vacation period. The Project work will be evaluated during the Semester VII as per the Teaching Scheme. As the contact hours include the 6-8 weeks of vacation period, the credits allotted to this subject are 2.

**COURSE OBJECTIVES**

To offer a profound understanding and implementation of any system or concept using any programming language or software tool.

**DETAILED SYLLABUS**

| NO | TOPIC |
|---|---|
| [1] | Plan, design and implement Software projects. |
| [2] | Analyze and interpret output. |
| [3] | Presentation Skill |
| [4] | Designing of Flowchart |

**RECOMMENDED TEXT / REFERENCE BOOKS**

Not applicable

**COURSE OUTCOMES**

At the end of the course,students should be able to

CO1. Identify the problem statement that solve societal, health and safety issues, through literature survey for project work and Arrive at conceptual project design through brainstorming.
CO2. Develop design strategy for the project work.
CO3. Develop presentation and interpersonal communication skills through project work
CO4. Evaluate outcome and application of project work with appropriate societal, health and safety consideration.

**COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO4 | 3 | 3 | 2 | 2 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – VII (EC)**
**SUBJECT: (EC724) WIRELESS COMMUNICATION**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 0 | 4 | 4 | 60 | 40 | - | - | 100 |

**COURSE OBJECTIVES**

In view of fast development in a range of applications depending on cellular systems as well as wireless technology in general, it is essential to understand the fundamentals of cellular concept with in-depth study of the characteristic of hostile wireless channels and design of various techniques to compensate the demerits of the channels.

The offered subject has to include the advance topics like cellular concepts, digital modulation techniques, spread spectrum techniques, speech coders, Adaptive equalizer, diversity, GSM architecture as the attempt of upgrading the quality of wireless communication.

To offer fundamental understanding of various aspects of wireless communication including cellular structure, interference and fading issues with different minimization techniques. The subject makes students aware of various mobile telephony standards like GSM-2G, 2.5G, 3G (WCDMA) and 4GLong Term Evolution (LTE).

**DETAILED SYLLABUS**

**NO TOPIC**

**[1] INTRODUCTION TO WIRELESS COMMUNICATION SYSTEM**
Evolution of mobile radio communications, Cellular Telephone System.
**MODERNWIRELESS COMMUNICATION SYSTEMS**
Second generation (2G) cellular networks, Third generation (3G) wireless networks, Bluetoothand personal area network.

**[2] THE CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS**
Introduction, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and grade of service, Improving coverage & capacity in cellular systems.

**[3] MOBILE RADIO PROPAGATION**
Large scale path loss, Small scale path loss fading and multi path Doppler shift, Fading offset, Level crossing rate, Fade duration.

**[4] MODULATION TECHNIQUES FOR MOBILE RADIO**
Digital modulation - an overview, Pulse shaping Techniques, Linear modulation techniques, Constant envelope modulation, combined linear and constant envelope modulation (QAM), Multiple Access Techniques, Spread spectrum modulation techniques.

**[5] EQUALIZATION, DIVERSITY, AND CHANNEL CODING**
Introduction, Fundamentals of equalization, Training , A generic adaptive equalizer, Equalizers in a communications receiver, Survey of equalization techniques, Linear equalizers, Nonlinear equalization, Diversity techniques, RAKE receiver, Interleaving, Fundamentals of channel coding.

**[6] SPEECH CODING**
Introduction, Characteristics of speech signals, Quantization techniques, Adaptive

differential pulse code modulation (ADPCM), Vocoders, Linear predictive coders, choosing speech codec for mobile communications, The GSM codec

**[7] MULTIPLE- ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION**

Introduction, Frequency division multiple access (FDMA), Time division multiple access,Spread spectrum multiple access, Frequency hopped multiple access (FHMA), Code-divisionmultiple access (CDMA), Hybrid spread spectrum techniques, Space division multiple access(SDMA), Packet radio, Capacity of cellular systems.

**[8] GSM SYSTEM**

RF specifications, Time slot data structure, Speech frame, Control channels System structure.HLR VLR AUC EIR MSC BSC BTS MS Equalization, Diversity, Channel Coding, SpeechCoding.

**[9] OVERVIEW OF 3G & 4G**

An overview of wireless systems, Techniques for high data rate in 3G, Brief about WCDMA,3GPP Long Term Evolution (LTE)- Goals, System overview, Network structure, MainFeatures

**RECOMMENDED TEXT / REFERENCE BOOKS**


1) Wireless communication, Theodore Rappaport, 2nd Edition, Prentice Hall of India.
2) Wireless Communication, W. C. Y. Lee, 3rd Edition, Tata McGraw Hill.
3) Wireless Communications, Andreas F. Molisch, 2nd Edition, A John Wiley and Sons, Ltd.
4) Wireless Communications and Networking, Vijay Garg, M.K. Publishers


**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1. Determine small scale multipath fading parameters for given operating frequency, speed of mobile and delay spread and compensate the fading using suitable algorithms for linear and non linear equalization

CO2. Analyse and evaluation of cellular system in terms of interference and capacity and system improvement techniques for coverage and capacity

CO3. Understand all types of diversity and Determine average SNR for given number of receive antenna for selection diversity and MRC diversity and Find out output bit rate for speech coders for given block of speech duration, sampling frequency and determine the bandwidth requirement for given type of FEC and modulation technique.

CO4. Compare modulation techniques in terms of bandwidth efficiency and power efficiency.

CO5. Understand GSM architecture and overview of 4G features and illustrate the call establishment process in GSM showing the usage of control channels at every step of data exchange between Mobile station and switching centre.

CO6. Compare the features of 1G, 2G & 3G mobile system, Compute path-loss and received signal strength with given transmit power, antenna gain and distance for largescale fading channel conditions and Compare multiple Access Techniques useful for different generation and Capacity of cellular systems -GSM and CDMA

**COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 0 | 0 | 2 | 0 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 |
| CO3 | 3 | 3 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 |
| CO4 | 3 | 2 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 |
| CO5 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 0 | 0 | 1 | 0 |
| CO6 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B.TECH. SEMESTER–I (EC/CE/IT)**

**SUBJECT: (ES107) SOFTWAREWORKSHOP (w. e. f. 2021-22)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 0 | 0 | 2 | 2 | 1 | - | - | 50* | - | 50 |

*TW Marks includes Viva based on TW

## COURSE OBJECTIVES

Creating sound back ground for use of Linux operating system helps the students for their future endeavor in the study of programming subjects and Project work. By offering this course, the department encourages the student to use Open source software such as Linux OS, Scilab and Latex. The laboratory covers fundamentals and high-level architecture of Linux operating system. The laboratory offers hands-on experience for Linux Installation, various commands and driver installation. Hands on experience for writing pseudo code for given problem and writing shell scripts are inclusive in this study. The broad objective of this course is to understand the basic concepts of Linux OS and study the usages of Linux commands. Also to understand the basics of C programming language

## DETAILED SYLLABUS

**[1] OPERATINGSYSTEMBASICS**

Introduction to Operating System and Linux Architecture

**[2] SOFTWAREINSTALLATION**

Installation of open source/freeware softwareusing package manager for programming/simulation.

**[3] SHELLCOMMANDS**

Linux usage, commands & shell scripting. Command structure and general purpose utility

**[4] FILE HANDLING**

basic of file handling. The file system, Handling ordinary files, File attributes and permission, file system details

**[5] SHELLSCRIPTING**

Basic Shell commands, Looping and Branching,

**[6] SHELLUTILITIES**

Find command and shell, simple filters, advance filters.

**[7] EDITORS**

VI editor for basic text editing, LATEX for scientific documents and report writing.

**TEXT / REFERENCE BOOKS**

1) Unix : Concepts and Applications, Sumitabha Das, 4th Edition, Tata McGraw Hill

**COURSE OUTCOMES**

At the end of the course,students should be able to

CO1. Store files, surf internet, carry out documentation work using Linux OS and Use Linux commands to perform file management and data security tasks.
CO2. Create articles and reports having multiple chapters and references using Latex typesetting.
CO3. Install open source software such as drivers of Hardware devices as well as other application like Scilab for mathematical computation.
CO4. Develop pseudo code for given problem statements.
CO5. Develop various shell scripts for any given problem statements along with use of filters.

**COURSE MATRIX**

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 2 | | | | 3 | | | 3 | | 1 | | 3 |
| CO2 | 2 | 2 | | | 3 | | | | | 1 | | |
| CO3 | | | | | 3 | 3 | | | | 3 | | |
| CO4 | 2 | | | | 3 | | | 3 | | 1 | | 3 |
| CO5 | 2 | 2 | | | 3 | | | | | 1 | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – II (EC/CE/IT)**

**SUBJECT: (ES201) PROGRAMMING FOR PROBLEM SOLVING - II (w. e. f. 2021-22)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 4 | 0 | 3 | 7 | 5.5 | 60 | 40 | 50* | - | 150 |

*TW Marks includes Viva based on TW

**COURSE OBJECTIVES**

To make students familiar with the difference between object-oriented programming and procedural programming. In addition, the student should acquire skills for programming using advanced C++ features such as composition of objects, operator overloading, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, etc.

**DETAILED SYLLABUS**

**[1] BASICS OF C++**

Overview, Program structure, keywords, identifiers, constants, data types, symbolic constants, declaration of variables, operators, namespaces, control structures, dynamic memory – C style – malloc(), calloc(), realloc() and free() Vs C++ style - new and delete keywords, reference and pointer

**[2] FUNCTIONS IN C++**

main function (variations in signature), function prototype, inline functions, call and return by reference, default parameters, function overloading

**[3] INTRODUCTION TO OBJECT ORIENTED PROGRAMMING**

Procedural Vs Object Oriented Programming, Principles of OOP, Benefits and applications of OOP

**[4] CLASSES AND OBJECTS – ENCAPSULATION AND ABSTRACTION**

Introduction, private and public members, Defining member functions, static members, Objects as function arguments and return type, friend functions, const member functions, Constructors and their types, Destructor, Operator overloading, type conversion

**[5] INTRODUCTION TO C++ STRING CLASS**

**[6] INHERITANCE**

Introduction, types of inheritance – single, multiple, multilevel, hierarchical, and hybrid inheritance, Protected members, overriding, virtual base class

**[7] POLYMORPHISM**

Introduction, Pointers and Objects, this pointer, pointer to derived classes, virtual and pure virtual functions, dynamic binding

**[8] INPUT/OUTPUT**

Introduction to streams, standard I/O stream objects, stream classes, unformatted and formatted I/O, manipulators

**[9] EXCEPTION HANDLING**

Basics of exception handling, try-catch-throw, rethrowing exceptions, user defined exceptions

**[10] TEMPLATES**

Basics of class templates and function templates

**TEXT / REFERENCE BOOKS**


1) Object-Oriented programming with C++, Seventh Ed., by E Balagurusamy, TMH publication
2) The C++ Programming Language, Fourth Ed., by Bjarne Stroustrup, Addison-Wesley publication
3) Object-Oriented Programming in C++, Fourth Edition, by Robert Lafore, SAMS publication
4) Accelerated C++: Practical Programming by Example, First Edition, by Andrew Koenig and Barbara E. Moo, Addison-Wesley publication
5) C++ Black Book, First edition, by Steven Holzner, Paraglyph Press
6) C++: The Complete Reference, Fourth Edition, by Herbert Schildt, McGraw Hill Education


**COURSE OUTCOMES**

At the end of the course,students should be able to

CO1. Realize the typical differences in C and C++ languages with reference to keywords, dynamic memory allocation, structures, strings and vetcoors etc. and write simple C++ programs.

CO2. Design simple object-oriented programs using classes with help of key fundamentals of object-oriented modeling and design.

CO3. Utilize distinctive features like function overloading, constructors, destructors and friend functions for dynamic handling of the objects in the programs.

CO4. Demonstrate reuse of the code using different forms of inheritance in programs.

CO5. Demonstrate run-time polymorphism using inheritance and virtual base class and analysis of run-time errors in orderly fashion with help of exception handling in C++.

CO6. Write objectoriented programs to exploit other salient features of C++ like operator overloading, templates and type conversion.

**B. TECH. SEMESTER II (EC/CE/IT)**

**SUBJECT: (ES202) HARDWAREWORKSHOP (w. e. f. 2021-22)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Pract. | Total |
| 0 | 0 | 4 | 4 | 2 | - | - | 100* | - | 100 |

*TW Marks includes Viva based on TW

**COURSE OBJECTIVES**

Operating the test and measuring electronic instruments is essential in the entire study of electronics and communication branch. Study of circuit simulators, PCB design software, Raspberry pi and Arduino boards help student in creating foundation for development of successful projects in higher semesters. Course covers study and hands on test and measuring instruments, operation of Raspberry pi and Arduino boards, circuit implementation on bread boar and simulators, Linux operating system and website development.

**DETAILED SYLLABUS**

**[1] ELECTRONICCOMPONENTS**

Digital Multi-meter, Power Supply, Function Generator, Cathode Ray Oscilloscope, Digital Oscilloscope, Measurement of Phase Difference in single phase circuit, Various Electrical and Electronics component like LED, LDR, Photo-diode, MOSFET, MCB and Relay.

**[2] COMPUTERHARDWARE**

Introduction to a personal computer and its basic peripherals, installation of Operating System Software and the required device drivers. Students are suggested to perform similar tasks on the Laptop scenario wherever possible.

**[3] PERIPHERALS**

Programming of Computer Ports & Interfacing of Electronic Components, Cables and Connectors like RJ45, RS232 and CRO probe.

**[4] INTERNET**

Introduction to Internet & World Wide Web modules, Making a PC Internet ready: Introduction to Internet and TCP/IP, Ethernet Connection, WiFi connection, configure TCP/IP (IP, Gateway, DNS, and Proxy), and use of ping command, Information sharing and data transfer over Local Area Network and Internet.

**[5] WEBINFRASTRUCTURE**

Basic Components of Web Sites, Front end & back end tools and technology. HTML & CSS, Developing, Configuring and deploying a website.

**[6] IOTBOARDSANDCIRCUITSIMULATION**

Introduction to IOT boards like Arduino, Raspberry Pie etc. Interfacing, Circuit designing and PCB designing.

**[7] MINIPROJECT**

Student will develop a mini project related to the topics listed above.

**TEXT / REFERENCE BOOKS**

1) Electronic Components and Materials Principles, Dr.MadhuriA Joshi, 2nd Edition, Shroff Publishers & Distributors PVT. LTD.
2) A Textbook of Computer Hardware and Networking, JyotikaDeshmukh, D J Publications
3) Learning Web Design, Jennifer Robbins, 4th edition, O'Reilly Media

**COURSE OUTCOMES**

At the end of the course,students should be able to

CO1. Use breadboard, DC Power supply, Function Generator, Cathode Ray Oscilloscope and Digital Storage Oscilloscope to verify the circuit operation.
CO2. Understand the working of MCB, Relay, and working of AC DC Motor.
CO3. Implement given circuit on NI-Multisim circuit simulator, on bread board and using Proteous PCB designing software and prepare physical PCB for hardware project (fixed DC power supply , water level detector).
CO4. Understand the usage of BNC, USB, RS232, RJ45, VGA, and HDMI connectors and make CRO probe and LAN cable using necessary wires and connectors.
CO5. Install Linux OS and the required drivers, and configure the network connection to transfer a file over LAN or Internet and Operate Arduino and Raspberry Pi IoT boards.
CO6. Develop a website using HTML and CSS.

**COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | | | | 3 | 1 | 1 | 1 | 1 | 1 | | 2 |
| CO2 | 2 | | | | 3 | 1 | 1 | 1 | 1 | 1 | | 1 |
| CO3 | 3 | 2 | 3 | | 3 | 1 | 1 | 1 | 1 | 1 | | 2 |
| CO4 | 2 | | 3 | | 3 | 1 | 1 | 1 | 1 | 1 | | 1 |
| CO5 | 3 | 2 | 3 | | 3 | 1 | 1 | 1 | 1 | 1 | | 2 |
| CO6 | 2 | | 3 | | 3 | | 1 | 1 | 1 | 1 | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**M. TECH. SEMESTER – I (ECS)**

**SUBJECT: ADVANCE DIGITAL SIGNAL PROCESSING**

**SYLLABUS & SCHEME (W.E.F. 2021)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 125 |

## COURSE OBJECTIVES

To offer in depth understanding of time domain and frequency domain analysis of discrete time signals and systems along with the design process of IIR and FIR digital filters and detailed study of advance topics in digital signal processing such as adaptive filter, multirate signal processing etc.

## DETAILED SYLLABUS

1. Overview of DSP, Overview of discrete time signal and systems, Convolution and correlations and their application, Characterization in time and frequency, overview of Z-transform and its applications, overview of DFT, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design & structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures, and Parallel all pass realization of IIR.

2. Multi rate DSP, Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in sub-band coding.

3. Minimum mean square error and linear minimum mean square error criteria, FIR Wiener filter and linear prediction, steepest descent algorithm and LMS algorithm, Recursive Least Square algorithm. Applications: Adaptive Modelling and System Identification, Inverse Adaptive Modelling, Deconvolution, Adaptive Inverse Control, Adaptive Interference Cancelling.

4. Estimation of Spectra from Finite-Duration Observations of Signals. Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation.

5. Fixed and floating point representation of numbers, quantization noise in signal representations, finite word-length effects in coefficient representation, limit cycle oscillations, scaling to prevent overflow

6. Characteristics of DSP algorithms and hardware requirements, von Neumann architecture, Harvard architecture, parallelism and hardware units of typical digital signal processor. Architectural details of TMS320C6x. Introduction to wavelets, Wavelet transform applications.

## RECOMMENDED TEXT / REFERENCE BOOKS


1. J. G. Proakis and D. G. Manolakis, “Digital signal processing: Principles, Algorithm and Applications”, 4$^{th}$Edition, Prentice Hall, 2007.

2. N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.
3. Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press, 1997.
4. Digital Signal Processing: A computerBased Approach, 2nd Edition By: S. K. Mitra Publisher: Tata McGraw Hill
5. Analog and Digital Signal Processing, 2nd Edition By: Ashok Ambardar Publisher: THOMSON Brooks
6. Digital Signal Processing: A Practical Approach, 2nd Edition, By - Emmanuel Ifeachor , Barrie Jervis Publisher: Pearson.
7. M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002.
8. S. Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.
9. D. G. Manolakis, V.K. Ingle and S. M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

## COURSE OUTCOMES

At the end of the course, students should be able to

CO1 Classify discrete time systems, Analyze and realize the DT system using z transform.

CO2 Represent analog and discrete signals, Find LTI-DT system's response using convolution and correlation.

CO3 Distinguish between FT, DTFT and DFT, Obtain spectrum of the given signal using DFT and FFT Algorithms.

CO4 Design of IIR and FIR filters

CO5 Select an appropriate DSP chip for implementation of adaptive filter using LMS algorithm, Determine truncation error due to finite word length effects, Understand the requirement of DSP algorithm and special features of DSP processors

CO6 Apply concepts of Multirate signal processing to poly phase filters, QMF, digital filter banks, and sub-band coding. Distinguishing Parametric & Nonparametric Methods for Power Spectrum Estimation.

## COURSE MATRIX

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO2 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO6 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**M. TECH. SEMESTER – I (ECS)**
**SUBJECT: WIRELESS AND MOBILE COMMUNICATION**
**SYLLABUS & SCHEME (W.E.F. 2021)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 125 |

## COURSE OBJECTIVES

This course offers an insight into the concepts of mobile and wireless data communication technologies. The objective of this course is to enable the student to understand the technologies of wireless and mobile communications.

The offered subject includes the advance topics like cellular concepts, digital modulation techniques, spread spectrum techniques, speech coders, Adaptive equalizer, diversity, GSM architecture as the attempt of upgrading the quality of wireless communication.

To offer fundamental understanding of various aspects of wireless communication including cellular structure, interference and fading issues with different minimization techniques. The subject makes students aware of various mobile telephony standards like GSM-2G, 2.5G, 3G (WCDMA) and 4GLong Term Evolution (LTE).

## DETAILED SYLLABUS

**1.** Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction techniques and methods to improve cell coverage, Frequency management and channel assignment. GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM. 2.5G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS), 2.75 G Standards: EDGE

**2.** Overview of digital modulation techniques: BPSK, QPSK, 8PSK, QAM, FSK and MSK, Spectral efficiency analysis based on calculations for Multiple access technologies: TDMA, FDMA and CDMA,Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas. Wireless network planning (Link budget and power spectrum calculations)

**3.** Code Division Multiple Access: Introduction to CDMA technology, IS 95 and CDMA 2000 system

**4.** Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.

**5.** Equalization, Diversity, Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency

diversity, Interleaving. Channel Coding & Speech Coding

6. Higher Generation Cellular Standards: 3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G (eMBB, uRLLC, mMMTC-5G IoT)

**RECOMMENDED TEXT / REFERENCE BOOKS**


1. Andreas F. Molisch, Wireless Communications, Second Edition, John Wiley & Sons Ltd. 2011
2. T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd Edition, PHI,2002.
3. V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th Edition, 2008.
4. V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th Edition, 2009.
5. William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd Edition, TMH, 1995.
6. Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Bosten, London,1997.
7. Multiple Access Techniques for 5G Wireless Networks and Beyond, aezi, Mojtaba, Ding, Zhiguo, Poor, H. Vincent, Springer International Publishing, 2020.


**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1 Understand the concept of cellular networks, GSM architecture, 2.5G, 2.75G standards
CO2 Understanding Wireless communication Channels for signal propagation in fading environment
CO3 Understand and analyze different types of digital modulation techniques and multiplexing techniques used for wireless communications.
CO4 Understand CDMA technology standards (IS-95 and CDMA 2000)
CO5 Understand and analyze Equalization, Diversity, channel coding & speech coding for wireless receivers.
CO6 Understand Higher Generation Cellular Standards with its architectures (3G, 4G and Introduction to 5G)

**COURSE MATRIX**

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 2 | 2 | - | - | | | | | | | |
| CO2 | 3 | 3 | 2 | 2 | 1 | | | | | | | |
| CO3 | 3 | 2 | 1 | 2 | 1 | | | | | | | |
| CO4 | 3 | 2 | 2 | 2 | - | | | | | | | |
| CO5 | 3 | 2 | 2 | 2 | 1 | | | | | | | |
| CO6 | 1 | 1 | - | - | - | | | | | | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**M. TECH. SEMESTER – I (ECS)**
**SUBJECT: VOICE AND DATA NETWORKS**
**SYLLABUS & SCHEME (W.E.F. 2021)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 125 |

## COURSE OBJECTIVES

Voice and Data networks plays a major role in every aspect of day to day life. The course is designed to impart fundamental knowledge of computer network architecture and major communication protocols. On completion of this course, students are familiarise with the Flow Control and Error Detection & Correction, understand fundamental concepts in Routing, Addressing & working of Transport Protocols, also gain the knowledge of queuing models and concurrent process.

## DETAILED SYLLABUS

1. Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of data networks, Layered and Layer less Communication, Cross layer design of Networks.

2. Data Communication Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

3. Unit 3: Queuing Models of Networks, Traffic Models, Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols for Local Area Networks.

4. Inter-networking, Bridging, Global Internet, IP protocol and addressing, Sub netting, Classless Inter domain Routing (CIDR), IP address lookup, Dynamic IP Address Configuration, Routing in Internet, Internet Routing Protocols – OSPF and BGP, Mobile IP, Translating IP addresses to domain names.

5. Unit 5: End to End Protocols, TCP and UDP. TCP Congestion Control - Additive Increase/Multiplicative Decrease , Slow Start, Fast Retransmit/ Fast Recovery, Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.

6. Socket Interface - Concept of Process, Process Creation (Forking) and Process Identification, Concurrent and Iterative mode of services, Socket Introduction Socket System calls.

## RECOMMENDED TEXT / REFERENCE BOOKS


1. Computer Networks, Andrew S. Tanenbaum, 3rd Edition, Prentice Hall of India
2. D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, Prentice Hall, 1992.

3. L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufman, 2011.
4. Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach", 1stEdition, Morgan Kaufman, 2004.
5. Walrand,"Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
6. Leonard Kleinrock, "Queueing Systems, Volume I: Theory", 1stEdition, John Wiley and Sons, 1975.
7. Aaron Kershenbaum, "Telecommunication Network Design Algorithms", McGraw Hill, 1993.
8. Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill, 1987
9. TCP/IP Protocol Suite, 7th Edition By: Behrouz A. Forouzan Publisher: Tata McGraw Hill
10. Internetworking with TCP/IP Vol.1, 2, 3, 2nd Edition By: Douglas Comer Publisher: Prentice Hall of India
11. Unix Network Programming, 1stEdition By: W. R. Stevens Publisher: Prentice Hall of India
12. TCP/IP Illustrated Vol. I, 1stEdition By: W. R. Stevens Publisher: Pearson Education

## COURSE OUTCOMES

At the end of the course, students should be able to

CO1 Describe the fundamental underlying principles of computer networking.
CO2 Discuss the functionality of layered network architecture.
CO3 Develop various protocols of data link layer for wired communication.
CO4 Analyze the different queuing model of networks.
CO5 Analyse the packet formation in *wireshark* packet capturing tool.
CO6 Assess the performance evaluation of transmission control protocol.
CO7 Develop the code to generate concurrent process using fork programming.

## COURSE MATRIX

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | | | | | 1 | | | | 3 | | |
| CO2 | 2 | | | | | 1 | | | | | | |
| CO3 | 3 | | 3 | | | | | | | | | |
| CO4 | 2 | | 2 | | | | | | | | | |
| CO5 | | 2 | | 3 | 3 | | | | | | | |
| CO6 | 3 | 2 | 2 | 1 | | | | | | | | |
| CO7 | 3 | 2 | 2 | 3 | 3 | | | | | | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**M. TECH. SEMESTER – I (ECS)**
**SUBJECT: ANALOG AND DIGITAL CMOS VLSI DESIGN**
**SYLLABUS & SCHEME (W.E.F. 2021)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 125 |

## COURSE OBJECTIVES

Very large scale integration (VLSI) is the process of creating an integrated circuit (IC) by combining millions of transistors together in a small silicon chip. In this subject, students will be able to design CMOS based digital and analog circuits, perform functional/timing simulations and synthesis operation using EDA tool like Quartz-II. Students can able to analyse and optimize the circuitry in terms of PPA (Power, Performance and Area) with the help of SPICE simulations. Students can also able to learn testing of CMOS circuits and aware with physical design flow of VLSI system. Students will be also aware about FPGA chip family like Altera, Xilinx and Actel ACT in view of logic cells, delay, IO cells and interconnect.

## DETAILED SYLLABUS

1. **Technology Scaling and Road map:**
   Scaling issues., Types of ASICs , ASIC Design Flow
   **Digital CMOS Design:**
2. **Review:** Basic MOS structure and its static behavior, CMOS Transistor RC model, Inverter: Static CMOS inverter, Switching threshold AC & DC analysis of CMOS logic and their evaluation, Dynamic behavior, Power consumption.
3. **Combinational logic:** Static CMOS design, Logic effort, Dynamic logic, Speed and power dissipation in dynamic logic, Cascading dynamic gates, CMOS transmission gate logic.
4. **Physical design flow:**
   Floor planning, Placement, CTS
5. **Advanced technologies:** Short channel effects, High–k, Metal Gate Technology, FinFET, TFET etc.
6. **ASIC TEST:** Boundary Scan Test, Fault modeling and simulation, ATPG & PODEM, Built in self test.
7. Programmable ASIC Logic Cells, IO cells, Interconnect
8. Routing
   **Analog CMOS VLSI Design**
9. **Single Stage Amplifier:** CS stage with resistance load, Divide connected load, Current source load, Triode load, CS stage with source degeneration, Source follower, Common gate stage, Cascade stage, Choice of device models. Differential Amplifiers: Basic difference pair, Common mode response, Differential pair with MOS loads, Gilbert cell.
10. **Passive and active current mirrors:** Basic current mirrors, Cascade mirrors, Active current mirrors. Frequency response of CS stage: Source follower, Common gate stage, Cascade stage and difference pair, Noise
11. **Operational amplifiers:** One stage OPAMP, Two stage OPAMP, Gain boosting, Common mode feedback, Slew rate, PSRR, Compensation of 2 stage OPAMP, Other compensation techniques.

## RECOMMENDED TEXT / REFERENCE BOOKS


1. J P Rabaey, A P Chandrakasan, B Nikolic, "Digital Integrated circuits: A design perspective", Prentice Hall electronics and VLSI series, 2nd Edition.
2. BehzadRazavi , "Design of Analog CMOS Integrated Circuits", TMH, 2007.
3. Phillip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford, 3rd Edition
4. Michael John Sebastian Smith, Application Specific Integrated Circuits, 6th Indian Edition, Pearson Education
5. John P. Uyemura, Introduction to VLSI Circuits and Systems, 1st Edition, Wiley publisher
6. Baker, Li, Boyce, "CMOS Circuit Design, Layout, and Simulation", Wiley, 2nd Edition.


## COURSE OUTCOMES

At the end of the course, students should be able to

CO1 Understand and compare different programmable ASICs in terms of Logic Cells, IO cells, interconnect and routing.

CO2 Analyse and evaluation of different configuration of analog circuits using MOSFET device.

CO3 Understand MOSFET device to estimate the switching delay of given digital logic which is useful to estimate maximum frequency of inputs. Also using inverter as a reference simple and subsequently complex digital circuitry are designed using, which are modeled using VHDL and subsequently simulate in terms of functionality and timing using Altera Quartus-II.

CO4 Fastest digital logic cascades is designed by using guidelines of Logical Effort theory specifically in terms of scaling of logical cascades. Also speed and power performance of CMOS circuitry is optimized with the help of advanced CMOS technology.

CO5 Test the CMOS based circuits using various testing methods to identify physical defects in a given chip.

CO6 Understand system-level physical design of VLSI chip and VLSI clocking. Understand technology scaling issues in ASIC and learn advanced process techniques to overcome to these issues.

## COURSE MATRIX

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 2 | 1 | | | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO2 | 3 | 3 | 3 | 1 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO4 | 3 | 3 | 3 | 2 | | 2 | 1 | | 2 | 2 | | 1 |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO6 | 3 | 3 | 2 | | | 2 | 1 | | 2 | 2 | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**M. TECH. SEMESTER – II (ECS)**
**SUBJECT: RF AND MICROWAVE CIRCUIT DESIGN**
**SYLLABUS & SCHEME (W.E.F. 2021)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 125 |

## COURSE OBJECTIVES

The subject aims to provide the student with:

- Ability to design and analysis of microwave matching networks in RF communication used in spacecraft and radar communication.
- An understanding of microwave waveguides, passive - active devices, and microwave tubes.
- Design of antenna array beamforming used in 5G mobile communication.

## DETAILED SYLLABUS

**1. TRANSMISSION LINE THEORY**
Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.

**2. MICROWAVE NETWORK ANALYSIS**
Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph.

**3. MICROWAVE COMPONENTS**
Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components

**4. MICROSTRIP ANTENNA ARRAY**
Fundamentals of Array Antenna, Linear & Planar Arrays, Array Synthesis, Adaptive Array, Microstrip Array

**5. MICROWAVE SEMICONDUCTOR DEVICES AND MODELING**
PIN diode, Tunnel diodes, Varactor diode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FET, MESFET, MOSFET, HEMT.

**6. AMPLIFIERS DESIGN**
Power gain equations, stability, impedance matching, constant gain and noise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design

## RECOMMENDED TEXT/ REFERENCE BOOKS


1. Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design", Author House, 2009.
2. D. M. Pozar, " Microwave engineering" ,Wiley, 4th edition, 2011.
3. R. Ludwig and P. Bretchko, "R. F. Circuit Design", Pearson Education Inc, 2009.
4. G.D. Vendelin, A.M. Pavoi, U. L. Rohde, "Microwave Circuit Design Using Linear AndNon Linear Techniques", John Wiley 1990.
5. S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987.
6. Radmanesh, "RF and Microwave Electronics Illustrated", Pearson Education, 2004.
7. C. A. Balanis, "Antenna Theory", Wiley, 3rd Edition, 2005.


## COURSE OUTCOMES

At the end of the course, students should be able to

CO1 Design and analysis of Mixer, Amplifier and RF Filter used in RF communication.

CO2 Design microwave matching networks using single-double stub and quarter wave transformer.

CO3 Design different types of metallic waveguides and analysis of different modes of propagation.

CO4 Demonstrate the structural and operational characteristics of microwave tubes and components to identify their applications and demonstrate their characteristics.

CO5 Design of antenna array and beam forming used in radar and mobile communication.

CO6 Syntesis of smart array antenna using Adaptive algorithm.

## COURSE MATRIX

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 2 | 3 | 1 | | | 2 | | 2 | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | 1 | | | | |
| CO3 | 2 | 1 | 1 | | | | | | | | | |
| CO4 | 2 | 1 | 1 | | | | 2 | | | | 2 | |
| CO5 | 3 | 3 | 2 | 3 | 3 | | | | 2 | | | |
| CO6 | 3 | 3 | 2 | 3 | 3 | | | | 2 | | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**M. TECH. SEMESTER – II (ECS)**

**SUBJECT: PATTERN RECOGNITION AND MACHINE LEARNING**

**SYLLABUS & SCHEME (W.E.F. 2021)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 125 |

## COURSE OBJECTIVES

The main objective of this course is to introduce students with fundamental concepts, theories, and algorithms for pattern recognition and machine learning which are used in computer vision, speech recognition, data mining, statistics, information retrieval, and bioinformatics. This course involves understanding of image processing, its role in pattern recognition, basics of pattern recognition, fundamentals of supervised and unsupervised learning, concepts of deep learning, and basics of support vector machine which can enable students to understand, apply, model, and evaluate artificial intelligence based systems.

## DETAILED SYLLABUS

**1.** Revisiting concepts of Image Processing

**2.** Introduction to Pattern Recognition: Problems, applications, design cycle, learning and adaptation, examples, Probability Distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes' rule, discriminant functions, loss functions and Bayesian error analysis

**3.** Linear Models: Linear Models for Regression, linear regression, logistic regression Linear Models for Classification

**4.** Neural Network: perceptron, multi-layer perceptron, back-propagation algorithm, error surfaces, practical techniques for improving back-propagation, additional networks and training methods, Adaboost, Deep Learning

**5.** Linear Discriminant Functions: decision surfaces, two-category, multi-category, minimum squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine

**6.** Algorithm independent machine learning: lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers

**7.** Unsupervised learning and clustering: k-means clustering, fuzzy k-means clustering, hierarchical clustering

## RECOMMENDED TEXT / REFERENCE BOOKS


1. Tom Mitchell, Machine Learning. McGraw-Hill, 1997.
2. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", 2nd Edition John Wiley & Sons, 2001.

3. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer, 2009.
4. Christopher Bishop, Pattern recognition and machine learning, SpringerVerlag, 2006.
5. Peter Harrington, Machine Learning in Action, Manning Shelter Island
6. Simon Haykin, Neural Networks and Learning Machines, 3rd edition, Pearson, PHI.

**COURSE OUTCOMES**

At the end of the course, students should be able to

CO1 Fundamentals of Image Processing and its role in pattern recognition. Evaluating Pattern recognition problems & challenges in various applications

CO2 Pattern Recognition: Understanding role of design cycle, learning and adaptation, Probability Distributions. Evaluation of Parametric Learning methods - Maximum likelihood and Bayesian Decision Theory- Bayes' rule, discriminant functions, loss functions and Bayesian error analysis

CO3 Fundamentals of machine learning and understanding of artificial neural networks using algorithms like perceptron and gradient descent

CO4 Evaluation of supervised learning using perceptron and back-propagation algorithm

CO5 Evaluation of Deep learning algorithms, understanding of algorithm independent machine learning and support vector machine

CO6 Evaluation of Unsupervised learning algorithm, clustering, and linear discriminant functions

**COURSE MATRIX**

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 2 | 1 | 1 | | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO2 | 3 | 3 | 3 | 1 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO6 | 3 | 3 | 2 | | | 2 | 1 | | 2 | 2 | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**M. TECH. SEMESTER – II (ECS)**

**SUBJECT: ADVANCED WIRELESS COMMUNICATION SYSTEMS**

**SYLLABUS & SCHEME (W.E.F. 2021)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 125 |

## COURSE OBJECTIVES

In view of fast development in a range of applications depending on cellular systems as well as wireless technology in general, it is essential to explore advance topics in wireless communication with in-depth study of the techniques included in it.

The offered subject has to include the advance topics like OFDM and MIMO along with their use in LTE. Cognitive radio and Cooperative communication are also the part of the course.

## DETAILED SYLLABUS

**1.** Multicarrier techniques, Orthogonal Frequency Division Multiplexing (OFDM), Cyclic prefix, OFDMA, AMC, bit and power allocation, PAPR, Synchronization issues. Introduction to NOMA.

**2.** Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation

**3.** MIMO precoding, MIMO Beam forming channel state information (CSI) and channel estimation techniques

**4.** Case study - MIMO in LTE, Codewords to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beamforming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models.

**5.** Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, Spectrum Management, Spectrum Sharing, Spectrum Overlay cognitive Radio, potential applications of cognitive radio.

**6.** Relaying, Multi-Hop, and Cooperative Communications - Introduction and Motivation, Fundamentals of Relaying, Relaying with Multiple, Parallel Relays, Routing and Resource Allocation in Multi-Hop Networks, Routing and Resource Allocation in Collaborative Networks, Relay Network Coding, Applications.

## RECOMMENDED TEXT / REFERENCE BOOKS


1. Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications : From Real-world
2. Propagation to Space-time Code Design",Academic Press, 1st Edition, 2010.
3. MohinderJanakiraman, "Space - Time Codes and MIMO Systems", Artech House Publishers, 2004.
4. Andreas F. Molisch, Wireless Communications, Second Edition, John Wiley & Sons Ltd. 2011
5. Ekram Hossain, DusitNiyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.
6. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
7. Bruce Fette, "Cognitive radio technology", Elsevier, 2nd Edition, 2009.
8. HuseyinArslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.
9. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, "Optimizing Wireless Communication Systems" Springer, 2009.
10. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009.
11. Multiple Access Techniques for 5G Wireless Networks and Beyond, aezi, Mojtaba, Ding, Zhiguo, Poor, H. Vincent, Springer International Publishing, 2020.


## COURSE OUTCOMES

At the end of the course, students should be able to

CO1 Understand the advantage of OFDM/OFDMA over conventional modulation techniques and find base band OFDM modulated signal.
CO2 Differentiate among MIMO diversity, spatial multiplexing and beam forming.
CO3 Understand the use of MIMO in LTE
CO4 Understand and Analyze concept of Cognitive radio for Increasing Spectrum Efficiency
CO5 Analyze wireless relay network system for extension of range.
CO6 Understand and analyze various routing techniques, relay network coding and applications for wireless networks.

## COURSE MATRIX

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | | 1 |
| CO2 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 |
| CO4 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | | 1 |
| CO6 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | | 2 | 2 | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## FINANCIAL AND MANAGEMENT ACCOUNTING (AF-310)

## SEM-III (2nd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | - | - | 60 | -- | 40 | -- | 100 | 3 | -- | -- | 3 |

**Objective:** The need to understanding concepts of accountancy is essential in daily life of individuals as well as company where engineering is applied. Thus for better decision making, principles of accounting are applied to produce financial statements which can be appealing to the prospective stakeholders. Traditional and modern approach provides learning to understand different perspectives of accountancy which have evolved over the years. Management accounting is for understanding the Cost-Volume-Profit analysis. Concepts such as ratio analysis along with breakeven analysis are important to compare different companies of the same industry, to do fundamental analysis of a company's financial statements.

**Learning Outcomes:**

After completion of this course students will be able to understand:

- Concepts and principles of accounting, double-entry bookkeeping, limitations and objectives of accounting.
- Process of accounting
- Balance sheet, profit & loss statement, cash flow statement, and contents of an annual report.
- Breakeven point, marginal cost and breakeven analysis
- Concepts of time value of money, present value, future value, annuity, growing annuity, and perpetuity.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

**Unit 1- Financial Accounting – An Introduction**: **(5 lectures)**

- Introduction
- Meaning of Accountancy
- Book-keeping and Accounting
- Accounting Process
- Objectives for accounting
- Differences between book-keeping and accounting
- Users of accounting information
- Limitations of Accounting
- Basic terminologies

**Unit 2- Accounting Concepts, Principles, Bases and Policies**: **(4 lectures)**

Introduction
Accounting Concepts
Principles
Policies and Standards
Types of accounting concepts

- Business Separate entity concept
- Going concern concept
- Money measurement concept
- Periodicity concept
- Accrual concept
- Accounting Principles

- Principle of Income recognition
- Principle of expense
- Principle of matching cost and revenue
- Principle of Historical costs
- Principle of full disclosure
- Double aspect principle
- Modifying Principle
- Principle of materiality
- Principle of consistency
- Principle of conservatism or prudence
- Accounting Policies
- Changes in Accounting Policies
- Disclosure in case of changes in Accounting Policies
- Accounting Standards
- Scope and functions of Accounting Standards Board
- International Financial Reporting System

**Unit 3- Double Entry Accounting:** **(5 lectures)**

- Introduction
- Meaning of double entry accounting
- Classification of accounts under Traditional approach
- Classification of accounts under Accounting Equation approach
- Comparison of traditional approach with Modern approach equal approach
- Accounting Trail

- Transactions and events
- Meaning and roles of debit and credit
- Accounting equation

**Unit 4- Secondary Books:** **(3 lectures)**

- Introduction
- Secondary books
- Purchases Book/Purchases Day book
- Cash discount, Trade discount
- Difference between cash discount and trade discount, Sales Book or Sales Day book
- Purchase Returns Book
- Sales Returns Book
- Bills receivable book
- Bills payable book
- Cash book
- Posting to Ledger accounts

**Unit 5-Trial Balance:** **(4 lectures)**

- Introduction
- Meaning
- Objectives of preparing a trial balance
- Methods of preparing a trial balance
- Preparation of Trial balance

- Adjusting Entries
- Errors and their rectification
- Errors disclosed by Trial Balance
- Errors not disclosed by Trial Balance
- Steps to locate the errors

**Unit 6- Final Accounts**: **(3 lectures)**

- Introduction
- Adjustments before preparing final accounts
- Depreciation
- Bad Debts and accounting treatment of bad debts
- Provision for doubtful debts
- Reserves for Discount on Debtors
- Reserve for Discount on Creditors
- Closing Stock
- Trading Account
- Profit and Loss Account
- Balance Sheet

**Unit 7- Introduction to Management Accounting**: **(3 lectures)**

- Introduction
- Meaning of Management accounting
- The Role of Management Accounting

- Management Accounting Framework
- Functions of Management Accounting
- Tools of Management Accounting
- The Balanced Scorecard
- Cost Management System
- Value Added Concept
- Merits of Management Accounting
- Demerits of Management Accounting
- Distinction between Management Accounting and Financial Accounting

**Unit 8- Financial Statement Analysis**: **(3 lectures)**

- Introduction
- Meaning of Ratio
- Steps in Ratio Analysis
- Classification of Ratios
- Du Pont Chart
- Solved Problems
- Advantages of Ratio Analysis
- Limitation of Ratio analysis

**Unit 9- Cash Flow Analysis**: **(4 lectures)**

- Introduction
- Meaning of Cash Flow Statement
- Purpose of Cash Flow Statement

- Preparation of Cash Flow Statement
- Format of Cash Flow Statement (AS3: Revised Method)
- Cash Flow from Operating Activities
- Cash Flow Statement under Direct Method
- Different between Cash Flow Analysis and Fund Flow Analysis
- Uses of Cash Flow Statement

**Unit 10- Marginal Costing and Break Even Analysis:** **(3 lectures)**

- Introduction
- Concept of Marginal Costing
- Characteristics of Marginal Costing
- Difference between Absorption Costing and Marginal Costing
- Marginal Cost
- Contribution
- Cost Volume Profit (CVP) Analysis
- Break Even Chart
- Break Even Point
- Profit Volume ratio or MCSR
- Target profit
- Margin of Safety
- Application of Marginal cost
- Limitations of Marginal cost
- Solved Problems

**Unit 11- Basics of Financial Management:** **(3 lectures)**

- Introduction of Financial Management
- Objectives of financial management
- Role of finance manager
- Functions of financial management
- Concept of time value of money
- Present value
- Future value
- Annuity concept
- Solved problems

**Term work:** **(40 marks)**

1. Students will be required submit assignment based on the topics covered in the syllabus such as ratio analysis for a company, calculation of breakeven point for a product, time value of money

**Text Books:**


1. Bhattacharya, S. K.; Dearden, J. *Accounting for Management – Text book & cases*; Vikash Publishing House: New Delhi, 2009.
2. Kishore, R. M. *Advanced Management Accounting*; Taxman: New Delhi, 2018.

**Reference Books:**


1. Arora, M. N. *A Text Book of Cost Accountancy*; Vikas Publishing: Mumbai, 2010.
2. Horngren, C. T.; Foster, S. M.; Datar, G. *Cost Accounting – A Managerial Emphasis*; Prentice Hall: New Jersey, 1997.
3. Prasad, N. K.; A.K. Prasad *Cost Accounting*; Book Syndicate: Kolkata, 2016.
4. Edmonds, T. P.; Edmonds, C. D.; Tsay, B,-Y *Fundamental Managerial Accounting Concept*; Irwin McGraw Hill: Boston, 2013.
5. Bhattacharya, A. *Principles and Practice of Cost Accounting*; Sultan Chand: New Delhi, 2004.
6. Pillai, R. S. N.; Bhagavati, V. *Cost and Management Accounting*; Sultan Chand: New Delhi, 2010.
7. Banerjee, B. *Cost Accounting – Theory & Practices;* Sultan Chand: New Delhi, 2014.
8. Saxena V. K.; Vashist, C. D. *Advanced Cost & Management Accounting – Problems & Solutions*; Prentice Hall of India: New Delhi, 2015.
9. Maheshwari, S. N. *Studies in Cost Management*; Sultan Chand & Sons: New Delhi, 2013.
10. Rao, M. E. T. *Cost and Management Accounting*; New Age International: New Delhi 2004.
11. Rao, M. E. T. *Management Accounting*; New Age International: New Delhi 2003.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### PROFESSIONAL COMMUNICATION-I (AF-501)

### SEM-V (3rd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 1 | 0 | 2 | 50 | - | - | 50 | 100 | 1 | 0 | 1 | 2 |

**Objectives:**

- To develop confidence in the students for communicating at workplace.
- Develop their Listening, Speaking, Reading, and Writing Skills.
- To give exposure of communicating with public.
- How to develop fluency in English Language.
- To prepare students for placement.
- To teach how to be effective at the job.

**Learning Outcomes:**

After completion of this course students will be able to understand:

- Communication Process and framework
- Obstacles in Communication

- Possible remedies to barriers of communication
- Effective Listening, Reading, Writing and speaking skills
- Implementation of Non-Verbal features in the presentation
- Ways and manners Presentations, Speech, Group talk and Interview
- Competence in writing and reading

**Unit 1- Introduction to Professional Communication**:

- Importance
- Methods and Manners
- Need of Professional Communication
- Objectives of Professional Communication
- Skills required for Professional Communication
- Employers' Expectations

**Unit 2- Communication and Barriers**:

- Introduction
- Process
- Principles
- Components
- Types of Communication
- Main problems of Communication
- Verbal Communication
- Oral Communication

- Written Communication
- Advantages of Verbal Communication
- Limitations of Verbal Communication
- Non-Verbal Communication
- Importance of Non-Verbal
- Kinesics
- Proxemics
- Chronemics
- Haptics
- Oculesics
- Paralanguage

- Barriers of Communication
- Intrapersonal
- Inter-Personal
- Organisational
- Noises in Channel
- Physical
- Semantic
- Psychological
- Physiological

**Unit 3- Language Proficiency:**

- Introduction
- Basic Grammar Rule

- Vocabulary Building
- Language Games

**Unit 4- Four Skills:**

- Introduction
- Listening
  - -Process
  - -Types of Listening
  - -Six Stages of Listening
  - -Listening Criticism
  - -Characteristics of effective listening
- Speaking
  - -Elements of speaking skills
  - -Pronunciation
  - -Speech art
- Reading
- Skimming
- Scanning
- Intensive Reading
- Levels of Comprehension (Literal and Inferential)
- Techniques of Good Comprehension
- Improving Comprehension Skills
- Writing
  - -Developing Writing skills

-Letter and E-mail writing

**Text Books:**


1. Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and Practice; Oxford University press: New Delhi, 2004.
2. Meenakshi Raman, Prakash Singh. Business Communication: Second edition; Oxford University Press: New Delhi, 2012.
3. Steve Hart, Arvind R. Nair, Veena Bhambhani. Embark: English for Undergraduates; Cambridge University Press: Delhi, 2016.


**Reference Books:**


1. T M Farhathullah. *Communication Skills for Technical Students;* Orient Longman Private Ltd.: Chennai, 2002.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### PROFESSIONAL COMMUNICATION-II (AF-601)

### SEM-VI (3rd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 1 | 0 | 2 | 50 | - | - | 50 | 100 | 1 | 0 | 1 | 2 |

**Objective:**

- To develop confidence in the students for communicating at workplace.
- Develop their Listening, Speaking, Reading, and Writing Skills.
- To give exposure of communicating with public.
- How to develop fluency in English Language.
- To prepare students for placement.
- To teach how to be effective at the job.

**Learning Outcomes:**

After completion of this course students will be able to understand:

- Psychological aspects in communication
- Developing Positive Attitude and empathy

- Importance of team and how to work in a team
- Effective Listening, Reading, Writing and speaking skills
- Corporate Communication
- Writing Minutes, Notice, Proposal and Report
- Competence in writing and reading

**Unit 1- Communication Skills**:

- Intrapersonal Communication
- Interpersonal Communication
- Importance of Empathy in Communication
- Psychological Dealings in Communication
- Positive Attitude

**Unit 2- Team Building**:

- Introduction
- Meaning and importance of team
- Skills and qualities of a team member
- Techniques to be a good team member
- Working in Groups
- Leadership Qualities
- Negotiation Skills
- Adjustment level and Flexibility
- Understanding Team mates

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

**Unit 3- Effective Self Presentation through LSRW:**

- Listening
  -active listening
- Speaking
  -Indianism
  Presentation
- Reading
- Speed Reading
- Reading Practice
- Levels of Comprehension (Evaluative and Applied)
- Comprehension practice
- Writing
  -Minutes
  - Notice
  - Proposal
  - Report Writing

**Text Books:**


**1.** Meenakshi Raman, Sangeeta Sharma. Technical Communication: Principles and Practice; Oxford University press: New Delhi, 2004.

2. Meenakshi Raman, Prakash Singh. Business Communication: Second edition; Oxford University Press: New Delhi, 2012.

3. Steve Hart, Arvind R. Nair, Veena Bhambhani. Embark: English for Undergraduates; Cambridge University Press: Delhi, 2016.


**Reference Books:**


**1.** T M Farhathullah. *Communication Skills for Technical Students;* Orient Longman Private Ltd.: Chennai, 2002.

**B.TECH. SEMESTER – VIII (IC)**

**SUBJECT: SEMINAR(AF802)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| -- | -- | 8 | -- | 100 | -- | -- | 100 |

**B.TECH. SEMESTER – VIII**

**SUBJECT: PROJECT/INDUSTRIAL TRAINING (AF801)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| -- | -- | 28 | -- | -- | 300 | 100 | 400 |

The students will undertake project work for the period of one semester. They should design/develop & fabricate the project.

They are supposed to prepared and submit a project report as a part of their term-work for the project and give seminars on their project work. The students may be sent to the industry for their project and they are to timely report to the department regarding monitoring and necessary guidance.

They should arrange for demonstration of the project work at the time of examination They are to be examined based on viva and/or demonstration.

**B.TECH. SEMESTER – VIII (IC)**

**SUBJECT: SEMINAR(AF802)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| -- | -- | 8 | -- | 100 | -- | -- | 100 |

**B.TECH. SEMESTER – VIII**

**SUBJECT: PROJECT/INDUSTRIAL TRAINING (AF801)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| -- | -- | 28 | -- | -- | 300 | 100 | 400 |

The students will undertake project work for the period of one semester. They should design/develop & fabricate the project.

They are supposed to prepared and submit a project report as a part of their term-work for the project and give seminars on their project work. The students may be sent to the industry for their project and they are to timely report to the department regarding monitoring and necessary guidance.

They should arrange for demonstration of the project work at the time of examination They are to be examined based on viva and/or demonstration.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## ENGINEERING ECONOMICS AND PRINCIPLES OF MANAGEMENT (AM-110)

## SEM-I (1st Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Ext** | **Sess.** | **TW** | **Prac** | **Total** | **Lect** | **Tut** | **Prac** | **Total** |
| 3 | - | - | 60 | -- | 40 | -- | 100 | 3 | -- | -- | 3 |

**Objective:** The need to understand the basics concepts of economics & management are important for the allocation of scarce resources of economy and proper utilization to generate the required products and services. Demand analysis and consumer behavior are the factors which teach about the equilibrium price. Types of markets, product pricing and factor pricing leads to a better understanding of a particular product or service demanded by the consumers. Production cost and revenue analysis is important for operation of a profitable business. Monetary & fiscal policies are important for the understanding of consumption, government expenditure, investment, exports and imports. It also educates us about the ways in which the government generates revenue and handles its expenditure for a stable economy.

**Learning Outcomes:**

After completion of this course students will be able to understand:

- Students will understand the definitions of economics, micro & macroeconomics, utility, money, wealth, consumer and producer surplus
- Students will understand demand, function of demand, elasticity, factors of production, supply & demand equilibrium

- Students will understand types of markets, price discrimination, dumping and kinked demand curve
- Students will understand production, short & long run production function, cost analysis, fixed cost, variable cost, revenue, breakeven analysis
- Students will understand monetary policy, fiscal policy, banking, instruments of monetary policy, liberalization, globalization, privatization, role of government in policy making and business cycles

**Detailed Syllabus:**

**Unit 1- Basic concepts and definitions**: **(4 lectures)**

1. Marshall, Robbins and Samuelson's definition of economics
2. Positive and normative economics, micro and macroeconomics
3. Utility, goods and services
4. Money and wealth
5. Consumer and Producer surplus

**Unit 2- Demand analysis and consumer behavior**: **(6 lectures)**

6. Demand function
7. Law of demand
8. Elasticity of demand and its types
9. Price, income and cross-elasticity

**10.** Measures of demand elasticity

**11.** Factors of production

**12.** Advertising elasticity

**13.** Law of supply and demand, equilibrium between demand and supply

**Unit 3- Markets, product pricing and factor pricing:** **(9 lectures)**

**14.** Concepts of perfect competition

**15.** Monopoly and monopolistic competition (meaning and characteristics)

**16.** Control of monopoly

**17.** Price discrimination and dumping

**18.** Concept of Duopoly and Oligopoly

**19.** Kinked demand curve (price leadership model with reference to oligopoly)

**Unit 4- Production cost & revenue analysis:** **(8 lectures)**

**20.** Production and production function

**21.** Short run & long run production function

**22.** Cost analysis

**23.** Various concepts of cost

**24.** Total fixed cost, total variable cost

**25.** Average fixed cost, average variable cost, average cost & marginal cost opportunity cost

**26.** Basic concepts of revenue

**27.** Relationship between average revenue and marginal revenue

**28.** Breakeven analysis; meaning and explanation

**Unit 5- Money:** **(9 lectures)**

**29.** Meaning, functions, types, monetary policy

**30.** Meaning, objectives, tools, fiscal policy

**31.** Meaning, objectives, tools, Banking; meaning, types, functions, central bank- RBI, it's function, concepts, Cash reserve ratio, bank rate, repo rate, reverse repo rate, statutory liquidity ratio, functions of central & commercial banks, inflation, deflation, stagflation, monetary cycles, new economic policy, liberalization, globalization, privatization, fiscal policy of the government.

**Termwork:** **(40 marks)**

- Students will be required submit assignment based on topics covered in the syllabus such as calculation of breakeven point, demand analysis of a product or service, GDP, and inflation.

**Text Books:**


- Ahuja, H. L. Modern economics; S.Chand: New Delhi, 2002
- Dewett, K. K. Modern economics theory; S Chand: New Delhi, 2006
- Seth, M. L. Monetary economics; Lakshmi Narain Agarwal: Agra, 2018


**Reference Books:**


- Paneerselvam, R. Engineering economics; PHI publication: New Delhi, 2014
- Robbins, S.; Decenzo, D. A. Fundamentals of management: Essential concepts and applications; Pearson education: New Jersey, 2015
- Mankiw, N. G. Economics: Principles of economics; Cengage learning: USA, 2017
- Williamson, T. R. Introduction to economics; D.C. Health & Company: Chicago, 1923

**B. TECH. SEMESTER – I (CH/CL/IC/MH)**

**SUBJECT: COMPUTER PROGRAMMING**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 0 | 3 | 5 | 3.5 | 40 | - | 50* | - | 90 |

Reference Code ESC103

*TW Marks includes Viva based on TW

**DETAILED SYLLABUS**

**[1] INTRODUCTION**

Introduction to components of computer system, Idea of algorithm, Introduction to C, Constants, Variables & Data types in C, Managing input and Output operators

**[2] OPERATORS AND EXPRESSIONS**

C Operators: Arithmetic, relational, logical, increment °t, assignment and conditional, Arithmetic Expressions & Precedence Rule, Type conversion in C, Mathematical.

**[3] DECISION MAKING AND BRANCHING**

Decision making with If & If...else statements, goto statements.

**[4] DECISION MAKING AND LOOPING**

The while statement, the break statement & the do... while loop, the for loop, Jump within loops - Programs.

**[5] ARRAYS**

Array 1D, 2D, Character Array as String.

**[6] USER DEFINED FUNCTIONS**

Categories of Functions (Including using built in library), Call by Value, Parameter passing to function, Recursion.

**[7] STRUCTURE**

Defining structure, Assigning value to the structure members, Array of structure

**[8] POINTER**

Idea of pointer, declaration and Initialization of pointer, Passing address as function argument, Passing array to function using pointer. 9 FILE HANDLING

**TEXT / REFERENCE BOOKS**

1) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

2.) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

3.) Yashvant Kanetkar, Let Us C, 12th Edition, BPB Publication.

4.) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## PROGRAMMING IN C (AX-123)

## SEM-I (1st Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 | 4 | -- | 1 | 5 |

**A. OBJECTIVES**

Introduction of C programming. In addition, students should acquire skills for programming using C features such as Operators, Decision Making And Branching and Looping, Arrays, Character Strings and User Defined Functions, etc.

**B. DETAILED SYLLABUS**

**[A] INTRODUCTION :** Introduction to Computer Hardware & OS, Introduction to DOS commands & languages, Introduction to Programming in C

**[B] CONSTANTS, VARIABLES AND DATA TYPES:** Constants , Variables & Data types in C, Declaration & Initialization of C variable, Basic C programs , Defining symbolic constants

**[C] OPERATORS AND EXPRESSIONS :** Operators in C, Operators in C & The ? : operator, Arithmetic Expressions & Precedence Rule, Type conversion in C, Mathematical Functions

**[D] MANAGING INPUT AND OUTPUT OPERATORS:** Reading / Writing characters, Formatted Input operations, Formatted Output operations

**[E] DECISION MAKING AND BRANCHING:** Decision making with If & If .. Else statements, If .. Else statements (Nested …. Ladder), The Switch & go to statements

**[F] DECISION MAKING AND LOOPING:** The while statement, The break statement & The Do.. While loop, The FOR loop, Jump within loops – Programs

**[G] ARRAYS :** Development of simple programs using loops, Introduction to one dimensional array, Array Programs

TERM WORK: The laboratory and termwork will be based on above topics.

**C. LEARNING OUTCOMES**

At the completion of the course, students will be able to …

1. Get familiar with C programming language.
2. Understand Basics features of C Language.
3. Implement programming solutions using other features of the C language including Operators, Arrays, Character Strings and User Defined Functions.

**D. Text Books:**

1 PROGRAMMING IN ANSI C By E. BALAGURUSAMY 2nd Edition TMH Publications

**E. Reference Books:**

1 Let us C. By : Yashwant Kanitkar

2. Programming in C By: Venugopal

# Dharmsinh Desai University
## Faculty of Technology
### Department of Instrumentation and Control Engineering

**F. LIST OF EXPERIMENTS**

- Write and Execute a Simple C Program.
- Demonstrate standard Input /Output Functions.
- Defining appropriate Operators and Expressions.
- To study various Formatted Input /Output operations.
- Implementing Decision Making and Branching (IF…Else).
- Implementing Decision Making and Branching (Switch…Case).
- Develop a C program using goto and continue.
- Implementing Decision Making and Looping (While and Do…While).
- Implementing Decision Making and Looping (for).
- Demonstrate use of Single Dimensional Array.
- Demonstrate use of Multidimensional Array.
- Use of Character Array as a String.
- Develop a C program with the help of User-Defined Functions.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## LINEAR ELECTRONICS-I (CI 308)

## SEM-III (2nd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 | 4 | -- | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

1. To understand the basic physical structure, principles of operation, electrical characteristics and circuit models of semiconductor devices like, various diodes, transistors and field effect transistors.
2. To understand and analyze the effect of temperature on operating point stability of BJT.
3. To introduce combination of devices in integrated-circuit form as basic system building blocks.

**B. DETAILED SYLLABUS**

**[A] JUNCTION-DIODE CHARACTERISTIC:**
The Temperature Dependence of the V/I Characteristics, Diode Resistance, Space- Charge, or Transition Capacitance CT, Charge controlled Description, Diffusion Capacitance, Junction-Diode Switching Times, Breakdown Diodes, Tunnel Diodes, Sampling gate.

**[B] BIPOLAR TRANSISTOR CHARACTERISTICS:** The Junction Transistor, Transistor Current Components, The Transistor as an Amplifier, Transistor Construction, The Common-Base (CB) Configuration, The Common-Emitter (CE) Configuration, The CE Cutoff Region, Currents, The CE Saturation Region, Typical Transistor-Junction Voltage Values, Common-Emitter Current Gain, Common Collector
Configuration, Inverted Mode of Operation, Transistor Ratings, Additional Transistor Characteristics, Transistor Switching Times.

**[C] TRANSISTOR BIASING & THERMAL STABILIZATION:**
The Operating Point of a BJT, Bias Stability, Self-Bias or Emitter Bias, Stabilization against variations in Ico, VBE and, β, Bias Compensation, Biasing Technique for Linear Integrated Circuits, Thermistor & Sensistor Compensation.

**[D] FREQUENCY RESPONSE OF AMPLIFIERS:**
Transistor Hybrid Model, The h Parameters, Conversion Formula For The Parameters of the Three Transistor Configurations, Analysis of Transistor Amplifier Circuit Using h Parameters, The Emitter Follower, Comparison of Transistor Amplifier Configurations, Miller's Theorem and its Dual, The Hybrid Pi Common Emitter Transistor Model at high Frequency, Hybrid Pi Conductance, Hybrid Pi Capacitances, Validity of Hybrid Pi Model, Variation of Hybrid Pi Parameters, The CE Shot Circuited Current Gain, Current Gain with Resistive Load, Single Stage CE Transistor Amplifier Response, The Gain Bandwidth Product, Emitter Follower At High Frequency, Step Response of an Amplifier, Band pass of Cascaded Stages.

**[E] INTEGRATED-CIRCUITS: FABRICATION AND CHARACTERISTICS**
Integrated Circuit (Microelectronic) Technology, Basic Monolithic Integrated Circuits, Epitaxial Growth, Masking and Etching, Diffusion of Impurities, Transistors for Monolithic Circuits, Monolithic Diodes, The Metal Semiconductor Contact, Integrated Resistors, Integrated Capacitors, Characteristics of Integrated Components.

**[F] FIELD-EFFECT TRANSISTORS:**
Construction & characteristics of JFETs, Transfer characteristics, Depletion type MOSFET, Enhancement-type MOSFET, MOSFET Handling, VMOS, CMOS, JFET biasing circuits, Depletion-type MOSFET biasing circuits, Enhancement-type MOSFET biasing circuits, FET Small signal model, AC analysis of different types of biased FET amplifiers.

**C. LEARNING OUTCOMES**

1. Students will be able to analyze and design circuits containing elements such as
2. diodes, transistors, and field effect transistors using the concepts of load lines,
3. Operating points and small signal low frequency and high frequency analysis.
4. Students will be able to design a biasing circuit for BJT for a specified stability.
5. Students will get basic idea of fabrication and characteristics of integrated circuits.

**D. RECOMMENDED TEXTBOOKS**

1. Integrated Electronics, 1st Edition By: Millman & Halkians Publisher: Tata McGraw Hill
2. Electronic Devices & Circuit Theory, 8th Edidtion By: Robert L. Boylestad & Louis Nashelsky Publication: Prentice Hall of India

**E. REFERENCE BOOKS**

1. Integrated Circuits, 9th Edition By: K. R. Botkar Publication: Khanna Publications

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

1. Characteristics of PN Junction Diode.
2. Characteristics of Zener Diode to obtain Dynamic Resistance.
3. Implementation of Zener Regulator circuit using Data Sheet.
4. Drain and Transfer Characteristics of FET.
5. Four Diode Bridge Sampling Gate Circuit.
6. Input and Output Characteristics of CE Configuration.
7. Input and Output Characteristics of CC Configuration.
8. Frequency Response of RC coupled CE Amplifier.
9. Gain Bandwidth product of Multistage Amplifier
10. Square Wave Response of CE Amplifier.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## ELECTRICAL MACHINES & POWER (CI-416)

## SEM-IV (2nd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 | 4 | -- | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

To offer a profound understanding of different electrical machines .Also to learn concepts of electrical power generation, transmission and distribution.

**B. DETAILED SYLLABUS**

**PART-I: ELECTRICAL MACHINES**

**[A] DC MACHINES:**

**DC Generator**

Types of Generator, Iron Losses in Armature, Total Losses in Generator, Stray Losses, Constant Losses, power stages, condition for maximum efficiency and power, No load saturation characteristics, loadsaturation curve, internal, external characteristics of separately excited generator, critical speed & resistance. All ofthese characteristics without mathematical treatment.

**DC motor**

Principle and basic theory

**[B] AC MACHINES:**

**Transformer**

(1 phase Transformer) Working principle, construction, elementary theory of ideal transformer,E.M.F.equation, transformer on no load and load, transformer with winding resistance but no magnetic leakage, equivalent resistance, magnetic leakage, transformer with leakage reactance and resistance, exact volt drop,equivalent circuit, O.C. & S.C. tests, efficiency & regulation, why transformer are rated in kVA?, losses, conditionfor maximum efficiency, all day efficiency, concepts of auto transformer, define Buchholz relay, basic of 3-phasetransformer & their types of connections

**Three Phase Motors**

Classification, merits & demerits, construction, why does rotor rotate, slip, frequency of rotorcurrent, Relation between torque & rotor p.f., starting torque of squirrel cage & slip ring motors, condition formaximum starting torque, effect of change in supply voltage on starting torque, torque slip characters, effect of voltage on torque & speed, Induction motor as a generator, power stages, torque, mechanical power & rotoroutput, analogy with mechanical clutch &DC motor, Linear induction motor.

**AC Starter**

DOL Starter, primary res. Starter, Auto transformer, Star delta (only theory).

**Single Phase Motors**

Types, Double Field Revolving Theory, Making motor self-starting, AC Series, Universal motors.

**Alternators**

Basic principle, difference with DC generator, construction, damper winding, factors affectingalternator size, Alternator on load, synchronous reactance, vector diagram of a loaded Alternator, determination ofvoltage regulation by EMF method, Parallel operation of alternators.

**PART–II: ELECTRICAL POWER**

**[A] GENERATING STATIONS**

Schematic arrangement of Power plants- thermal, hydro, nuclear, diesel and gas turbine.

**[B] VARIABLE LOAD ON POWER STATIONS** Structure of electric power system, load curves, important terms and factors, unit generated per annum, loadduration curves, types of loads, typical demand and diversity factors.

**[C] POWER FACTOR IMPROVEMENT**
Power factor, Power triangle, Disadvantage of low p.f., causes, (Significance of low and high power factor), (KVAR)calculations, power factor improving equipment, importance of p.f. improvement, Most economical power factor.

**[D] MECHANICAL DESIGN OF OVER HEADING LINES**
Main components, conductor materials, line supports, types of insulators, string Efficiency and its improvement.

**[E] PERFORMANCE OF TRANSMISSION LINE**
Classification of overload transmission line, important terms, Performance of short transmission line.

**[F] UNDER GROUND CABLES**
Construction of cables, insulating materials, classification.

**[G] INTRODUCTION TO SWITCH GEAR**
Switchgear, essential features of switchgear, switchgear equipments, bus bar arrangement, short-circuits currents, faults in power system.

**[H] CURCUIT BREAKER**
Arc phenomenon, principle and methods of arc quenching, important terms

**[I] FUSES**
Fuses, desirable characteristics of fuse element, Fuse element material, important terms, and types of fuse.

**[J] RELAY**
Protective relays, Fundamental requirements of protective relaying, relay timing, important terms, Time/P.S.M.curve, and calculation of relay operating time.

**[K] PROTECTION OF ALTERNATORS & TRANSFORMERS**
Differential protection of alternators, Protection of transformer, earth-fault protection

**C. LEARNING OUTCOMES**

Compare the various types of power stations for generation of power and comparative Merit/Demerits. Analyze the performance of various units involved in the power plants.

1. Design power system components for a specified system and applications.
2. Calculate electrical power and plot the power /Energy demand in the form of graph.
3. Understand working of electrical machines and their applications.
4. Differentiate electrical machines
5. Understand different types of circuit breakers, fuses and protective relaysfor protecting power system equipments.

**D. RECOMMENDED TEXTBOOKS**

1. Electrical Technology (Vol: II), Authors : B. L. Theraja&A.K.Theraja Edition : 23rdEdition Publisher : S. Chand & Company Ltd
2. Principles of Power System Authors : V. K. Mehta&Rohit Mehta Edition :4th Edition, Publisher: S. Chand & Company Ltd

**E. REFERENCE BOOKS**

1. Theory and Performance of ElectricalMachine Authors : V.B. Gupta Edition : 13th Edition Publication: Laxmi
2. Electrical Engineering Authors : R.K. Rajput Edition : 1st Edition Publication: Laxmi
3. Course in Power System Authors : J. B. Gupta Edition : 10th Edition Publication: S. K. Kataria& Sons
4. Switchgear and Protection Authors : J. B. Gupta Edition : 2nd Edition Publisher: S. K. Kataria& Sons

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD**

1. Study of DC Generator
2. Transformer Open Circuit Test and Short Circuit Test
3. Load Test on Single Phase Transformer
4. Transformer Sumpner’s Test
5. DC Shunt Generator Characteristics
6. DC Series Generator Characteristics
7. DC Compound Generator Characteristics

8. DC and AC starter
9. No-load and Block rotor test on 3-Phase Squirrel Cage Induction Motor
10. Load Test on 3-Phase Squirrel Cage Induction Motor
11. To find out the Regulation of Alternator by Synchronous Impedance Method.
(OC & SC Test and Load Test of 3-Phase Alternator)

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## LINEAR ELECTRONICS – II (CI-418)

## SEM-IV (2nd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 | 4 | -- | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

To offer a profound understanding of the design, analysis, and applications for analog electronics circuits.

**B. DETAILED SYLLABUS**

**[A] P0WER CIRCUITS AND SYSTEMS:**

Amplifier Classification, Distortion in Amplifiers, Large-Signal Amplifiers, Harmonic Distortion, , Efficiency of a Class A Amplifier, Push-Pull Amplifiers, Class B amplifiers, Class AB Operation, Regulated Power Supplies, Series Voltage Regulator.

**[B] FEEBACK AMPLIFIER CHARACTERISTIC:**

Classification of amplifiers, the feedback concept, The Transfer Gain with Feedback, General Characteristics of negative-feedback amplifiers, Input Resistance, Output Resistance, Method Analysis of a feedback amplifier, Voltage-series feedback, Current-series feedback, Current-Shunt feedback, Voltage-shunt feedback.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

**[C] OSCILLATORS USING TRANSISTOR:**
Sinusoidal Oscillators, The phase-shift Oscillators, Resonant-circuit Oscillators, A general form of Oscillator circuits, Colpitt's Oscillator, Hartley's Oscillator, Clapp's Oscillator, Crystal Oscillators.

**[D] OPERATIONAL AMPLIFIER CHARACTERISTICS:**
Differential amplifier, DC and AC analysis of bipolar differential Amplifier, The ideal operational amplifier, Inverting and Non-inverting Amplifiers, Op-Amp Parameters, Measurement of Op-Amp Parameters, General description of various stages of Op-Amp, Open-loop and Closed-loop Frequency response, Op-Amp Stability, Frequency Compensation.

**[E] LINEAR APPLICATIONS OF OP-AMP:**
Summing and Difference amplifiers, Integrator and Differentiator, Current-to-voltage converters, Voltage-to-current converters, Current Amplifiers, Voltmeters and Current meters, Instrumentation Amplifiers, Transducer Bridge Amplifiers, Ideal and realistic frequency response of various filters, Basic first-order low-pass and high-pass filters, first order wideband band pass filters(phase-shifter), Second-order low-pass filters, Secondorder high-pass filters, Second-order Band-pass filters, Second-order Band-reject filters.

**[F] NON-LINEAR APPLICATIONS OF OP-AMP:** Precision half-wave rectifiers, Precision full wave rectifiers, Log amplifiers, Antilog amplifiers, Zero crossing detector, level detectors, Voltage magnitude comparator and window detector, Basic peak detectors using Op-Amps and comparators, Basic Sample and Hold circuits, Digital-to-Analog (D/A) Converters, Analog-to- Digital (A/D) Converters.

**[G] WAVESHAPING & WAVEFORM GENERATORS:** The Op-Amp as Voltage comparator, Some Applications of a comparator using Op-
Amp, Schmitt trigger circuit, Basic Triangular wave generator, Astable and Monostable multivibrator using Op-Amp, Introduction to 555 Timer, Timer 555 used in Astable and Monostable mode.

**C. LEARNING OUTCOMES**

At the completion of the course, students will be able to

1. Understand the fundamentals and datasheet parameters of Op – Amp.
2. Design and analyze linear, non-linear, and waveform generating applications using Op – Amp.
3. Design various amplifier and oscillator circuits using feedback concepts.
4. Design and develop various applications using 555 timer in astable and monostable modes.
5. Design voltage regulator and different class of power amplifier circuits.

**D. RECOMMENDED TEXTBOOKS**

1. Integrated Electronics, 1st Edition By: Millman & Halkians Publisher: Tata McGraw Hill
2. Op- Amp and Linear Integrated Circuits, 4th Edition By: Ramakant A. Gayakwad. Publication: Pearson Education

**E. REFERENCE BOOKS**

1. Integrated Circuits, 9th Edition By: K. R. Botkar Publication: Khanna Publications

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

1. Inverting - Non Inverting Amplifier
2. Op-amp as a Summer Circuit and a Differential Amplifier
3. Feedback Amplifiers
4. Frequency Response Parameters
5. Integrator and Differentiator
6. Comparator Applications and Schmitt Trigger
7. RC Phase-Shift Oscillator
8. Square wave and Triangular wave Generator
9. Frequency Response of Low-pass Butterworth Filter
10. Monostable and Astable Multivibrator
11. Regulated Power Supply

**B. TECH. SEMESTER – II (CH/CL/IC/MH)**

**SUBJECT: WORKSHOP PRACTICE - II**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 0 | 0 | 3 | 3 | 1.5 | - | - | 50* | - | 50 |

Reference Code ESC104b

*TW Marks includes Viva based on TW

**DETAILED SYLLABUS**

• Introduction to Electrical Components: Switches, MCB, ELCB, Tube-light, Bulb, parallel connection of electrical components, wiring in fan and motor

• Introduction to Electronic Components: Active and passive components

• Use of basic source & measuring instruments (Power supply, function generator, CRO, DMM)

• Measure voltage, current, frequency, phase difference, power, power factor for single and three phase supply

• Identify various types of ports, cables and connectors

• Linux installation

• Network cabling and crimping for wired and wireless network

• PCB layout design (like proteus) Software installation and layout design using the same

• Solder and de-solder electronic components on PCB

• Identify and rectify open circuit and short circuit faults in PCB/system.

• Test assembled electronic circuit for various parameters and faults • To design a device for charging small battery during door opening and closing.

• To design a mobile charger using solar PC cell panel for offices and house hold.

• To design/develop an electronic weighing machine.

• To design/develop an electronic lock for house in the workshop.

• To design/develop and innovative electrical bell using electronics components

**MINI Project:**

Apart from above experiments a group of students has to undertake a mini project. Following are some examples for the same:

**TEXT / REFERENCE BOOKS**

1) Electronic Principles, Albert Malvino and David J. Bates, 7th Edition, McGraw Hill

2) Electronic Devices, Thomas L. Floyed, 7th Edition, Pearson

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## ELECTRONIC WORKSHOP (CT-217)

## SEM-II (1st Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Ext** | **Sess.** | **TW** | **Prac** | **Total** | **Lect** | **Tut** | **Prac** | **Total** |
| -- | - | 2 | -- | -- | 50 | -- | 50 | -- | -- | 1 | 1 |

- Introduction to Electrical Components : Switches, MCB, ELCB, Tube-light, Bulb, parallel connection of electrical components, wiring in fan and motor
- Introduction to Electronic Components : active and passive components
- Use of basic source & measuring instruments (Power supply, function generator, CRO, DMM)
- Measure voltage, current, frequency, phase difference, power, power factor for single and three phase supply
- Identify various types of ports, cables and connectors
- Linux installation
- Network cabling and crimping for wired and wireless network

- PCB layout design (like proteus) Software installation and layout design using the same ◦ Solder and de-solder electronic components on PCB ◦ Identify and rectify open circuit and short circuit faults in PCB/system.
- Test assembled electronic circuit for various parameters and faults

**MINI Project :**

Apart from above experiments a group of students has to undertake a mini project. Following are some examples for the same :

- To design a device for charging small battery during door opening and closing.
- To design a mobile charger using solar PC cell panel for offices and house hold.
- To design/develop an electronic weighing machine.
- To design/develop an electronic lock for house in the workshop.
- To design/develop and innovative electrical bell using electronics components

**Ref. Books :**


1) Electronic Principles, Albert Malvino and David J. Bates , McGraw Hill (7th Edition)

2) Electronic Devices, Thomas L. Floyed, Pearson (7th Edition)

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## ENVIRONMENT SCIENCE (ES-210)

## SEM-II (1st Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Ext** | **Sess.** | **TW** | **Prac** | **Total** | **Lect** | **Tut** | **Prac** | **Total** |
| 3 | - | - | 60 | - | 40 | - | 100 | 3 | -- | -- | 3 |

**Objective:** The objective for this course is to bring awareness about sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. Managing environmental hazards have become very important. It is now even more critical than ever before for mankind as a whole to have a clear understanding of environmental concerns and to follow sustainable development practices.

**Learning Outcomes:**
After completion of this course students will be able to understand:

1. The meaning of environment, ecology, ecosystems, biotic & abiotic components, food chains & webs
2. Natural resources, biodiversity, hotspots, threats to biodiversity
3. Factors causing environmental pollution, prevention of pollution, role of an individual in pollution control & abatement and disaster management
4. Social issues related to environmental science, water conservation, rain water harvesting, environmental ethics, climate change, wasteland reclamation, consumerism and waste products, environment protection act and public awareness
5. Issues of population growth, population explosion, human health and rights
6. Field work related to ecosystems, polluted sites, and species

# Dharmsinh Desai University
## Faculty of Technology
### Department of Instrumentation and Control Engineering

**Detailed Syllabus:**

**Unit 1: The multidisciplinary nature of environmental studies** **(2 lectures)**

Definition, scope and importance & Need for public awareness

**Unit 2: Natural resources** **(8 lectures)**

- **Renewable and non-renewable resource**: **Natural resources and associated problems**
- Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams, and their effects on forests and tribal people
- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefit and problems
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies
- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies
- Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification
- Role of an individual in conservation of natural resources. Equitable use of resources of sustainable lifestyles

**Unit 3: Ecosystems** **(8 lectures)**

- Concept of an ecosystem, Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem
- Ecological succession, Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

**Unit 4: Biodiversity and its conservation** **(8 lectures)**

- Introduction definition: Genetic, species and ecosystem diversity
- Bio-geographical classification of India

- Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels
- India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India
- Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity

**Unit 5: Environmental Pollution** **(8 lectures)**

- Definition, Causes, effects and control measures of:
- Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards
- Solid waste management, causes, effects and control measures of urban and industrial wastes
- Role of an individual in prevention of pollution, Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides

**Unit 6: Social issues and the environment** **(8 lectures)**

- From unsustainable to sustainable development, Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns. Case studies
- Environmental ethics: Issues and possible solutions
- Climate change: Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.
- Case studies
- Wasteland reclamation, Consumerism and waste products
- Environment Protection Act: Air (Prevention and Control of Pollution) Act, Water (Prevention &Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

**Unit 7: Human Population and the Environment** **(8 lectures)**

- Population growth, variation among nations, population explosion, Family Welfare Program, environment and human health, human rights, Value education
- HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environmental and human health
- Case studies

**Unit 8: Field work**

- Visit to a local area to document environmental assets (river/forest/grassland/hill/mountain)
- Visit to a local polluted site - Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems – pond, river, hill, slopes etc.

**Termwork:** **(40 marks)**

1. Students will be required submit assignment based on field work related to biodiversity of the ecosystems, waste management, environmental pollution, and social issues of environment.

**Text Books:**


- Erach Bharucha *Textbook of Environmental Studies*; Second Edition, Universities Press: Hyderabad, 2013.
- Poonia, M. P.; Sharma, S. C. *Environmental studies*; Khanna Publishing House: New Delhi, 2017.
- Rajagopalan, R. *Environmental Studies*; Oxford University Press: India, 2015.


**Reference Books:**


1. Varandani, N. S. *Basics of Environmental studies*; Lambert Academic Publishing: Germany, 2013.
2. Basak, A. *Environmental Studies*; Dorling Kindersley: India, 2009.
3. Dhameja, S. K. *Environmental studies*; S. K. Kataria and Sons: New Delhi, 2007.
4. Rao, C. S. *Environmental Pollution Control Engineering*; Wiley publishers: New Delhi, 2006.
5. Brunner, R. C. *Hazardous Waste Incineration*; McGraw Hill: Michigan, 1989.
6. Clark, R. S. *Marine Pollution*; Clanderson Press Oxford: Bath, 2001.
7. Trivedy, R. K. *Handbook of Environmental Laws, Acts, Guidelines, Compliances & standards*; B. S. publications: Hyderabad, 2005.

8. Jadhav, H.; Bhosale, V. M. *Environmental Protection and Laws*; Himalaya Pub. House: Delhi, 1995.
9. Agarwal, K. C. *Environmental Biology*; Nidi Publ.: Bikaner, 2001.
10. Bharucha, E. *The Biodiversity of India*; Mapin Publishing: Ahmedabad, India, 2002.
11. Cunningham, W.P.; Cooper; Gorhani, T. H. E.; Hepworth, M.T., *Environmental Encyclopedia;* Jaico Publ. House: Mumbai, 2001.
12. De, A. K. *Environmental Chemistry;* Wiley Eastern: New Delhi, 2006.
13. Gleick, H. P. Water in crisis, Pacific Institute for Studies in Dev., *Environment & Security*; Stockholm Env. Institute Oxford Univ. Press: New York, 1993.
14. Hawkins, R.E., *Encyclopedia of Indian Natural History*; Bombay Natural History Society: Bombay, 1987.
15. Heywood, V. H.; Waston, R. T. *Global Biodiversity Assessment;* Cambridge Univ. Press: Cambridge, 1995.
16. Mckinney, M.L.; School, R.M. *Environmental Science systems & Solutions*; Web enhanced edition: USA, 1996.
17. Miller, T.G. Jr.; Spoolman, S. E. *Environmental Science*; Cengage learning: Wadsworth, 2014.
18. Odum, E.P. *Fundamentals of Ecology*; W.B. Saunders: USA, 1971.
19. Rao, M. N.; Datta, A.K. *Waste Water treatment*; Oxford & IBH Publ.: New Delhi, 1987.
20. Sharma, B. K., *Environmental Chemistry*; Goel Publ. House: Meerut, 2001.
21. Townsend, C., Harper, J.; Michael, B. *Essentials of Ecology*; Blackwell: Oxford, 2008.
22. Trivedi, R. K., *Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards*, Vol I and II; B. S. Publications, Hyderabad, 2010.
23. Trivedi, R. K.; Goel, P. K. *Introduction to air pollution*; ABD Publishers: Jaipur, 2003.
24. Wanger, K. D., *Environmental Management;* W.B. Saunders Co. Philadelphia, USA, 1998.

## B. TECH. SEMESTER – IV (IC)

## SUBJECT: TECHNICAL COMMUNICATION SKILLS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| - | - | 2 | 4 | 3 | 40 | - | - | 50 | 90 |

Reference Code HSMC201

### A. COURSE OVERVIEW

The course is designed to help students learn technical communication and ethics in engineering. It helps students to understand the importance of self development and moral reasoning along with building positive self esteem.

### B. DETAILED SYLLABUS

**NO TOPIC**

**[1] INTRODUCTION**
Basics and importance of Technical Communication, General and Technical Communication, objectives and Characteristics of Technical Communication, Process of Communication, interpersonal and organisational Communication levels, Non-verbal communication.

**[2] TECHNICAL WRITING**
Writing technical reports, technical proposals, Formal letters, memos, Email, Email etiquettes, Business letters, Research papers and technical descriptions, application letter writing, resume writing, follow-up letter writing, Minutes of meeting, Making notes.

**[3] TECHNICAL COMMUNICATION**
Effective public Speaking, Formal Presentations, Presentation aids, Interviews, Group discussions, Telephone Etiquettes.

**[4] ENGINEERING ETHICS**
Ethics and excellence in Engineering, Role and responsibility of engineer, Moral reasoning and Code of ethics.

**[5] SELF DEVELOPMENT AND SELF-ESTEEM**
Importance of Attitude, Goal setting, Self-esteem, Steps to building positive Self-esteem

### C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Raman Sharma, Technical Communications, 3rd Edition, Oxford Publication, London
2) David F. Beer and David McMurrey, Guide to writing as an Engineer, 3rd Edition, John Willey, NewYork
3) Shiv Khera, You Can Win, Macmillan Books, New York
4) Diane Hacker, Pocket Style Manual, Bedford Publication, New York.
5) David F. Beer and David McMurrey, Guide to writing as an Engineer, 3rd Edition, John Willey, NewYork
6) Shiv Khera, You Can Win, Macmillan Books, New York
7) Diane Hacker, Pocket Style Manual, Bedford Publication, New York.


### D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Describe Verbal and Non Verbal aspects of Communication |
| **CO2** | Synthesis | Write technical documents for professional communication |
| **CO3** | Apply | Practice etiquettes in communication at workplace |
| **CO4** | Apply | Demonstrate ethics and moral reasoning in engineering |
| **CO5** | Apply | Practice positive attitude and set long term/short term goals |
| **CO6** | Synthesis | Plan self development and build positive self esteem |

## B. TECH. SEMESTER – V (IC)

## SUBJECT: (IC5XX) COMMUNICATION SYSTEMS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 1 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |

**Reference Code PEC**

**Type of Course:** Program Elective-II

**Prerequisite:** Analog Electronics

**Rationale:** In the modern world, communication is crucial for exchange of information. Modern communication relies on efficient hardware and is based on analog and digital techniques. This course will equip students with the knowledge of communication techniques and hardware components.

### A. OBJECTIVES OF THE COURSE

- To understand the basic concepts of communication systems and protocols
- To familiarize students with analog and digital communication
- To impart knowledge about hardware components involved in fundamental and modern communication systems.

### B. DETAILED SYLLABUS

**[A] INTRODUCTION TO COMMUNICATION SYSTEMS**

Introduction to Communication, Elements of Communication System, Need for Modulation, Electromagnetic Spectrum & Typical Applications, Basic Terminologies in Communication Systems, Signal Representation & Analysis

**[B] AMPLITUDE MODULATION**

Principles of Amplitude Modulation (AM), AM modulating circuits, AM Modulator & Demodulator Circuits, Basics of AM Transmitters & Receivers.

**[C] ANGLE MODULATION**

Introduction, Principal of FM, Sinusoidal FM & Analysis, Non-Sinusoidal Modulation : Deviation Ratio, Phase Modulation, Comparison between PM & FM, Sinusoidal PM, Digital PM, Angle Modulators & Demodulators, FM Transmitters & Receivers

**[D] DIGITAL COMMUNICATION**

Introduction, Information Capacity, Bits, Bit Rate, Baud, and Mary Encoding, Amplitude-Shift Keying, Frequency-Shift Keying, Phase-Shift Keying, Quadrature-Amplitude Modulation, Bandwidth Efficiency, Carrier Recovery, Clock Recovery, Differential Phase-Shift Keying, Probability of Error and Bit Error Rate. Error Performance

**[E] PULSE MODULATION**

Introduction, Pulse Amplitude Modulation, Pulse Code Modulation, Differential PCM, Delta Modulation, Pulse Frequency Modulation, Pulse Time Modulation, Pulse Position Modulation, Pulse Width Modulation

**[F] FIBER OPTICS**

Introduction, History of Optical Fiber Communications, Optical Fibers versus Metallic, Electromagnetic Spectrum, Block Diagram of an Optical Fiber Communications System, Optical Fiber Types, Light Propagation, Optical Fiber Configurations, Optical Fiber Classifications, Cable Facilities, Losses in Optical Fiber Cables, Light Sources, Optical Sources, Light Detectors, Lasers

**[H]INTRODUCTION TO DATA COMMUNICATIONS AND NETWORKING**

Introduction & History, Data Communications Network Architecture, Protocols and Standards, Standard Organization for Data Communication, Layered Network Architecture, Data Communication Circuits, Serial & Parallel Data Transmission, Data Communication Circuit Arrangement, Data Communication networks

**[I]FUNDAMENTAL CONCEPTS OF DATA COMMUNICATIONS**

Introduction, Data Communications Codes, Bar Codes, Error Control, Error Detection, Error Correction, Character Synchronization, Data Communications Hardware, Data Communications Circuits, Line Control Unit, Serial Interfaces (RS232 & RS485), Data Communications Modems

## D. COURSE OUTCOMES

After completion of the course students should be able to:

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To understand fundamentals of communication systems and data communication models |
| **CO2** | Analyze | To understand and analyze different modulation techniques and study of various protocols for data communication in industrial networking |
| **CO3** | Analyze | To understand hardware, circuits for implementation of modulation techniques and study fiberoptics data communications. |

## E. COURSE MATRIX

Mapping of CO's and PO's (number grading)

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO 9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 0 | 0 | 2 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| CO2 | 2 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO3 | 3 | 0 | 0 | 3 | 3 | 2 | 0 | 2 | 2 | 0 | 0 | 3 |

**D. RECOMMENDED TEXTBOOKS**

[1] Electronics Communication, Roddy & Coolen, Pearson Prentice Hall, Inc.
[2] Advanced Electronic Communications Systems, Wayne Tomasi, Pearson Education Limited.
[3] Electronic Communication Systems, George Kennedy, Tata McGraw-Hill Education Pvt. Ltd.

**E. REFERENCE BOOKS AND NOTES**

[1] Modern digital ananlog communication system, B.P.Lathi
[2] Electronic Communication Systems, William Schweber, PHI Publication.
[3] Communication systems, Simon Haykins, John Wiley Publication.

**B. TECH. SEMESTER – VI(IC)**

## SUBJECT: (IC6XX) ANALYTICAL INSTRUMENTS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 2 | 1 | 0 | 3 | 3 | 60 | - | - | - | 60 |

**Reference Code PEC**

**Type of Course:** Program Elective-IV

## A. COURSE OVERVIEW

Analytical Instruments is a course to make the students aware about importance of analytical instruments to control quality of food, chemicals and pharmaceutical and beverages. The latest techniques such as GC, Spectrometers etc. have been included. The knowledge gained in this subject will help the students to work in this field.

## B. DETAILED SYLLABUS

**NO. TOPIC**

**[1] Spectrophotometers: UV - VIS – IR**

Electromagnetic radiation, beer-Lambert law, Absorption Instruments, Colorimeters, Spectrophotometers, Sources of error in Spectrophotometric Measurement, Calibration.

**[2] Spectrophotometers: IR, Raman & Photo acoustic and photo thermal**

Infrared Spectroscopy, Basic Components of Infrared spectrophotometers, Sample Handling Technique Fourier Transform Infrared Spectroscopy, Calibration, Attenuated Total Reflection Technique, Raman Spectrometers, Photo acoustic and photo thermal Spectrometers.

**[3] Gas Chromatograph, Liquid Chromatograph & Mass Spectrometers:**

Chromatography, Basic Parts of a Gas Chromatograph, Methods of Measurements of Peak Areas, Liquid chromatography, types of LC, Amino Acid Analyzers. Basic Mass Spectrometers, Types of Mass Spectrometry, Components of Mass Spectrometers, Resolution, Application of Mass Spectrometry.

**[4] Flame Photometers & X-Ray Spectrometers:**

Principle, Constructional Details of Flame Photometers, Clinical Flame Photometers,Accessoriesfor Flame Photometers, Interferences in Flame Photometry, Procedure for Determination.

**[5] Electron and Ion Spectroscopy:**

Surface Spectroscopic Techniques, Electron Spectroscopy, Instrumentation for ElectronSpectroscopy, Ion Spectroscopy, Instrumentation for Ion Spectroscopy, Radio chemical Instruments, Automated Biomedical Analysis Systems.

**[6] Gas Analyzer & Industrial Gas Analyzers:**

Blood pH measurement, CO2 & O2 Analyzer, gas analyzers, para-magnetic O2 analyzer, magnetic wind analyzer, IR gas analyzer.

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Handbook of Analytical Instruments by: R. S. KHANDPUR
2) Instrumentation methods by B. K. Sharma
3) Analytical Instrumentation by Bela G. Liptak
4) Laboratory Instrumentation by Mary C. Haven (Author), Gregory A. Tetrault(Author), Jerald R. Schenken (Author)

## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Develop awareness about needs of different Analytical instruments for measuring different parameters for analysis and testing of the products, classification and associated technical terminologies. |
| **CO2** | Analyse | Compare specifications and salient characteristics based choice making of analytical instruments and methods and applications in the field of Analytical instrumentation. |
| **CO3** | Analyse | Develop awareness of measuring different strategies with analytical instruments and acquired the knowledge about its importance for the analysis and testing of any product/material with the help of different analytical instruments. |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 |
| **CO2** | 3 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 3 | 2 | 0 | 1 | 2 |

**B. TECH. SEMESTER – VI (IC)**

**SUBJECT: (IC6XX) AUTOMATION SYSTEM INTEGRATION**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PCC**

## A. COURSE OVERVIEW

Automation System Integration course makes a bridge between academics and industries in automation field. This subject is introduced to make students aware about the concept and components of Automation system and make students aware about basics of communication protocols used for automation application and also to enable students to write PLC program for a given application and also prepare the students to develop automation application using PLC and SCADA.

## B. DETAILED SYLLABUS

**NO. TOPIC**

**[1] PROGRAMMABLE LOGIC CONTROLLER**

**The PLC: A Overall look :-**Introduction, Manufacturing and assembly process , PLC advantages and Disadvantages, Overall PLC system , CPU and Programmers , PLC Input/output modules, Solid state memory

**General PLC programming Procedures**

**Devices connected with PLC I/O modules :-**Input/output on/off switching devices **,** Input/ output Analog devices

**Programming on/off inputs to produce on/off outputs**

**Relation to digital gate logic to contact/coil logic**

**Creating ladder diagrams from process control descriptions**

**PLC Basic functions :-**PLC timer, counter, arithmetic functions

**PLC Intermediate functions :-**PLC Number comparison functions **,** Numbering systems and PLC number conversion functions

**Data Handling Functions:-**PLC skip and master control relay functions, JUMP functions, PLC data moves.

**PLC functions working with bits:-** Digital bits, Sequential, controlling a robot with PLC, Matrix functions

**Advanced PLC functions :-** Analog PLC operations, PID control of continuous process, networking of PLCs

**PLC Installation, Trouble shooting and maintenance**

**PLC Auxiliary Commands and Functions** Monitor Mode function, Force mode function, functions for different programming formats, print functions, Selection of PLC, Industrial control and rise of PLC, PLC versus PC, factors to consider in selecting a PLC

**PLC Installation Practices** Installation Practices, Consideration of the operating environment, receiving check, testing and assembly, electrical connections, grounding and suppression considerations, circuit protection and wiring, troubleshooting PLC malfunctions, PLC maintenance

**[2] DATA ACQUISITION SYSTEM**

Introduction of Data Acquisition system, sampling concept, digital to analog converters, analog to digital converters, Block diagram, Protections in DAS, Isolation in DAS, Data Acquisition Configuration

**[3] SYSTEM INTEGRITY LEVEL IN AUTOMATION SYSTEMS**

Conceptual design stage, ISA conceptual design stage, IEC 615108 on conceptual design, skills and resources, basic SIS configuration, shared functions, technology choices, pneumatics relays, safety relay, solid state systems,

**[4] SAFETY PLC**

Programmable systems for the logic solver, upgrading of PLCs for safety applications, characteristics of safety PLCs, hardware characteristics of safety PLC, software characteristics of safety PLC, design of safety PLC, Triple Modular Redundant (TMR) systems, safety PLC with 1oo3 architecture, communication features of safety controllers, classification and certification , SIS architecture conventions

**[5] BASICS OF SCADA CONFIGURATION**

Basic & Advance configuration of WONDERWARE SCADA, Detail study of SCADA configuration building blocks

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Programming Logic Controllers- Principles and applications, By John W. Webb & Ronald Reis, PHI, fifth Edition (2006)
2) PC based Instrumentation – Concepts and practice By N.Mathivanan, PHI, 2007 Edition
3) Practical Industrial safety, Risk Assessment and Shutdown Systems By- Dave Macdonald, Elsevier science technology,
4) User manual for Wonderware InTouch SCADA development software
5) Programming Logic Controllers- Programming methods and applications
   By John R. Hackworth & Frederick D. Hackworth Jr. , Pearson Education, Low Price Edition
6) Programming Logic Controllers and Industrial Automation – An Introduction,
   By Madhu chhanda, Samarjit sen Gupta, Tata Mc Graw Hill


## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Describe the basic architecture of automation systems incorporating PLC, DAQ and SCADA |
| **CO2** | Application | Describe, design and develop PLC programs using ladder diagrams. |
| **CO3** | Create | Design and develop industrial automation applications using PLC |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 1 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 0 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 2 |

## F. LIST OF EXPERIMENTS

1. Introduction to Wonderware InTouch SCADA
2. Study of basic features of SCADA
3. Study of Advanced features of SCADA
4. Programming in SCADA using scripts
5. Study and understand RSLogix 500 software.
6. Development of ladder program using bit instructions
7. Development of ladder program using Timer Functions
8. Development of ladder program using counter and compare Functions
9. Development of ladder program using Advance (Arithmetic) Functions
10. Development of ladder program using Advance (Analog) Functions
11. Development of ladder program using Advance (Program control and Sequencer) Functions
12. Project Development

## B. TECH. SEMESTER – VI (IC)

## SUBJECT: (IC6XX) ECONOMICS AND MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 0 | 3 | 5 | 60 | 0 | 0 | 0 | 60 |

**Reference Code: HSMC**

### A. COURSE OVERVIEW

To acquire knowledge of economics to facilitate the process of economic decision making. Acquire knowledge on basic financial management aspects. Develop the skills to analyze financial statements. This course introduces the basic concepts of management and organisation structure of an industry, Material management cost analysis, engineering economics and project management.

### B. DETAILED SYLLABUS

**NO TOPIC**

**[1] INTRODUCTION**

Introduction: The Scope and Method of Managerial economics –Fundamental Economics concepts – Managerial Economics with other subjects – Objectives of the Firm

**[2] DEMAND AND SUPPLY ANALYSIS**

Meaning, Types and Determinants – Demand estimation- Demand elasticities for decision making – Business and Economic forecasting: Qualitative and Quantitative methods – Supply analysis: Meaning, elasticities and determinants – Market equilibrium and price determination

**[3] PRODUCTION ECONOMICS**

Production and Production function – Types – Estimation – Returns to Scale – Economies and Diseconomies of Scale and Economies of Scope. Factor Inputs – Input-Output Analysis

**[4] MARKET STRUCTURE**

Perfect Competition – Imperfect Competition: Monopoly – Monopolistic – Oligopolistic Strategy, Cartels, Cournot, Kinked Demand and Price Leadership. Oligopolistic Rivalry & Theory of Games – Measurement of economic concentration – Policy against monopoly and restrictive trade practices – Competition Law – Pricing Practices: Objectives – Determinants – Pricing Methods – Government Policies and Pricing

**[5] INTRODUCTION TO MICRO ECONOMICS**

Circular Flow of Income and Expenditures – Components of National Income and its significance – Measuring Gross Domestic Product (GDP) – Inflation and Business Cycles – Government Fiscal and Monetary Policy – Balance of payments – Foreign exchange markets

### C. RECOMMENDED TEXT / REFERENCE BOOKS


1) P.L. Mehta – Managerial Economics Analysis, Problems and cases, Sultan Chand & Co. Ltd., 2001
2) Peterson and Lewis: Managerial Economics, 4th Ed., Prentice Hall , 2004
3) Dholakia and Oza: Microeconomics for Management Students, 2nd Edition, Oxford University Press
4) Gregory Mankiw: Principles of Microeconomics, Havcourt Asia Publishers, 2001
5) Mote and paul – Managerial Economics, Tata McGraw Hill, 2001

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Analysis | Evaluate the economic theories, cost concepts and pricing policies |
| **CO2** | Analysis | Understand the market structures and integration concepts |
| **CO3** | Analysis | Understand the measures of national income, the functions of banks and concepts of globalization. |
| **CO4** | Analysis | Apply the concepts of financial management for project appraisal |
| **CO5** | Analysis | Understand accounting systems and analyze financial statements using ratio analysis |
| **CO6** | Analysis | Understand the impact of inflation, taxation, depreciation. Financial planning, |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 3 | 3 |
| **CO2** | 0 | 1 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 0 |
| **CO3** | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 2 |
| **CO4** | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| **CO5** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 3 |
| **CO6** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |

## B. TECH. SEMESTER – VII (IC)
## SUBJECT: DIGITAL SIGNAL PROCESSING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 2 | 1 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

PEC

### A. COURSE OVERVIEW

"Digital signal processing" is a core course in the field of data processing. Course starts from the basic concepts of discrete-time signals and proceed to learn how to analyze data via the Fourier transform, how to manipulate data via digital filters and how to convert analog signals into digital.

### B. DETAILED SYLLABUS

| NO. | TOPIC |
|---|---|
| [1] | **DISCRETE-TIME SIGNALS AND SYSTEMS**<br>Introduction, Representation of Discrete-Time Signals, Basic Operations on Sequences, Classification of Discrete-time Signals, Classification of Discrete-Time Systems |
| [2] | **DISCRETE CONVOLUTION AND CORRELATION**<br>Impulse Response and Convolution Sum, Analytical evaluation of Discrete Convolution, Convolution of finite sequences, Methods to compute the convolution sum of two sequences, Deconvolution using tabular method, Interconnection of LTI System, Discrete Correlation |
| [3] | **THE Z-TRANSFORMS**<br>Z-transforms by summation of left, right and two-sided sequences, Regions of convergence and z-transform properties, inverse z-transforms |
| [4] | **SYSTEM REALIZATION**<br>Introduction, Realization of discrete time systems, Structure for realization of IIR systems, Structures for Realization of FIR Systems |
| [5] | **DISCRETE –TIME FOURIER TRANSFORM**<br>Discrete – Time Fourier Transform(DTFT), Existence of DTFT, Relation between Z-Transform and Fourier Transform, Relation between Z- Transform and Fourier Transform,Inverse DTFT, Properties of DTFT |
| [6] | **DISCRETE FOURIER SERIES AND DISCRETE FOURIER TRANSFORM**<br>Discrete Fourier Series, Properties of DFS, Relation between DFT and Z transform, Comparison between DTFT and DFT, IDFT, Properties of DFT |
| [7] | **INTRODUCTION OF INFINITE DURATION IMPULSE RESPONSE (IIR) FILTERS AND FIR FILTERS**<br>Introduction, Requirements for Transformation, Design of IIR Filters, Specification of the Low-pass Filter, Design of digital low –pass butterworth and chebyshev filters, Characteristics of FIR filters |

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Digital Signal Processing: A. Anand Kumar, PHI Publication
2) Discrete Time Control Systems: Katsuhiko Ogata, Pearson Edition,2nd Edition
3) Digital Signal Processing: A Computer-Based Approach, S. K. Mitra, McGraw-Hill, Third edition, 2006.
4) Analog and Digital Signal Processing by Ashok Ambardar, THOMSON Books/Ole
5) Discrete-Time Signal Processing by A. V. Oppenheim and R. W. Shafer, PHI,2/E, 2000
6) Digital Signal Processing: Principles, Algorithms and Applications, J. Proakis, D. Manolakis, Prentice-Hall, 2006 (4-th edition)
7) Digital Filters – Analysis, Design & Applications by Andreas Antoniou, Tata McGrow Hill, 2nd Edition

## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Classify systems based on their properties: in particular, to understand and exploit the implications of linearity, time-invariance, causality, memory, and bounded-input, bounded-out (BIBO) stability. |
| **CO2** | Understand | Gain knowledge about Z transform tool for discrete system for analysi |
| **CO3** | Application | Apply system realization methods and z transformation tools for design and analysis of discrete time system for IIR and FIR filters. |
| **CO4** | Evaluate | Evaluation of convolution and correlation for continuous-time and discrete-time signals |
| **CO5** | Analysis | Generate Fourier transforms, DTFT and DFT for analysis of discrete time systems |
| **CO6** | Apply | Understand and apply the design techniques for IIR and FIR filter using transformation technique |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 3 | 1 | 0 | 0 | 2 | 2 | 1 | 3 |
| **CO2** | 3 | 3 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 1 | 0 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 0 | 2 | 1 | 0 | 2 |
| **CO4** | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 0 | 1 | 2 | 0 | 1 |
| **CO5** | 3 | 3 | 1 | 1 | 3 | 2 | 0 | 0 | 0 | 1 | 0 | 2 |
| **CO6** | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 0 | 2 | 2 | 1 | 2 |

## F. LIST OF EXPERIMENTS

1. Introduction to signals and systems
2. Basic operations on Discrete time signals
3. Convolution and Correlation
4. Z-Transformation
5. Inverse Z- Transformation
6. Discrete System Realization
7. Discrete time Fourier Transform and Discrete Fourier Transform
8. Introduction to FDA Tool
9. IIR/ FIR Filter design (Butterworth filter)
10. IIR/ FIR Filter design (Chebyshev filter)

**B. TECH. SEMESTER – VII (IC)**

**SUBJECT: (IC-7XX) SMART INSTRUMENTATION**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 3 | 0 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |

## A. OBJECTIVES OF THE COURSE

Modern world manufacturing facilities are upgraded and leading towards smart factories. To equip the factories with state-of-the-art facilities meeting global standards, it is imperative to upgrade the existing instrumentation with smart instrumentation. This course provides knowledge regarding different types of smart sensors and their usage for transducer design. The course also discusses usage of microprocessors for development of smart instrumentation and networking. Relevant international standards are also included in the discussion employed in realization of smart sensor networking. The course intends to make students aware about classification, fabrication and recent trends in sensor technologies, sensor-networking techniques and relevant standards, protocols and technologies.

## B. DETAILED SYLLABUS

**NO TOPIC**

**[1] Smart Sensors**

Sensors and their classification, Sensor fabrication techniques, Sensors fabrication process details and latest trends in sensor fabrication, some special types of sensors: Fiber optic sensors, Chemical sensors, Biosensors, Characterization of sensors

**[2] Sensor Networks:**

Basic concepts, Sensor networking, industrial networking, sensor networking solutions, ISO/OSI model of 7-layers, Smart Sensors, Smart Sensor manufacturing technologies, Smart transducers and smart valve actuators

**[3] LAN: Technologies, Protocols, and Topologies**

Wired and wireless networking, Various topologies, Wired network protocols, wireless network protocols

**[4] WSNs and their applications**

Basic concepts, purposes, usage, Factors and considerations for applications, Practical implementation issues, WSN standard IEEE 802.15.4, WSN applications in emerging areas

**[5] IEEE 1451 Family of Standards**

Brief discussions on IEEE 1451.0 standard, IEEE 1451.1 standard, IEEE 1451.2 standard, IEEE 1451.3 standard, IEEE 1451.4 standard, IEEE 1451.5 standard, IEEE 1451.6 standard and IEEE 1451.7 standard

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Understanding Smart Sensors by R. Frank, Artech House
2) Smart Material Systems and MEMS: Design and Development Methodologies: Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan , John Wiley & Sons Ltd.
3) Data and computer communication by William Stallings, Pearson
4) Wireless Sensor Networks – Architecture and Protocols, by Edger H. Callaway, CRC Press
5) Measurement and Instrumentation: Theory and Application, by AS Morris, R Langari and Butterworth-Heinemannm, Elsevier
6) Intelligent Instrumentation, by G. Barney, PHI
7) Chemical Sensors and Bio-Sensors, by Brayan Eggins, John Wiley & Sons.
8) Fiber Optic Sensors, by Eric Udd, Wiley
9) Smart Sensors, by Chapman P., ISA Publications

10) John G. Webster, Editor-in-chief, "Measurement, Instrumentation, and Sensors Handbook", CRC Press.

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To develop awareness regarding sensor technologies, special types of sensors, and relevant terminologies |
| **CO2** | Understand | To familiarize regarding wired-wireless networking techniques along with relevant terminologies and technical specifications |
| **CO3** | Understand | To study IEEE 1451 family of standards with each sub-standard information and their application for smart transducers development |

## E. CO-PO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **CO2** | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## F. CO-PSO MAPPING

| | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 2 | 1 | 1 |
| **CO2** | 2 | 2 | 2 |
| **CO3** | 2 | 2 | 1 |

**B. TECH. SEMESTER – III (EC/IC)**

**SUBJECT: DIGITAL ELECTRONICS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code EC03

## A. COURSE OVERVIEW

Computer systems and digital communications have affected positively every aspect of our life. Digital Electronics is the foundation of these systems. On completion of the subject students will have the skills and confidence to conceive and implement a digital system. The objective of this course is to provide the fundamental concepts associated with the digital logic and circuit design. To apply the laws involved in the Boolean algebra for the simplification of logic functions which results in the minimization of hardware requirements. To design and analysis of combinational and sequential circuits utilized in the different digital circuits and systems.

## B. DETAILED SYLLABUS

| NO. | TOPIC |
|---|---|
| [1] | **INTRODUCTION TO LOGIC CIRCUITS**<br>Logic Gates & Networks, Truth Tables, Boolean Algebra, Synthesis using AND, OR and NOT Gates, NAND – NOR Logic Networks, Sum of Products and Product of Sums Forms, Introduction to Verilog. |
| [2] | **IMPLEMETATION TECHNOLOGY**<br>Transistor Switches, NMOS & CMOS Logic Gates, Negative Logic Systems, Introduction to PAL, PLA, CPLD & FPGAs, Voltage Levels in Logic Gates, Noise Margin, Dynamic Operation & Power Dissipation in Logic Gates, Fan-in and Fan-out, Transmission Gates, Transistor-Transistor Logic, Emitter - Coupled Logic. |
| [3] | **OPTIMIZED IMPLEMENTATION OF LOGIC FUNCTIONS**<br>Karnaugh Map Strategy for Minimization, Minimization of POS Forms, Multiple Output Circuits, Multilevel Synthesis, Analysis of Multilevel Synthesis. |
| [4] | **COMBINATIONAL CIRCUITS**<br>Multiplexers, Decoders, Encoders, Code Converters, Arithmetic Comparison Circuits |
| [5] | **SEQUENCIAL CIRCUITS**<br>Basic Latch, Gated SR Latch, Gated D Latch, Master Slave & Edge Triggered D Flip-Flops, T & JK Flip Flops, Registers, Counters, Reset Synchronization, BCD- Ring –Johnson Counters. |
| [6] | **SYNCHRONOUS SEQUENCIAL CIRCUITS**<br>Basic Design Steps, Mealy State Model, Design of Counter, FSM as an Arbiter Circuit, Analysis of Synchronous Sequential Circuits. |

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Fundamentals of Digital Logic with Verilog Design, Stephen Brown & Zvonko Vrenesic, Tata McGraw Hill

2) Digital Logic and Computer Design, Morris Mano, Prentice Hall of India

3) Fundamental of Digital Circuits, Anand Kumar, Prentice Hall of India

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Analysis | Analyze and calculate parameters such as noise margin, input –output voltages, fan-out, and speed power product, power dissipation for ECL and TTL logic families. Implement the Boolean functions using CMOS gates. |
| **CO2** | Analysis | Optimize the Boolean expressions by using minimization techniques as K-Map method and Tabulation Method with "don't care" conditions up to 6 variables. |
| **CO3** | Application | Apply Boolean algebra and able to minimize Boolean expressions.<br>Synthesize the Boolean expressions using AND-OR-INVERT functions as well as universal gates. |
| **CO4** | Application | Illustrate the conversion of Boolean expressions from SOP to POS forms and vice versa. |
| **CO5** | Synthesis | Design the combinational circuits like Multiplexers, Decoders, Encoders, Code Converters, and Arithmetic Comparison Circuits using basic gates. |
| **CO6** | Application | Design and Implement the digital circuit using combinational blocks like multiplexers, decoder, PLA, PAL for given problem statement. |
| **CO7** | Application | Construct sequential circuits like asynchronous/ synchronous counters, shift registers and FSM using flip-flops. |
| **CO8** | Synthesis | Design memory elements like basic latch, gated S-R latch, D latch, Master-Slave and edge triggered D flip-flop and J-K flip flop using gates. |
| **CO9** | Analysis | Analyze and troubleshoot sequential circuits for given input conditions and reconstruct the same to resolve the issues found while troubleshooting. |
| **CO10** | Evaluate | Simulate and analyse the combinational and sequential circuits using MULTISIM and QUARTUS-II EDA tool. |

## B. TECH. SEMESTER – III (EC/IC)

## SUBJECT: ELECTRONIC MEASUREMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 1 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code EC22

### A. COURSE OVERVIEW

The creating sound background for understanding of operating principle, working and application of various electronic instruments. By offering these course department encourages to use sensors for measurement of various parameters like temperature, pressure, level and flow. Moreover, design and analysis of various bridge circuits and meter circuit utilized in electronic measurement.

### B. DETAILED SYLLABUS

| NO. | TOPIC |
|---|---|
| [1] | **MEASUREMENT AND ERROR**<br>Accuracy and Precision, Definitions, Significant Figures, Types of Error, Statistical Analysis, Probability of Errors, Limiting Errors , Problems. |
| [2] | **SYSTEM OF UNITS OF MEASUREMENTS**<br>Fundamental and Derived Units, System Of Units, Electric and Magnetic Units, International System of Units, Other System of Units, Conversion of Units. |
| [3] | **STANDARDS OF MEASUREMENTS**<br>Classification of Standards, Standards of Mass, Length and Volume, Time and Frequency Standards, Electrical Standards, Standards of Temperatureand Luminous Intensity, IEEE standards. |
| [4] | **BRIDGES AND THEIR APPLICATION**<br>Introduction, Wheatstone Bridge, Kelvin Bridge, Guarded Wheatstone Bridge, AC Bridges and their Application, Comparison Bridges, Maxwell Bridge, Hay Bridge, Schering Bridge, Unbalance Conditions, Wien Bridge, Wagner Ground Connection, Potentiometer. |
| [5] | **ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAMETERS**<br>Amplified DC Meter, AC Voltmeter using Rectifiers, True RMS- Responding Voltmeter, Electronic Multimeter, Analog Voltmeter, Differential Voltmeters, Digital Voltmeters, Component Measuring Instruments, Q Meter, Vector Impedance Meter, Vector Voltmeter, RF Power and Voltage Measurement. |
| [6] | **OSCILLOSCOPES**<br>Introduction, Oscilloscope, Block Diagram, Cathode Ray Tube, CRT Circuits, Vertical Deflection System, Delay Line, Multiple Trace, Horizontal Deflection System, Oscilloscope Probes and Transducers, Oscilloscope Techniques, Special Oscilloscopes. |
| [7] | **ELECTROMECHANICAL INDICATING INSTRUMENTS**<br>Suspension Galvanometer, Torque and Deflection of the Galvanometer, Permanent-Magnet Moving coil Mechanism, DC Ammeters, DC voltmeters, Voltmeter Sensitivity, Series ohmmeter, Shunt ohmmeter, Multi meter or VOM, Calibration of DC Instruments, Thermo instruments, Electrodynamometers in Power Measurements, Watt Meter, Instrument Transformers |

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Electrical & Electronic Measurement & Measuring Instruments, A. K. Sawhney, 17th Edition, Dhanpat Rai & Co.
2) Electronic Instrumentation and Measurement Technique, Wlliam D. Cooper & Albert D. Helfrick, 5thEdition, Prentice Hall of India
3) Electronics Measurement & Instrumentation, R. K. Rajput, 1st Edition, Prentice Hall of India
4) Electronic Instrumentation, H. S. Kalsi, 2nd Edition, Tata McGraw Hill

## D. COURSE OUTCOMES

| CO NUMBER | Statement |
|---|---|
| **CO1** | Study of various parameters based on measurement and error. |
| **CO2** | Study of system units of Measurements like, fundamental and derived units, Electric and Magnetic units and conversion of units. |
| **CO3** | Design and extend meter circuit like DC Ammeter, DC Voltmeter & series type ohmmeter for given specification. |
| **CO4** | Illustrate the working of instrument for measuring AC parameters like voltage, current, power factor and energy. |
| **CO5** | Design DC bridges for measurement of low & medium value of resistance like Wheatstone bridge, kelvin's double bridge. |
| **CO6** | Design AC bridges for measurement of primary and secondary parameters of components. |
| **CO7** | Compare various voltmeters like amplified DC meter, AC voltmeter using rectifier, True rms responding voltmeter and electronic multimeter for improving accuracy of measurement. |
| **CO8** | Illustrate the working of various oscilloscope for measuring voltage, frequency and phase. Applications of various transducers used in measurement systems. |

## B. TECH. SEMESTER – IV (IC)
## SUBJECT: CONTROL SYSTEM COMPONENTS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 2 | - | 2 | 4 | 3 | 60 | - | 25 | 25 | 110 |

Reference Code EC19

## A. COURSE OBJECTIVES

This course is designed with the objective of making students -

- To understand the working principle, construction of various electrical, mechanical, electromagnetic, hydraulic and optoelectronic components used in control systems
- To analyse operation of various electrical, mechanical, electromagnetic, hydraulic and optoelectronic components used in control systems
- Applications of various electrical, mechanical, electromagnetic, hydraulic and optoelectronic components used in control systems
- Appraise design feature of control system components
- Determine basic structure of Control System Problem.

## B. DETAILED SYLLABUS

### 1 INTRODUCTION TO CONTROL PROBLEM

Control systems: Terminology and basic structure, the genesis and essence of feedback control theory, Feedback control structure.

### 2 MECHANICAL COMPONENTS

**CAMS AND FOLLOWERS:**

Introduction, Components of Cam, Types of Cam, Types of Followers, Classifications, Cam Motions, Cam Terminology, Cam Profile

**GEARS, CLUTCHES, BREAKS:**

Introduction of Gears, Clutches, Brake.

### 3 ELECTRO-MECHANICAL COMPONENTS

**SERVO MOTOR:**

Introduction, DC Servomotors, AC Servomotors

**STEPPER MOTORS:**

Introduction, PM type Stepper Motor, VR type Stepper Motor, Hybrid Stepper Motor, Disc Magnet Stepper Motor, Applications of Stepper Motors

**UNIVERSAL MOTOR:**

Construction, Operation, Speed control

**TACHOMETERS:**

Introduction, Characteristics requirement, DC Tachogenerator, AC Tachogenerators, Tachometer Applications, characteristics of Tachogenerator

**SOLENOIDS:**

Introduction,Construction, Working, Selection and different types of Solenoid.

### 4 OPTO-ELECTRONIC DEVICES

Classification, Photo conductive, Photo Voltaic & Photoemissive sensors , Liquid Crystal Display.

5 **SAFETY AND AUXILIARY COMPONENTS**

**RELAYS:**

Introduction, Classification of Relays, Relay Circuits, Construction of Relay, Logic Relay, Optoelectronic Relay, Relay Problems & Remedies, Relay Race, Actuation & Release Time, Characteristics of Electromechanical Relay, Dynamic Characteristics of Reed Relay

**SWITCHES:**

Single pole, double pole, electro mechanical Switches

**POTENTIOMETER:**

Introduction, Type of Potentiometers, Applications, Selection of Potentiometers.

6 **HYDRAULIC SYSTEMS**

Introduction, Advantages & Disadvantages of Hydraulic Systems, Components of Hydraulic System, Classification of Hydraulic Systems, Pump-Controlled Hydraulic System, Pump Controlled Hydraulic Motor, Hydraulic Transmission Lines, Hydraulic Power Supply, Hydraulic Valves.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1. Control systems components, By: M.D. Desai, PHI publication, 2008
2. Control systems principle and design, 4th Edition, By: M.Gopal, Tata McGraw-Hill Education publication, 2015
3. Electronic Devices and Circuits – An Introduction, By: Mottershed, Prentice hall publication, 1997
4. Modern Control Technology: Components and systems, By: Kilian, Cengage Learning publication, 1996
5. Mechanical & Industrial Measurements, 11th Edition, By: R. K. Jain, Khanna Publishers, 2011


## D. COURSE OUTCOMES

After completing this course students will be able to:

1. Describe construction, operation & behaviour of electrical, mechanical and hydraulic control system components
2. Interpret the characteristics of electrical, mechanical and hydraulic control system components
3. Describe various standards used for selection of electrical, mechanical and hydraulic control system components
4. Select electrical, mechanical and hydraulic control system components
5. Develop and build basic applications of electrical control system components
6. Describe Identify different control problem

## B. TECH. SEMESTER – IV (EC/IC)
## SUBJECT: ELECTRICAL MACHINES & POWER

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code ESCXXX

## A. COURSE OVERVIEW

This course provides fundamental concepts associated with working and analysis of electrical machines. This also includes concepts to analyse the mechanism of electrical power generation, transmission and distribution. After studying this course, the students will be able to identify and troubleshoot electrical faults in switchgear.

## B. DETAILED SYLLABUS

**NO. TOPIC**

**[1] DC MACHINES**

**DC Generator & DC Motor**

Operating Principle and Types of DC generator &motor, Losses in DC Generator, Power Stages in DC Generator, Maximum Efficiency and Power in DC Generator, Generator Characteristics, Speed control of DC motor

**[2] AC MACHINES**

**Single Phase Transformer**

Working Principle, Construction, Characteristics of an Ideal Transformer, EMF Equation, Transformer Load Analysis, Transformer Parameters, Equivalent Circuit, Open Circuit & Short Circuit Tests, Efficiency, Regulation, All day efficiency, Parallel Operation of transformer.

**Three Phase Induction Motors**

Working Principle, Construction, Relation between Torque & Rotor Power Factor, Starting Torque and Running Torque of Motor, Effect of Change in Supply Voltage on Starting Torque, Torque Slip Characteristics, Induction Motor as a Generator, Power Stages, Starting Methods of Induction Motor, Speed Control of Induction Motors

**Single Phase Motors**

Introduction and Broad Classifications, Self-Starting Mechanism, AC Series Motor and Universal Motors.

**Alternators**

Working Principle, Construction, Factors Affecting Alternator Size, Alternator on Load, Synchronous Reactance, Vector Diagrams, Voltage Regulation by EMF Method, Parallel Operation of Alternators.

**[3] ELECTRICAL POWER GENERATION**

Schematic Arrangement of Various Power Plants - Thermal, Hydro, Nuclear, Diesel and Gas Turbine Based Power Plant, Structure of Electric Power System, Load Curves, Important Terms and Factors, Load Duration Curves, Types of Loads, Wind energy: types, power in the wind, types of wind turbine generators, Solar Energy: types of solar cell, A generic photovoltaic cell, from cells to modules to array, physics of shading, Introduction to major types of PV system, Maximum Power point tracker, Concentrating Solar Power (CSP) Technologies, Introduction to smart grid

**[4] POWER FACTOR IMPROVEMENT**

Power Triangle, Disadvantages and Causes of Low Power Factor, KVAR Calculations, Importance of Power Factor Improvement, Most Economical Power Factor.

**[5] TRANSMISSION LINE & UNDER GROUND CABLES**

Classification of Transmission Line & Under Ground Cables, Main Components, Conductor Materials, Types of Insulators, String Efficiency and Its Improvement, Construction of underground Cables

**[6] INTRODUCTION TO SWITCH GEAR**

Essential Features of Switchgear, Switchgear Equipment - Circuit Breaker, Fuses, Relay, Principle and Methods of *arc* Quenching in Circuit Breaker, Desirable Characteristics of Fuse Element, Fuse Element Materials, Theory of Protective Relays, Fundamental Requirements of Protective Relay, Calculation of Relay Operating Time, The Bus Bar Arrangement, Faults in Power System.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Electrical Technology (Vol: II), B. L. Theraja& A. K. Theraja, 23rd Edition, S. Chand & Company Ltd.
2) Principles of Power System, V. K. Mehta &Rohit Mehta, 4th Edition, S. Chand & Company Ltd.
3) Theory and Performance of Electrical Machine, V.B. Gupta, 13th Edition, Laxmi Publications
4) Electrical Engineering, R.K. Rajput, 1st Edition, Laxmi Publications
5) Course in Power System, J. B. Gupta, 10th Edition, S. K. Kataria& Sons.
6) Switchgear and Protection, J. B. Gupta, 2nd Edition, S. K. Kataria& Sons.


## D. COURSE OUTCOMES

At the end of the course, students should be able to:

- Analyse important parameters such as regulation, efficiency, output power and losses of AC electrical machines like transformer, auto-transformer and induction motor.
- Analyse no load and load characteristics of DC shunt, series and compound DC machines.
- Evaluate synchronous reactance of an alternator and discriminate magnetic effects like magnetising, demagnetising and cross magnetising on operation of an alternator.
- Explain split phase mechanism to make single phase induction motor self-starting and classify types of single phase induction motors.
- Compare and conclude merits and demerits of conventional and non-conventional electrical energy generation power plants.
- Analyse effect of power factor improvement in AC electrical power system. Analyse and compute diversity factor, load factor, demand factor and average load.
- Choose the best material considering conductivity, tensile strength, durability, considering cost, life, fault frequency and safety for underground and overhead transmission line.
- Illustrate relay circuit breaker coordination to protect electrical system. Choose required protective devices like fuses, circuit breakers, relays or isolator switch to protect against electrical faults.

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC-5XX) CYBER PHYSICAL SYSTEMS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 1 | 1 | 0 | 3 | 3 | 60 | - | - | - | 60 |

Reference Code PEC

**Type of Course:** Program Elective-II

**A. COURSE OVERVIEW**

Cyber Physical System (CPS) plays crucial role in today's industry, where automation is generally achieved by interdisciplinary mode involving various branches of engineering to solve real life problems. It improves the standard of living of human life. It provides challenges to implement next generation systems leading to solutions showing future trends, application area and challenges.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] Introduction to Cyber Physical Systems**

Cyber-Physical Systems (CPS) in the real world , Basic principles of design and validation of CPS, Industry4.0, Auto SAR, IIOT implications, Building Automation, Medical CPS

**[2] CPS-Environment**

Human and CPS, Human Computer Interface(HCI),Hardware and Software Co-Design CPS HW platforms - Processors, Sensors, Actuators, CPS Network – Wireless Hart, CAN, Automotive Ethernet, CPS Sw stack- RTOS, Scheduling Real Time control tasks

**[3] CPS Engineering**

CPS Models, Low level Control, Mid High Level Control and Automation, From features to software components, CPS performance Analysis- effect of scheduling, bus latency, Sense and actuation faults on control performance, network congestion Architecture and Design Language

**[4] CPS Analysis and Verification**

Advanced Automata based modeling and analysis, Basic introduction and examples, Timed and Hybrid Automata Formal Analysis: Flow pipe construction, reachability analysis, Analysis of CPS Software, Weakest Pre-conditions, Hybrid Automata Modeling: Flow pipe construction using SpaceX and Phaver tools, CPS SW Verification: Frama-C

**[5] CPS Security**

Information and Cyber Security basics, Privacy in CPS, Threats to CPS in various domains such as Automotive, Medical ,Industrial control etc.,CPS Attack models

**C. RECOMMENDED TEXT / REFERENCE BOOKS**


1) Principles of Cyber-Physical Systems, Rajeev Alur, MIT Press
2) Introduction to Embedded Systems-A Cyber-Physical System Approach, Sanjit Seshia, MIT Press
3) Verification and Control of Hybrid Systems: A Symbolic Approach, P. Tabuada, Springer-Verilog

**D. COURSE OUTCOMES**

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To develop awareness regarding Cyber Physical System and its design and implementation in various applications |
| **CO2** | Understand | To familiarize regarding CPS environment, Human Computer Interaction design aspects and relevant hardware-software |
| **CO3** | Understand | To study implementation technologies for CPS engineering design |
| **CO4** | Understand | To learn CPS modelling, analysis and security aspects for CPS |

**E. COURSE MATRIX**

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| **CO2** | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **CO3** | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **CO4** | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: ENTREPRENEURSHIP AND INNOVATION**

| Teaching Scheme (Hours) | | | Examination Scheme (Marks) | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | PW | Total | Lect | Tut | Prac | Total |
| 2 | - | 1 | 60 | - | 25 | 25 | 110 | 2 | - | 0.5 | 2.5 |

Reference Code OEC

**A. COURSE OVERVIEW**

This Innovation and Entrepreneurship course focuses on the interconnection between entrepreneurial thinking and innovation. Specifically, we look at models used in Silicon Valley to grow both start-up companies as well as innovation inside large organizations. This course addresses critical areas for successful growth, including design thinking, open innovation, business models, product-market fit, and financing. This course will teach you how to think like an entrepreneur and provide you with the models, tools, and frameworks to further develop your business or idea.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] INTRODUCTION TO SUSTAINABLE ENTREPRENURSHIP**

Sustainability, Innovation and Society: Sustainability: The Concept for Modern Society, Challenges for the Future; Innovation and Entrepreneurship: The Invisible Cycle; Sustainability, Ethical Perspectives; International Perspective on Entrepreneurship.

**[2] BUSNESS RELATED CONCEPTS AND CSR STRATEGY**

Business Related Concepts: Entrepreneurship: A Driver for Innovation, Next Stage of Responsible Business; Entrepreneurship: Introducing Shared Innovation into the Business Model; the Evolution of CSR from Compliance to Sustainable Entrepreneurship; How to Design CR Strategies that Optimize Impact for Business and Society.

**[3] CORPORATE CAPABILITY MANAGEMENT**

Implementation and Instruments: Embedding Entrepreneurship in Companies: The Eternal Internal Challenge; Fostering Sustainable Innovation within Organizations; Corporate Capability Management: Collective Intelligence in Use for Improvement on a Company's Sustainability, Innovativeness and Competitiveness.

**[4] SOCIAL ENTREPRENURSHIP**

New perspectives: Social Entrepreneurship/ Responsible Entrepreneurship; Sustainability and SMEs: The Next Steps; Risk Management Issues; Marketing issues; funding a venture; presentation on idea generation by students for their business; writing, refining and
presenting the business model for the proposed business idea.

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Weidinger, C. (2014). Sustainable Entrepreneurship Business Success through Sustainability. Springer. Leal-Millan, A., Peris-Ortiz, M., & Leal-Rodríguez, A. L. (2018). Sustainability in Innovation and Entrepreneurship. Springer International Publishing: Cham, Switzerland.
2) Sharma, S., Starik, M., & Wuebker, R. (2008). Sustainability, innovation and entrepreneurship: introduction to the volume.
3) Nicolopoulou, K., Karatas-Ozkan, M., Janssen, F., & Jermier, J. M. (Eds.). (2016). Sustainable entrepreneurship and social innovation. Taylor & Francis.
4) Wagner, M. (Ed.). (2017). Entrepreneurship, innovation and sustainability. Routledge.
5) Larson, A. (2011). Sustainability, innovation, and entrepreneurship

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Analysis | Understand and imbibe the concepts of sustainability and sustainability entrepreneurship opportunities that arise even in crisis situations |
| **CO2** | Synthesis | Learn ecological problems facing local and global communities and recognize. |
| **CO3** | Analysis | Evaluate the rewards and risks of undertaking Sustainable Entrepreneurship |
| **CO4** | Application | Learn to exploit opportunities in the form of innovative products, services, and production processes that alleviate social or environmental conditions. |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 0 | 0 | 0 | 3 | 3 | 1 | 1 | 0 | 0 | 3 |
| **CO2** | 0 | 3 | 3 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| **CO3** | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 0 | 0 | 0 | 2 |
| **CO4** | 0 | 0 | 3 | 2 | 0 | 2 | 3 | 2 | 0 | 0 | 0 | 1 |

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC-5XX) INSTRUMENTATION SOFTWARE TOOLS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code PEC

**Program Elective I**

**A. COURSE OVERVIEW**

Simulation and GUI development are amongst most important areas of instrumentation. While, simulation provides an opportunity to study the aspects that are physically unrealizable and feasible, GUI development enables user-friendly operation of a process interface. The course provides learning of Simulation and GUI Designing software. Using simulation software, the students can design-develop models, study, analyze and solve engineering problems to consolidate theoretical learning. Using GUI development platform, simple-effective-user friendly GUIs can be designed and implemented to cater to need-based custom solutions and facilitate human-machine interaction.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] Introduction to Scilab**

The Scilab, Scilab architecture, Installation and setting up Scilab, Scilab environment, Syntax

**Scilab data types**

Constants, Constant matrices, String matrices, Polynomials, Boolean operations, Matrix operations

**[2] Programming with Scilab**

Programming structures: Operators–General, Arithmetic, Conditional, Boolean type operators

Structures–Conditional, Loop structures: FOR loop, DO WHILE Loop, Functions, Selected data types

**[3] Graphics under Scilab**

The graphics window, The media, Plotting parameters, 2D plotting, Graphics library

**[4] Formatted Input and Output (Lab content)**

Scilab environment, General display commands, Output commands, Input commands, Commands for files

**[5] Introduction to LabVIEW**

Introduction, Advantages of LabVIEW, Software environment, Creating and saving a VI, Front panel toolbar, Block Diagram toolbar, Palettes – Tools, controls and functions palettes, Front Panel controls and indicators, Block diagram – terminals, nodes, functions, SubVIs, Express Vis and wires, Data types, Data flow diagram

**Modular Programming**

Introduction, Modular programming in LabVIEW, Build a VI front panel and block diagram, Icon and connector pane, Creating an icon, Building a connector pane, Displaying SubVIs and express Vis as icons or expandable nodes, Creating SubVIs from sections of a VI, opening and editing SubVIs

**[6] Repetition and Loops**

Introduction, FOR loops, WHILE loops,

**Arrays**

Introduction, Arrays in LabVIEW, Creating one-dimensional array controls, indicators and constants, Creating two-dimensional arrays

**Clusters**

Introduction, Creating cluster controls, indicators and constants, Order of cluster elements, Cluster operations, Assembling-Disassembling clusters, Conversions between Arrays and Clusters

**Structures**

Introduction, Case structures, Formula nodes

**[7] Graphical system design (Lab content)**

Introduction, Graphical System Design (GSD) model, Design flow with GSD, Virtual Instrumentation, Virtual Instrument (VI) and Traditional Instrument, Hardware and software in VI, VI for test, control and design, GSD using LabVIEW, Graphical programming and textual programming

**Plotting data (Lab content)**

Introduction, Types of waveforms, Waveform graphs, Waveform charts, Waveform data type, XY graphs

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Virtual Instrumentation using LabVIEW, Jovitha Jerome, Prentice Hall of India
2) Programming in Scilab 4.1 by Vinu V. Das, Newage Publication
3) Notes on Scilab, Gary Bunting
4) Introduction to Scilab, Michael Baudin, Scilab Consortium
5) Virtual Instrumentation using LabVIEW, Sanjay Gupta & Joseph John, Tata McGraw Hill


## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To understand the significance and use of modelling-simulation and Graphical Use Interface (GUI) design |
| **CO2** | Application | To write simulation program using SCILAB software and to write graphical programs for GUI development |
| **CO3** | Application | To build models for simulation study and data acquisition applications to cater customized requirements |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **CO2** | 2 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 2 | 0 | 2 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

## F. LIST OF EXPERIMENTS

1. Introduction to LabVIEW
2. Using loops in LabVIEW
3. Arrays and Clusters in LabVIEW
4. Decision Making using Case Structures in LabVIEW
5. File Handling in LabVIEW
6. Introduction to Scilab
7. Matrix Algebra in Scilab
8. Using loops and logical operators in Scilab
9. Graphical data presentation in Scilab
10. File handling in Scilab

## B. TECH. SEMESTER – V (IC)

## SUBJECT: MICROCONTROLLER FUNDAMENTALS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code PCC

### A. COURSE OVERVIEW

Microprocessors are used extensively in the design of any computing facility. On the other hand, microcontrollers are single chip computers, integrating processor, memory and other peripheral modules into a single System-on-Chip (SoC). The use of microcontrollers in industrial and domestic electrical devices has become ubiquitous over the past decade. Engineers associated with Instrumentation/Electrical domain need to have an understanding of such embedded systems, both hardware and software. The aim of this subject is to equip students with programming and analytical skills required for embedded system implementation. Specifically, the students would be able to comprehend 8 bit microcontroller and microprocessor architectures. Additionally, this course would enable students to program microcontrollers in high level as well as assembly languages.

### B. DETAILED SYLLABUS

**NO TOPIC**

**[1] INTRODUCTION TO MICROPROCESSOR & MICROCONTROLLER**
Introduction to Microprocessors, Basic information about Instruction Set & Assemble Language, Introduction to CISC & RISC Architecture, Difference between Microprocessor & Microcontroller and Example Application Discussion

**[2] MICROPROCESSOR 8085 ARCHITECTURE, MEMORY & I/O DEVICES INTERFACING**
Microprocessor Architecture & Its Operation, Memory Devices, I/O Devices, Logic Devices for Interfacing, Memory Interfacing, I/O Interfacing, Timing diagram & Applications

**[3] AVR ARCHITECTURE & ASSEMBLY LANGUAGE PROGRAMMING**
Architecture, Memory Map & Registers of AVR, Assembly Programming, Data Move Instructions and I/O Port Programming, Branch & Call Operations, Arithmetic Instructions and Programs

**[4] AVR TIMERS & INTERRUPTS**
Programming Timers 0, 1 and 2, Counter Programming, Timer Programming in C, AVR Interrupts, Programming of Timer & External Hardware Interrupts, Interrupt Priority, Interrupt Programming in C, Serial Port Connection of ATMEGA & Programming in C and Assembly Language

**[5] BASICS OF SERIAL COMMUNICATION**
Basics of Serial Port Communication, SPI & I2C Bus.

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Microprocessor Architecture, Programming and Applications with the 8085, by R. S. Gaonkar, Penaram International Publishing (India) Private Limited.
2) The AVR Microcontroller & Embedded Systems, by Mahuammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Pearson Publication.
3) Embedded Systems, by B. Kanta Ra, PHI.
4) Fundamentals of Microprocessors & Microcomputers ,b y B. Ram, Dhanpat Rai Publications.
5) Microprocessor Application in Control & Instrumentation by Bibbero
6) PROGRAMMING AND CUSTOMIZING THE AVR MICROCONTROLLER BY DHANANJAY GADRE

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Analysis | To conceptually differentiate and comprehend microprocessor & microcontroller architectures, to analyse different microcontroller datasheets |
| **CO2** | Application | To build programming logic/logical flowcharts and utilize features of AVR Atmega microcontroller |
| **CO3** | Application | To perform assembly language & C programming for AVR Atmega microcontrollers using suitable programming tool |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **CO2** | 0 | 0 | 3 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 0 | 0 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## F. LIST OF EXPERIMENTS

1. Introduction to 8085 microprocessor
2. Microprocessor : Pin functions , Data operations and Timing Diagrams
3. Introduction to AVR/Atmel Studio
4. Basics of AVR Assembly Language
5. Advanced Data Transfer
6. Branching & Looping
7. Arithmetic, Logical Instructions & Programs
8. I/O port programming & Programming Logic
9. AVR Timers/Counters
10. Introduction to AVR microcontroller kit

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC-5XX) MODELING, SIMULATION, AND EVOLUTIONARY TECHNIQUES**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code PEC

**Program Elective I**

**A. COURSE OVERVIEW**

Novel techniques are emerging for mathematical optimization of control systems aiming to overall enhancement of manufacturing units. Using computer or microprocessor based control systems; such techniques are first simulated and then implemented to solve long pending process control problems of the industry. This course provides knowledge about modeling and simulation of various types of controllers. Using this learning, students can learn to build and analyze different models of controllers and advanced control algorithms leading to intelligent process control strategies.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] Introduction:**

Introduction, Objectives of the course, Overview of the course, Classification of Systems, Models, Purposes of Modelling, Classification of Models, Modelling Techniques, System Variables.

**[2] Simulation:**

Explanations of System, Modelling and Simulation, Classification of System Models, Step-wise Procedure for Simulation Study, Advantages and Disadvantages of Simulation, Basic Flow Chart for Simulation Study

Monte-Carlo Simulation Technique, Step-wise Procedure for Monte-Carlo Simulation Technique, Verification and Validation of Simulation Models, Various techniques of model validation.

**[3] Fuzzy Logic Control (FLC):**

Introduction, Fuzzification and Defuzzification of models, Fuzzy sets and set operations, Elementary Fuzzy Operators, Step-wise Procedure for Design of FLC using Matlab, Detailed Explanation of Matlab Fuzzy Logic Toolbox and its usage, Design of Fuzzy Controller, Design of Fuzzy Logic based Controller

**[4] Artificial Neural Networks (ANN):**

Architecture Introduction to ANN, ADALIN, Learning method Delta Rule, MSE based Training to ADALIN, Adaptive Filtering, Tapped Delay Line, Adaptive Filter, Basic ANFIS, ANFIS Learning Algorithms, Step-wise Procedure to setup ANFIS using Matlab Takagi-Sugeno FIS, Mamdani FIS, Mamdani v/s Sugeno

**[5] Evolutionary Techniques:**

Introduction to Genetic Algorithms (GA), Darwin's Observation, Darwin's Theory – Natural Selection, Terminology of GA, Applications of GA, Controller optimization using GA, Kohonon's Self Organizing Map (SOM), Hopfield Neural Network

## C. RECOMMENDED TEXT / REFERENCE BOOKS


[1] Process Control–Principles and Applications by Surekha Bhanot, Publisher: Oxford University Press.

[2] Introduction to Artificial Neural Systems by Jacek M. Zurada, West Publishing Company, USA.

[3] Advanced Control Engineering by Ronald S. Burns, Butterworth-Heinemann Publishers, USA.

[4] Genetic Programming – On the Programming of Computers by Means of Natural Selection by John R. Koza, A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England.

[5] Optimization of PID controller using Ant Colony and Genetic Algorithms by Unal, Tpuz and Erdal, 2013 edition, Springer

[6] Design of Fuzzy Controllers by Jan Jantzen, Tutorial Paper, Department of Automation, Technical University of Denmark, Denmark.

[7] G. D. Sousa, B. K. Bose, "A Fuzzy Set Theory based Control of a Phase-controlled Convertor DC Machine Drive", IEEE Trans., Vol. IA – 30, no. I, pp. 34-44.

[8] Process Control and Optimization, Instrument Engineer's Handbook, Volume II by Bela G. Liptak, 2006 Edition, Taylor and Francis, CRC Press, USA.

[9] Aris R., "Mathematical Modelling, Vol. 1: A Chemical Engineering Perspective (Process System Engineering)", Academic Press, 1999.


Referred Research Publications:


- M. Godoy Simoes, Bimal K. Bose and Ronald J. Spiegel, "Fuzzy Logic based intelligent control of a variable speed cage machine wind generation system", IEEE Trans. on Power Electronics, Vol. 12, pp. 87-95, Jan. 1997.
- M. Godoy Simoes, Bimal K. Bose and Ronald J. Spiegel, "Design and Performance Evaluation of a Fuzzy Logic based Variable Speed Wind Generation System", IEEE Trans. on Industry Applications, Vol. 33, pp. 956-965, July-Aug. 1997.


+Class Notes and Discussions in Theory and Laboratory Sessions

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To understand the significance and use of simulation based study and choice of suitable models and techniques |
| **CO2** | Application | To learn and apply Fuzzy Logic Control (FLC) for customized needs |
| **CO3** | Application | To learn and apply Artificial Neural Network(s) (ANN), Genetic Algorithms (GA) to suit custom requirements |

## E. COURSE MATRIX

| POs COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **CO2** | 2 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 2 | 0 | 2 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

## F. LIST OF EXPERIMENTS

1. Introduction to Modeling and Simulation
2. Modeling of simple process control systems
3. Evolutionary techniques, classification, and application criteria
4. Fuzzy Logic: concepts, terminologies, and application development
5. Fuzzy Logic: design and implementation
6. Genetic Algorithms: concepts, terminologies, and application development
7. Genetic Algorithms: design and implementation
8. Artificial Intelligence and Neural Networks: concepts, design and application development
9. Adaptive system design and tuning approaches
10. Case study: classical, Fuzzy Logic, Genetic Algorithms and ANFIS

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC-517) PROCESS MEASUREMENT**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**PCC**

A. **COURSE OVERVIEW:** This course provides knowledge about the measurement of process parameters like Pressure, temperature, Flow and Level. Measurement of these parameters is a very important and crucial part of plant engineering specially in process and manufacturing industries. Further, the knowledge of the measuring equipment is very essential for Instrumentation and control engineering students.

B. **DETAILED SYLLABUS**

**NO TOPIC**

**[A] PRESSURE MEASUREMENT:**

Manometers, Elastic type – Bourdon tube, diaphragm, bellows elements, Bell gauges, Solid State, Piezo-elastic and vibrating element type pressure transducer, Vacuum gauges Mechanical and electric types, differential pressure transmitter, ISA/ANSI/IEC Standards for pressure measurement devices

**[B] FLOW MEASUREMENT:**

Theory of flow system, Reynold's number, Variable pressure (Head) type meters-orifice, Orifice calculations and installation, Venturi tube, Pilot tube, Flow nozzle. Variable Area meters-rotameter, Open channel meters, Mass flow meters, Velocity meters, Quantity meters, Electomagnetic flow meter, turbine flow meters, Ultrasonic flow meters, Vortex flow, Anemometers, Flow markers, Laser anemometers, Flow measurement for solid materials, ISA/ANSI/IEC Standards for flow measurement devices

**[C] LEVEL MEASUREMENT:**

Theory of level measurement, Float gauges, Differential pressure type level measurement technique, Level measurement by weighing, bubbler technique, thermal effect type, Capacitance type, Ultrasonic and radiation type level measurement techniques, level measurement in open vessels and pressure vessels, Measurement of interface levels, Measurement of level of dry material, ISA/ANSI/IEC Standards for level measurement devices

**[D] TEMPERATURE MEASUREMENT:**

Liquid Gas and Vapour filled thermometers, Bimetal thermometers, Resistance Thermometers RTD, Thermisters, Thermo electric temperature measurement technique Thermocouples and thermopiles Radiation thermometers optical and electrical pyrometers Accuracy and response characteristic of different devices, Differential Temperature measurement, ISA/ANSI/IEC Standards for temperature measurement devices

C. **RECOMMENDED TEXT/REFERENCE BOOKS**


[1] Industrial Instrumentation, D.P. Eckman. , CBS Publishers and Distributers
[2] Principles of industrial instrumentation , D Patranabis, Tata Mc Graw Hill
[3] Industrial Instrumentation and Control, S.K.Singh, Tata Mc Graw Hill
[4] Instrumentation Devices and system , Rangan, Sharma, Mani, McGraw Hill Education
[5] Instrumentation, Measurement and Analysis , B.C. Nakra & K. K. Chaudhary , McGraw Hill
[6] Mechanical And Industrial Measurements, R. K. Jain, Khanna Publishers
[7] Modern Sensors Handbook, Pavel Ripka, Wiley
[8] Industrial Instrumentation- Principles & Design , Tattamangalam R.Padmanabham, Springer
[9] Instrumentation and Process Measurement , W.Bolten, Universities Press
[10] Instrumentation Measurement and Control , A.K. Ghosh, PHI

## D. COURSE OUTCOMES

After completion of the course students should be able to:

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Describe working principle and operation of various transducers/sensors for process measurements applications |
| **CO2** | Understand | Describe the construction of various instruments used for measurement of process parameters like pressure, temperature, level and flow in automation and control |
| **CO3** | Analyze | Describe and analyze various standards and characteristics of the sensors for process parameters like pressure, temperature, level and flow in automation and control |
| **CO4** | Apply | Describe features of measuring devices for selection, calibration, installation and commissioning of instrumentation systems. |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | **3** | **3** | **2** | **1** | **0** | **1** | **3** | **2** | **1** | **1** | **0** | **2** |
| **CO2** | **3** | **3** | **2** | **1** | **0** | **1** | **2** | **1** | **1** | **1** | **0** | **2** |
| **CO3** | **3** | **3** | **3** | **2** | **0** | **1** | **2** | **1** | **1** | **1** | **0** | **2** |
| **CO4** | **3** | **3** | **2** | **2** | **0** | **1** | **3** | **2** | **1** | **1** | **0** | **2** |

## F. LIST OF EXPERIMENTS

1. To find out input output characteristic of RTD
2. To find out time constant of given RTD
3. To find out input output characteristic of Thermocouple
4. To find out time constant of given Thermocouple
5. To find out characteristic of Thermistor
6. To measure temperature of an object using non contact thermometer
7. To find out characteristics of given strain gauge pressure transducer
8. To find out characteristics of given piezoelectric pressure transducer
9. To measure flow using orifice plate
10. To measure flow using Venturi tube
11. To measure level in a tank using hydrostatic level sensor
12. To measure level in a tank using Ultrasonic level sensor

## B. TECH. SEMESTER – V (IC)
## SUBJECT: SENSORS AND TRANSDUCERS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

PCC

### A. COURSE OVERVIEW

Sensors and Transducers is a prominent course to make the students aware about importance of measurement in control system design-development along with classification and terminologies of measurement Techniques and to learn about specifications, selection criteria and characteristics of instrumentation measurement systems

### B. DETAILED SYLLABUS

**NO. TOPIC**

**[1] FUNDAMENTAL INSTRUMENTATION**

Basic concepts of measurement , Fundamental elements of measurement system, Applications of instrumentation systems, Classification of Instruments, Standards & calibration, Errors & Uncertainties in performance parameters, Static performance parameters, Impedance loading & matching, Selection of the instrument, Formulation of system equations, Dynamic response

**[2] INDUSTRIAL MEASUREMENT**

Displacement Measurement: Introduction, Principles of transduction (variable resistance, inductance, reluctance and capacitance type transducers), digital transducers, measurement of Acceleration

Speed Measurement: Introduction, Mechanical tachometers: Revolution counter, Centrifugal force tachometer, Resonance tachometers, Electric tachometers: Eddy current type tachometers, Electric Generator type tachometers, Contactless type tachometers, Frequency type tachometers, Ignition type tachometers, Stroboscopic tachometers, Pneumatic type speed transmitting elements, Measurement of Speed, Frequency and Short Time Intervals by direct application of frequency standards by comparative methods.

**[3] PROCESS PARAMETERS MEASUREMENT**

Measurement of Humidity, Specific gravity and Viscosity, Measurement of pH & conductivity.

**[4] STRAIN MEASUREMENT**

Introduction, Factors affecting strain measurements, Types of strain gauges, Theory of operation of resistance strain gauges, Types of electrical strain gauges, Materials for strain gauges, Gauging techniques and other factors, Strain gauge circuits

**[5] VIBRATION MEASUREMENT**

Introduction, Characteristics of vibration, Analysis of vibration sensing devices, Vibration sensing devices, Signal conditioners, Shock measurements, System characteristics, Vibration exciters, Calibration

**[6] BASICS OF ANALYTICAL INSTRUMENTS**

Basic elements of analytical instruments, Basic Introduction mass Spectrometers, IR Spectrophotometers and UV Spectrophotometers, Introduction of chromatography – Gas Chromatography

## C. RECOMMENDED TEXT / REFERENCE BOOKS

**G.** Instrumentation Devices & Systems by Rangan, Sharma & Mani, 2nd edition-2005
**H.** Mechanical & Industrial Measurement by: R.K. JAIN, 11h Edition- 2004
**I.** Handbook of Analytical Instruments by: RS Khandpur, 16th reprint -2005
**J.** Instrumentation Measurement & Analysis by: B.C. NAKRA & K. K. CHAUDHRY,3rd edition-2013
**K.** Mechanical & Industrial Measurement by: R.K. JAIN, 11th Edition-2004
**L.** Handbook of Analytical Instruments by: R. S. KHANDPUR
**M.** Instrumentation devices & systems by RANGAN, SHARMA & MANI
**N.** Industrial Instrumentation Fundamentals by: A.E.FRIBANCE

## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Develop awareness about needs of measurement systems along with their design-development, classification and associated technical terminologies |
| **CO2** | Synthesis | Understand criteria to design measurement system |
| **CO3** | Application | Develop measurement system for different process parameters as per standards. |
| **CO4** | Understand | Understand static & dynamic characteristics of instruments |
| **CO5** | Analysis | Learn methods and applications in the field of analytical instrumentation. |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO2** | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO5** | 2 | 2 | 0 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 1 |

**F. LIST OF EXPERIMENTS**

1. Demonstrate the characteristics of Linear Variable Displacement Transformer
2. To Perform the characteristics of Light Dependent Resistor
3. To Perform the characteristics of Strain Gauge
4. Demonstrate the characteristics of Capacitive Pick-up
5. Observe characteristics of Piezoelectric Pick-up
6. Demonstrate the working of Proximity Switch
7. Measurement of pH of different solutions using Combination Electrode.
8. Measurement Of Conductivity Using Conductivity Cell (DIGITAL).
9. Measurement of Relative Humidity.
10. To study the Gas Chromatography

# B. TECH. SEMESTER – VI IC

## SUBJECT: (IC-6XX) EMBEDDED SYSTEMS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code PEC

**Type of Course:** Program Elective-III

**Prerequisite:** Basic Programming, Digital Electronics

**Rationale:** Microcontrollers are single chip computers, integrating processor, memory and other peripheral modules into a single System-on-Chip (SoC). Engineers associated with the Instrumentation/Electrical domain need to have an understanding of such embedded systems, both hardware and software. This subject will equip students with programming and analytical skills required for embedded system implementation. Specifically, the students would be able to comprehend ARM controller architectures.

**A. OBJECTIVES OF THE COURSE**

- To understand architecture of ARM microcontrollers
- To equip with skills required for microcontroller system implementation
- To write programs for ARM microcontrollers as per requirement

**B. DETAILED SYLLABUS**

**[A] TECHNICAL OVERVIEW OF ARM CORTEX M3 & M4 PROCESSORS**

General Information & Features of ARM Processors

**[B] ARM ARCHITECTURE**

Introduction, Programmer's model, Application Program Status Register (APSR), Memory Exceptions & Interrupts, System Control Block, Debug, Reset & Reset Sequence, Architecture Over view of STM324xx Cortex M4, Introduction to Memory & Bus Architecture

**[C] INSTRUCTION SET**

Introduction & Comparison of Instruction set of M4 Processor, Understanding Assembly Language Syntax, Unified Assembly Language, Instruction Set , Cortex M4 Specific Instruction Set, Barrel Sifter

**[E] MEMORY SYSTEM**

Memory System Feature, Memory Map, Interfacing of Processor to memory & peripherals, memory requirement, Data Alignment & Unaligned data access support, Bit band Operation ,Memory access permission & attributes, Memory barriers & memory system in microcontroller, Embedded flash memory interface of STM32, Overview of memory protection unit

**[E] EXCEPTIONS AND INTERRUPTS**

Overview of Exceptions & Interrupts, Types of Exceptions, Interrupt management, Priority & Vector Table, Interrupt Input & Pending Behaviours, Exception Sequence Overview , NVIC Registers for interrupt control, SCB Registers for interrupt & exception Control, Special Registers for Exception or Interrupt masking, Examples & Software Interrupts, Exception Handling in C, Exception Sequence, Exception Handling Optimisation.

**[F]FLOATING POINT OPERATION & DSP**

Floating Point data Presentation, FPU of Cortex M4, Lazy stacking, Floating Point operation in C, Floating point exceptions, DSP on a microcontroller, Dot product, Cortex-M4 DSP instructions, Writing optimized DSP code. Writing optimized DSP code

**[G]INTRODUCTION TO CORTEX M4 PERIPHERALS**

Power Control, Reset & Clock Control, System Configuration Controller, General Purpose Digital I/O, Watch Dog Timer, Basic Timer, General Purpose Timers, Advanced Control Timers, Real Time Clock, Analog to Digital Converter, PWM & DMA Controller

**C. COURSE OUTCOMES**

After completion of the course students should be able to:

i To conceptually comprehend advanced microcontroller architectures/systems

ii To utilize/apply features of embedded system and build programming logic/logical flowcharts

iii To write/create assembly language and C programs for AVR microcontrollers

Mapping of CO's and PO's (number grading)

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **CO2** | 0 | 0 | 3 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 0 | 0 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**D. RECOMMENDED TEXTBOOKS**

1. The Definitive Guide to ARM® CORTEX® -M3 and CORTEX® -M4 Processors (Third Edition) By: Joseph Yiu, Newnes, Elsevier

2. Embedded Systems By: B. Kanta Rao , PHI Learning Private Limited.

3. STM32F4xx Reference Guide By: Silicon Technologies

**E. REFERENCE BOOKS AND NOTES**

1. Mastering STM32 ,A step-by-step guide to the most complete ARM Cortex-M platform, using a free and powerful development environment based on Eclipse and GCC, By: Carmine Noviello

**F. LIST OF EXPERIMENTS**

1. Getting Started with Integrated Development Environment ( Student Edition Open Source)
2. System Clock & Configuration Programming
3. Digital I/O Programming
4. General Purpose Timer & Time Delay Applications in C
5. Advanced Timer Applications Programming in C
6. DMA Application Programming in C
7. ADC Application Programming in C
8. UART Application Programming in C
9. SPI & I2C Programming in C
10. Temperature Monitoring

**B. TECH. SEMESTER – VI (IC)**

## SUBJECT: INTRODUCTION TO R PROGRAMMING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 0 | 2 | 4 | 3 | 60 | 0 | 0 | 0 | 60 |

Reference Code OEC

### A. COURSE OVERVIEW

**Type of Course:** Open Elective

**Prerequisite:** Basic Programming, C Programming

**Rationale:** Since the world is marching towards a future that would be highly dependent on to data in order to analyze, evaluate the underlying information. R is an open source programming language which is widely accepted and used for data analysis and graphics design. R lets you clean, organize, analyze, visualize, and report data in new and more powerful ways. In this course the students will learn how to program in R and how to use R for data analysis.

### B. DETAILED SYLLABUS

| NO | TOPIC |
|---|---|
| [1] | **INTRODUCTION**<br>Introduction, Overview and History, R Console Input and Evaluation, Data Types, Reading Tabular Data, Textual Data Formats, Subsetting, Vectorized Operations |
| [2] | **PROGRAMMING IN R**<br>Control Structures - If-else, Control Structures - For loops, Control Structures - While loops, Control Structures - Repeat, Next, Break, Functions, Scoping Rules, Statistical analysis in R : Descriptive Statistics, Measures of Central Tendency and variability, Skewness, Correlations, Simple Linear Regression |
| [3] | **LOOP FUNCTIONS & DEBUGGING**<br>Loop Functions – lapply, apply, mapply, tapply, split ; Diagnosing problems, Basic Tools |
| [4] | **DATA VISUALIZATION**<br>Using ggplot, Enhancing visualizations, Aesthetics, Saving visualizations |

### C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Hadley Wickham, Garrett Grolemund, R for Data Science, O' Reilly Publications.
2) The Book of R, Tilman M. Davies, No Starch Publications.
3) Daniel Joseph Navarro, Learning Statistics with R, Lulu Press Incorporated.
4) Garett Grolemund, Hands on Programming with R, O' Reilly Publications.
5) Advanced R, Hadley Wickham, CRC Press.

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Analysis | To comprehend critical programming language concepts |
| **CO2** | Analysis | To analyse data and discover meaningful information |
| **CO3** | Application | To implement techniques for data analysis and visualization |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **CO2** | 0 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## F. LIST OF EXPERIMENTS

1. Study of basic Syntaxes in R
2. Vector data objects operations
3. Matrix, array and factors and perform va in R
4. Use of data frames in R
5. Data manipulation with R
6. Data Manipulation with dplyr package
7. Data Manipulation with data.table package
8. Control structures in R
9. Data Visualization with ggplot
10. Lab Project

## B. TECH. SEMESTER – VI (IC6XX)
## SUBJECT: INSTRUMENTATION SYSTEMS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code PCC

### A. COURSE OVERVIEW

This course provides useful information regarding standard P&I diagrams and their interpretation. This course also provides useful information for standard instrument installation practices and safety instruments and related aspects. The course also provides knowledge about DCS architecture, networking fundamentals and application of industrial networking for automatic industrial process control.

### B. DETAILED SYLLABUS

**NO** **TOPIC**

**[1] INTRODUCTION & SYMBOLS**

Introduction to instrumentation system, Standard instrumentation system symbols, Symbols for Distributed Control Systems, Standard P & I diagrams for typical instrumentation systems.

**[2] INSTRUMENT AIR SYSTEMS**

Sizing criteria, Pressure level, air supply source, compressor systems, dryers, Distribution systems, case purging for electrical area classification

**[3] CONTROL CENTRES AND CONTROL PANELS**

Control rooms, layout, Uninterruptible power supply, electrical classifications, Control panel types, graphical displays, Panel inspection

**[4] INDUSTRIAL NETWORKING**

An introduction to networking in process automation, Serial Communication, communication formats,error checking, encoding, communication modes, Serial interface standards, RS-232, RS-422, RS-485, USB, HART network, Field buses, MODBUS, PROFIBUS, FOUNDATION, Infrared, Radio and Wireless LAN networks, Introduction to OLE and OPC.

**[5] DISTRIBUTED DIGITAL CONTROL SYSTEMS**

Introduction, History, Architecture of DCS, Architecture of DCS components – like Process Control Units, Single Loop & Multi Loop Controllers, Man-Machine Interface, Key-board units, Engineering unit etc., Typical graphics display used in DCS, Architecture of some popular DCS.

**[6] INSTALLATION PRACTICE**

Installation practice for commissioning, maintenance & renovation of a plant. Documents required for installation of instrumentation systems. Testing of different instruments. Industry Standards & Recommended Practices for the installation & maintenance of various Instruments.

**[7] SAFETY DEVICES**

Pressure safety valves, pressure relief valves, pressure switch, rupture disc, flame arrester, intrinsic safety

## C. RECOMMENDED TEXT/REFERENCE BOOKS

1) Applied Instrumentation in Process Industries, Vol. I and II by Andrews & Williams
2) Instrument Engineer's Handbook (Process Control), by B. G. Liptak
3) Computer based industrial control, by Krishnakant, 1997 edition
4) PC-based Instrumentation Concepts and Practice by N. Mathivanan

## D. COURSE OUTCOMES

| CO NUMBER | SKILL | STATEMENT |
|---|---|---|
| **CO1** | Application | To understand, interpret, design and apply P and I diagrams |
| **CO2** | Understand | To understand instrument air systems and control room supply systems |
| **CO3** | Understand | To study and understand working of safety devices and standard installation procedures for instruments |
| **CO4** | Analysis | To understand distinguishing architectures of popular DCS and industrial networking |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 0 | 3 | 0 | 0 | 0 | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 2 | 0 | 3 | 0 | 0 | 0 | 2 | 2 | 1 | 1 |

## F. LIST OF EXPERIMENTS

1. Instrumentation symbols and their interpretation
2. Uninterruptible Power supply.
3. P and I diagrams using Smart Draw – software tool
4. Compressor for Instrument Air supply system
5. Pressure switch
6. Air Filter and Regulator unit for instrument air supply
7. Strip Chart Recorder
8. Application of MODBUS communication
9. HART protocol and its applications
10. DCS architecture

## SUBJECT: MICROCONTROLLER APPLICATIONS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code PEC

**Type of Course:** Program Elective-III

**Prerequisite:** Basic Programming, Digital Electronics, Microcontroller Fundamentals

**Rationale:** Microcontrollers are widely used in various applications to control products, devices, processes and systems and hence it is important for students involved with the domain of Instrumentation and Control as well as Automation. This subject will equip students with skills required to conceive and implement microcontroller based system.

### A. OBJECTIVES OF THE COURSE

- To utilize features of microcontroller system for various applications
- To design/implement required hardware circuits for sensing/measurement and control
- To write assembly and C programs for AVR microcontrollers for interfacing hardware components

### B. DETAILED SYLLABUS

**NO TOPIC**

**[1] AN AVR MICROCONTROLLER DESIGN**
Aspects of microcontroller design, Testing the Design, Timing Subroutine, Lookup Tables Concept

**[2] PROGRAMMING DISPLAYS**
LCD Pin diagram, LCD Interfacing, LCD Datasheet, LCD Timing diagram, LCD Programming : 8 bit mode, Programming and Interfacing : 4 bit mode, Seven Segment Display: Interfacing & programming

**[3] DATA ACQUISITION**
Different types of Keyboard, Keyboard Programming Issues, Keyboard programming logic, Keyboard Interfacing & programming, ADC Characteristics, Concept of Successive Approximation, ADC Programming, Internal ADC Programming, Sensor Interfacing and signal conditioning, DAC interfacing, Programming DAC for signal generation

**[4] ACTUATION**
Relay, Relay Interfacing, Optoisolators, Stepper Motor Construction, Interfacing & Programming, Stepper motor control : Normal 4 step sequence, Wave drive 4 step sequence, Half step 8 step sequence, Input Capture programming, Wave Generation in AVR , PWM Programming & DC Motor Speed Control, Multiplexers, Decoders, Encoders, Code Converters, Arithmetic Comparison Circuits

**[5] SERIAL**
Serial Data Communication, Serial Peripheral Interface, MAX7221 Display Interface using SPI, Inter IC bus, DS1307 RTC Interface using I2C, RS232 & RS485 Bus Communication applications using UART.

**[6] OTHER APPLICATIONS**
Measurement of frequency, Voltage, Current, Power, Temperature, Pressure, Level & Flow

### C. RECOMMENDED TEXT / REFERENCE BOOKS

1) The AVR Microcontroller & Embedded Systems, by Mahuammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Pearson Publication
2) Embedded Systems, by B. Kanta Ra, PHI
3) Fundamentals of Microprocessors & Microcomputers ,b y B. Ram, Dhanpat Rai Publications
4) Microprocessor Application in Control & Instrumentation by Bibbero
5) Programming and Customizing the AVR Microcontroller by Dhananjay Gadre

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Analysis | To understand, analyse criteria/features of microcontroller according to applications |
| **CO2** | Application | To design signal conditioning circuits, understand hardware components and protocols |
| **CO3** | Application | To develop high level and assembly language programs using internal organization of AVR architecture based microcontroller and build applications. |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| **CO2** | 3 | 0 | 3 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## F. LIST OF EXPERIMENTS

1. Introduction to AVR microcontroller kit
2. Buzzer test with delay
3. I/O Interfacing
4. LCD Display
5. Keyboard Interfacing
6. ADC Interfacing & LCD Display
7. Motion Control using L293 Driver IC
8. Real Time Clock display using DS1307
9. ULN 2003 high current driver Interfacing
10. Serial Communication using RS232

## B. TECH. SEMESTER – VI (IC)

## SUBJECT: PROCESS INSTRUMENTATION AND CONTROL

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code PCC

**Type of Course:** Program Core

**Prerequisite:** Measurement techniques, Process measurement and control theory

### A. COURSE OVERVIEW

Core subject for Instrumentation and Control Engineering undergraduate course. Using proper instrumentation and control systems maintain the proper ratio of ingredients, regulate temperatures and monitor outputs. Without this standard of control, products would vary and quality would be impaired. With improved quality comes higher levels of safety.

### B. DETAILED SYLLABUS

**NO TOPIC**

**[1] P/I AND I/P CONVERTERS**
Manometric transducers, Torque balance design, Oscillator type, electro pneumatic transducers, Transducer positioners, magnetic converters, differential transformer converters

**[2] CONTROLLER PRINCIPLES**
Introduction, process characteristics, control system parameters, discontinuous controller modes, continuous controller modes, composite control modes

**[3] CONTROL LOOP CHARACTERISTICS**
Introduction, control system configuration, Single and multivariable control systems, Control system quality, Stability, Process loop tuning

**[4] PNEUMATIC CONTROL VALVE AND ACTUATORS**
Introduction, operating mechanism of control valves, direction control valves, construction and working of control valves, Pneumatic Actuators, Selection of control valves and actuators

**[5] CONTROL VALVE CHARACTERISTICS**
Characteristics of control valves, rangeability, control valve selection, Sizing of control valves

### C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Process Control Instrumentation Technology, By: C. D. Johnson, Pearson Education Ltd
2) Industrial Instrumentation Fundamentals By: Austin Fribance, Tata McGraw Hill publication
3) Applied Instrumentation in Process Industries, Vol. II, By: W. G. Andrews/H. B.Williams, Gulf Publication Company
4) Control system components By: M. D. Desai, Pearson Prentice Hall, Inc
5) Measurement systems: Applications & Design By: Ernest Doeblin, McGraw Hill
6) Instrumentation measurement & analysis By: B.C. Nakra & K. K. Chaudhary, McGraw Hill
7) Mechanical & Industrial Measurement, By: R. K. Jain, Khanna Publishers
8) Transducers & Instrumentation, By: D. V. S. Moorty, PHI Learning Pvt.Ltd
9) Instrumentation-Devices & Systems, By Rangan, Sharma & Mani, Tata McGraw Hill publication

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Application | Understand the basic hardware components used in feedback control system design |
| **CO2** | Application | Design and analyze P, PI, PD, PID Controllers |
| **CO3** | Understand, Analysis | Understand and identify the criteria for selection for pneumatic control valve upon various selection parameters. |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| **CO2** | 3 | 0 | 3 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| **CO3** | 3 | 0 | 3 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |

## F. LIST OF EXPERIMENTS

1 To perform the working of the given I to P Converter.

2 To perform the working of the given P to I Converter.

3 To study and develop various controller simulations using Simulink

4 To simulate the Proportional controller.

5 To simulate the Proportional Integral controller.

6 To simulate the Proportional Integral Derivative controller.

7 To study various control valve cut sections

8 To study various Pneumatic actuators

9 To study various Pneumatic Control valves

10 To perform characteristics of Control valves

## B. TECH. SEMESTER – VI (IC)

## SUBJECT: POWER PLANT AUTOMATION

| Teaching Scheme (Hours) | | | Examination Scheme (Marks) | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | PW | Total | Lect | Tut | Prac | Total |
| 2 | 1 | - | 60 | - | - | - | 60 | 2 | 1 | - | 3 |

PEC

**Type of Course:** Program Elective-IV
**Prerequisite:** Measurement Techniques, Process Measurement
**Rationale:** Core subject for Instrumentation and Control Engineering undergraduate course. Modern Power Plant are having DCS/PLC systems. The purpose is to lessen the various automated control process in the power plant process. Also to add up as various numbers of process are going on it is quite difficult to maintain each and every process manually.

### A. OBJECTIVES OF THE COURSE

- To prepare students to acquire knowledge various types of power plants.
- To prepare students to acquire knowledge different control techniques for boiler and turbine.
- To prepare students to acquire knowledge about various interlocks and safety standards for turbine and generator.

### B. DETAILED SYLLABUS

**[A] Introduction to Power Plant:**
Plant overview, Role of Control and instrumentation in power plant, Classification of power plants: thermal, hydro, combined cycle and nuclear.

**[B] Boiler & Turbine Supervisory Control:**
Introduction, Operation, Drum level control, Combustion control, Turbovisory system, Measurement and analysis of gas, Super-heated steam temperature, Level, Pressure and Flow. Coordinated controls of boiler and turbine.

**[C] Power Plant Process:**
Boiler process, Turbine process, Fuel Handling Plant, Air Compressor, etc.

**[D] Power Plant Subsystem Automation:**
Control of mill throughput, Mill temperature control, Forced draught control, Feed pump control, Boiler-following-turbine load control, Advanced Gas Cooled Reactors (AGRs) .

**[E] Electrical Instruments and Metering:**
Recorders and Industrial Displays, Electrical Instruments and Metering Working of meters, Meter calibration.

**[F] Plant Optimization:**
Performance optimization of power plant with integrated Controls, Plant Optimization Performance measurement of power plant.

**[G]System Interlocks and Safety:**
Turbine Interlock and Protections, Interlock and Protections for Generator.

## C. COURSE OUTCOMES

| CO NUMBER | SKILL | STATEMENT |
|---|---|---|
| **CO1** | Understand | To understand, thermal power plant and nuclear power pant and understand the role of control and instrumentation in power plant. |
| **CO2** | Understand | To understand, solar power plant and wind power pant and understand the role of control and instrumentation in power plant. |
| **CO3** | Understand | To s understand various thermal power plant optimization performance parameters |

**D.** Mapping of CO's and PO's (number grading)

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 1 | 2 | 0 | 1 | 1 |

## E. RECOMMENDED TEXTBOOKS


[1] Modern Power Station Practice: Incorporating Modern Power System Practice: Vol. F- Control and Instrumentation. / by British Electricity International

[2] Instrumentation Engg's Handbook on Process Control- Bela G. Liptak

[3] Power plant Engineering – P. K. Nag, Mc Graw Hill, 3rd edition


## F. REFERENCE BOOKS AND NOTES


[1] Power plant instrumentation and control handbook – Swapan Basu and Ajaykumar Debnath, Academic Press, 1st edition

[2] Standard Handbook of Power plant Engineering– Thomas C. Elliot, Mc Graw Hill

[3] Energy and Power Generation Handbook – K. R. Rao, ASME Press

**B. TECH. SEMESTER – VIII(IC)**

**SUBJECT: (IC8XX) INDUSTRIAL INTERNSHIP & PROJECT**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 0 | 0 | 24 | 24 | 12 | 0 | 0 | 0 | 350 | 350 |

**PROJ**

**Type of Course:** Program Core

## A. DETAILED SYLLABUS

The students will undertake project work for the period of one semester. They should design/develop & fabricate the project. They are supposed to prepared and submit a project report as a part of their term-work for the project and give seminars on their project work. The students may be sent to the industry for their project and they are to timely report to the department regarding monitoring and necessary guidance. They should arrange for demonstration of the project work at the time of examination They are to be examined based on viva and/or demonstration.

## B. COURSE OUTCOMES

After completion of the course students should be able to:

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Make use of acquired knowledge of instrumentation for the problem identification and definition related to current industrial trends |
| **CO2** | Analysis | Industrial aspects of the project in a systematic way |
| **CO3** | Understand | Selection of modern tools and techniques for problem solving |
| **CO4** | Create | Perceive the possibility of scalability and scope of intellectual property rights |
| **CO5** | Apply | Demonstrate and conclude the project with effective communication amongst peers and mentors |

## C. Mapping of CO's and PO's (number grading)

| POs<br>COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 0 | 0 | 1 | 2 | 0 | 1 | 1 | 1 | 2 |
| **CO2** | 2 | 3 | 3 | 1 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 2 |
| **CO3** | 3 | 2 | 2 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| **CO4** | 2 | 2 | 2 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| **CO5** | 2 | 2 | 2 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |

**D. Mapping of CO's and PSO's (number grading)**

| PSOs<br>COs | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 2 | 2 | 3 |
| **CO4** | 2 | 2 | 2 |
| **CO5** | 2 | 2 | 2 |

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## ELECTRONIC MEASUREMENT (IC-301)

## SEM-III (2nd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 | 4 | -- | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

- To familiarize with the technology and practices in the area of Electrical & Electronic Measurement & Instrumentation.
- To develop different type of skills leading to the achievement of following competency, Operation & maintenance of various Electronic,
- Test and Measuring Instrument Measurement of different electrical parameters using variety of instruments

**B. DETAILED SYLLABUS**

**[A] MEASUREMENT AND ERROR:** Definitions, Accuracy and Precision, Significant Figures Types of Error, Statistical Analysis, Probability of Errors Limiting Errors.

**[B] SYSTEM OF UNITS OF MEASUREMENT:** Fundamental and Derived Units, Systems of Units, Electric and magnetic Units, International System of Units, Other Systems of Units, Conversion of Units.

**[C] STANDARDS OF MEASUREMENT :** Classification of Standards, Standards for Mass Length, and Volume, Time and Frequency Standards, Electrical Standards, Standards of temperature and Luminous Intensity, IEEE Standards.

**[D] DIRECT-CURRENT INDICATING INSTRUMENTS :** Suspension Galvanometer, Torque and Deflection of the Galvanometer, Permanent-Magnet Moving-Coil Mechanism, DC Ammeters, DC Voltmeters, Voltmeter Sensitivity, voltmeter, Ammeter Method of Measuring Resistance, Series-Type Ohmmeter Shunt-Type ohmmeter, Multimeter or VOM, Calibration of DC Instruments, Alternating-Current indicating instruments Thermo instruments, Electrodynamometers in Power Measurements Watt-hour Meter, Power- Factor Meter, Instrument Transformers.

**[E] BRIDGES AND THEIR APPLICATION:** Introduction, Wheatstone Bridge, Kelvin Bridge,
Guarded Wheatstone Bridge, AC Bridges and Their Application, Comparison Bridges, Maxwell Bridge, Hay Bridge, Schering Bridge, Unbalance Conditions, Wien Bridge, Wagner Ground Connection, Potentiometer.

**[F] ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAMETERS :** Amplified DC Meter, AC Voltmeter Using Rectifiers, True RMS- Responding Voltmeter, Electronic Multimeter, Considerations in Choosing an Analog Voltmeter, Differential Voltmeters, Digital Voltmeters, Component Measuring Instruments, Q Meter, Vector Impedance Meter, Vector Voltmeter, RF Power and Voltage Measurement.

**[G] OSCILLOSCOPES:** Introduction, Oscilloscope Block Diagram, Cathode Ray Tube CRT Circuits, Vertical Deflection System, Delay Line, Multiple Trace, Horizontal Deflection System, Oscilloscope Probes and Transducers, Oscilloscope Techniques, Special Oscilloscopes.

**C. LEARNING OUTCOMES**

At the completion of the course, the students will be able to....

- Understand concept, system of units and standards of measurement.
- Measure various electrical parameters with accuracy, precision and resolution, in any electrical/electronic system.
- Use AC and DC Bridge for relevant parameter measurement.
- Use CRO, DSO, Multimeter and LCR meter for appropriate measurement
- Test and troubleshoot electronic circuit using various measuring instruments.

**RECOMMENDED TEXTBOOKS**

**1.** Electronic Instrumentation and Measurement Technique, 5th Edition By: Wlliam D. Cooper & Albert D. Helfrick Publisher: Prentice Hall of India

**REFERENCE BOOKS**

1. Electrical & Electronic Measurement & Measuring Instruments, 17th Edition By: A.K. Sawhney Publisher: Dhanpat rai & Co.
2. Electronics Measurement & Instrumentation,1st Edition By: R.K.Rajput Publication: S. Chand & Company Ltd

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

1. To determine the resolution and internal resistance of Multimeter by measuring different electrical quantities in various ranges.
2. To study the operation and applications of CRO and DSO.
3. To determine the deflection sensitivity of CRT.
4. To study operation of LCR meter and to measure unknown value of component using LCR meter.
5. To measure unknown value of resistance using Wheatstone bridge.
6. To extend the range of an Ammeter.
7. To extend the range of a Voltmeter.
8. To Calibrate the D'Arsonval movement as a series type ohmmeter.
9. To determine frequency and phase using Lissajous Pattern on CRO/DSO.
10. To find modulation index of a modulated wave on CRO/DSO.
11. To measure high resistance using loss of charge method.
12. Design series type ohmmeter for a given half scale position resistance

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## CONTROL TECHNOLOGY: COMPONENTS & SYSTEMS (IC-408)

## SEM-IV (2nd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | - | 2 | 60 | 40 | 25 | 25 | 150 | 4 | -- | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

To prepare the students to gain knowledge about construction & operation of Control Systems Components and to determine basic structure of Control System Problem.

**B. DETAILED SYLLABUS**

**[A] INTRODUCTION TO CONTROL PROBLEM**

Control systems: Terminology and basic structure, the genesis and essence of feedback control theory, Feedback control structure, and Multivariable control systems.

**[B] MECHANICAL COMPONENTS:**

**CAMS AND FOLLOWERS:**

Introduction, Components of Cam, Types of Cam, Types of Followers, Classifications, Cam Motions, Cam Terminology, Cam Profile , Cam as a Mechanical Function Generator

**GEARS, CLUTCHES, BREAKS:**

Brief introduction of Integrators, Gears, Clutches, Break etc.

**[C] OPTO-ELECTRONIC DEVICES:**
Classification, Photoconductive, Photo Voltaic & Photo-emissive sensors with applications. Liquid Crystal Display device.

**[D] ELECTRO-MECHANICAL COMPONENTS:**
**POTENTIOMETER:**
Introduction, Type of Potentiometers, Applications, Selection of Potentiometers
**TACHOMETERS:**
Introduction, Characteristics requirement, DC Tachogenerator, AC Tachogenerators,
Tachometer Applications, characteristics of Tachogenerator
**SERVO MOTOR:**
Introduction, DC Servomotors, AC Servomotors
**RELAYS:**
Introduction, Classification of Relays, Relay Circuits, Construction of Relay, Logic Relay, Optoelectronic Relay, Relay Problems & Remedies, Relay Race, Actuation & Release Time, Characteristics of Electromechanical Relay, Dynamic Characteristics of Reed Relay, Merits & Design Features of Reed Relay
**STEPPER MOTORS:**
Introduction, PM type Stepper Motor, VR type Stepper Motor, Hybrid Stepper Motor, Disc Magnet Stepper Motor, Applications of Stepper Motors, Drive Circuits for Stepper Motor
**SOLENOIDS:**
Construction, Selection & Different types of Solenoid.
**UNIVERSAL MOTOR:**
Construction, Operation, Speed control
**SWITCHES:**
Single pole, double pole, elect mechanical, thumbwheel etc.

**[E] HYDRAULIC SYSTEMS & VALVES:**
Introduction, Advantages & Disadvantages of Hydraulic Systems, Components of Hydraulic System, Classification of Hydraulic Systems, Control with Pump-Controlled Hydraulic System, Pump Controlled Hydraulic Motor, Hydraulic Transmission Lines , Hydraulic Power Supply, Different types of Hydraulic Valve

**C. LEARNING OUTCOMES**
At the completion of the course, students will be able to
1. Explain construction, operation & behaviour of different control system components
2. Identify different control problem

**D. RECOMMENDED TEXTBOOKS**
[1] Control systems principle and design By: M.Gopal, Tata McGraw-Hill Education publication
[2] Electronic Devices & Circuits – An Introduction By: Mottershed, Prentice hall publication
[3] Modern control Technology: Components and systems By: Kilian, Cengage Learning publication
[4] Control systems components By: M.D. Desai, PHI publication

**E. REFERENCE BOOKS**
[1] Electro-Mechanical System Components By: Edward S. Charkey, John Wiley & Sons Canada Limited publication
[2] Control System Components By: Gibson & Tuteur, Ernest otto doebelin Publication
[3] Handbook of Gear design By: Gitin M. Maitra, Tata Mcgrow Hill Publication
[4] Servomechanism Practice By: Ahrendt & Savant, McGraw-Hill
[5] Mechanical & Industrial Measurements By: R. K. Jain, Khanna Publishers
[6] Electro-Mechanical Components for Servo Mechanism By: Davis & Ledgerwood, McGraw-Hill publication

**F. LIST OF EXPERIMENTS**
1. Operation &Construction of Stepper Motor
2. Characteristic of a Relay
3. Hysteresis of DC Relay

4. Cams & Followers
5. Speed Measurement using Photoelectric type sensor
6. Speed Measurement using Magnetic type Sensor
7. Potentiometer as an Error Detector
8. Opto Transmitter &Receiver Devices
9. Gears, Breaks & Clutches

# Dharmsinh Desai University

## Faculty of Technology

## Department of Instrumentation and Control Engineering

**B.TECH. SEMESTER – V (IC)**

**SUBJECT: MICROPROCESSOR & MICROCONTROLLER(IC511)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| 3 | 1 | 2 | 60 | 40 | 25 | 25 | 150 |

**(A) INTRODUCTION:**

Microprocessors, Microprocessor instruction set & computer languages, from large computer to single chip microcontroller, Microprocessor architecture & its operations, memory, input & output (I/O) devices, Example of microcomputer system, Logic devices for interfacing.

**(C) 8085 MICROPROCESSOR ARCHITECTURE & INTERFACING:**

The 8085 MPU, Example of 8085 based microcomputer, Basic interfacing concepts, memory interfacing, Testing & troubleshooting memory interfacing circuits, interfacing output displays, Interfacing input devices, and memory mapped I/O, Testing & troubleshooting I/O interfacing circuits.

**(D) MICROCONTROLLER MCS 8051 ARCHITECTURE:**

Introduction, MCS 8051 Architecture, Input & output pins & circuits, External memory interfacing, Counters & timers, serial data input/output, Interrupts.

**(D) MCS 8051 ASSEMBLY LANGUAGE PROGRAMMING:**

8051 ASSEMBLER:

Introduction, Assembler directives, Numbers, Labels, Symbols. 8051 SIMULATOR:

Introduction, features, simulator programs, Application 8051

ASSEMBLY LANGUAGE PROGRAMMING:

The assembly language programming process, The PAL practices CPU, Data Transfer Operations, Logical Operations, Arithmetic Operations, Jump and Call Instructions.

**Text Books:**

1) Microprocessor Architecture, Programming and Applications with 8085 by R. S. Gaonkar. (4th edition)
2) The 8051 microcontroller architecture, programming & applications(2nd Edition) By Kenneth J. Ayala

**Reference Books:**

1) Fundamentals of Microprocessors & Microcomputers by B. Ram
2) Introduction to Microprocessors by A. P. Mathur
3) INTEL Manual for MP 8085 and MCS 8051.

## INTENDED LEARNING OUTCOMES:

After completing this course students should be able to:

- Understand the basics of Microprocessor & Microcontroller
- Understand the architecture of 8085 & 8051
- Interface Memory & I/O Devices to 8085
- Understand Timing Diagram of 8085 & 8051
- Understand the Instruction Set of 8085 & 8051.
- Programming of 8085 & 8051
- Understand the SFRs of 8051
- Make the various application projects using 8051 & 8085

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## MICROPROCESSOR & MICROCONTROLLER (IC-514)

## SEM-V (3rd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

- To prepare the students to gain application level knowledge about microprocessor & microcontroller

**B. DETAILED SYLLABUS**

**[A] INTRODUCTION TO MICROPROCESSOR & MICROCONTROLLER**

Introduction to Microprocessors, Basic information about Instruction Set & Assemble Language, Introduction to CISC & RISC Architecture, Difference between Microprocessor & Microcontroller and Example Application Discussion

**[B] MICROPROCESSOR 8085 ARCHITECTURE, MEMORY & I/O DEVICES INTERFACING**

Microprocessor Architecture & Its Operation, Memory Devices, I/O Devices, Logic Devices for Interfacing, Memory Interfacing, I/O Interfacing, Timing diagram & Applications

**[C] AVR Architecture & Assembly Language Programming**

Architecture, Memory Map & Registers of AVR, Assembly Programming, Data Move Instructions and I/O Port Programming, Branch & Call Operations, Arithmetic Instructions and Programs

**[D] AVR Timer, Interrupt**

Programming Timers 0, 1 and 2, Counter Programming, Timer Programming in C, AVR Interrupts, Programming of Timer & External Hardware Interrupts, Interrupt Priority, Interrupt Programming in C, Serial Port Connection of ATMEGA & Programming in C and Assembly Language

**[E] Serial Port, SPI & I2C Bus**

Serial Port of ATMEGA32 & Programming using Assembly & C SPI Bus Protocol and Programming I2C Bus Protocol and Programming

**C. LEARNING OUTCOMES**

At the completion of the course, students will be able to

- Explain basic operation and architectural difference between of microprocessor & microcontroller

- Integrate memory devices & Input output devices with 8085

- Explain timing diagram of various instructions of 8085

- Do basic programming of 8085 in Assembly language

- Utilize various features of AVR microcontroller for building up various applications

- Do basic & application level of programming of AVR Controller in Assembly & C Language

- Develop basics application using AVR microcontroller

**D. RECOMMENDED TEXTBOOKS**

1. Microprocessor Architecture, Programming and Applications with the 8085, by R. S. Gaonkar, Penaram International Publishing (India) Private Limited

2. The AVR Microcontroller & Embedded Systems, by Mahuammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Pearson Publication

3. Embedded Systems, by B. Kanta Ra, PHI

**E. REFERENCE BOOKS AND STUDY MATERIAL**

1. Microprocessor Application in Control & Instrumentation by Bibbero

2. Programming and Customizing the AVR Microcontroller by Dhananjay Gadre

**F. LIST OF EXPERIMENTS**

1. Importance of Microprocessor & Microcontroller

2. Architecture of 8085 & Interfacing of Memory Devices, Input Devices & Logic Devices with 8085

3. Interrupts & Timing Diagram of 8085

4. Basic 8085 Assembly Programming

5. AVR Architecture

6. Getting Started with AVR Studio ( Free Version) for programming of AVR Controller

7. Simulation of Data Move Instructions and I/O Port Programming, Branch & Call Operations, Arithmetic Instructions using AVR Studio in Assembly & C

8. AVR Timer Programming & Simulation using AVR Studio

9. AVR Interrupt Programming & Simulation using AVR Studio

10. AVR Serial Port Programming & Simulation using AVR Studio

11. Mini Project Part-1 using AVR Microcontroller (Shall be demonstrated in practical exam)

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## SIMULATION TOOLS (IC-515)

## SEM-V (3rd Year)

## Program Elective-I

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

- To develop the ability in students for use of simulation tools in order to apply for better theoretical understanding.
- To apply use of such tools to experiments, projects etc. for implementation and detailed analysis of the same.

**B. DETAILED SYLLABUS**

**Computing with Scilab**

**[A] Introduction to Scilab**
Basics of Scilab, Numbers, Constants, Syntax

**[B] Matrices**
Entering Matrices, Subscripts, The Colon Operator, Concatenation, Special Matrices, Size of a Matrix

**[C] Matrix Algebra**
Transpose, Adding and Subtracting Matrices, Multiplication and Powers of Matrices, The Dot Operator, Mathematical Functions

**[D] Programming in Scilab**

FOR loops, Functions, Returning Multiple Values, Local and Global Variables, Comparison and Logical Operators, WHILE Loops, IF Statements, Graphs, Simple Graphs, Styles, Multiple Curves, Multiple Plots, Other Features, 3D Curves, Histograms

**[E] Working with Files in Scilab**

Function Files, Script Files, Exporting Data, Importing Data

**Virtual Instrumentation using LabVIEW**

**[F] Introduction to Virtual Instrumentation**

What is VI?, How to use Computer in VI?, LABVIEW & Virtual Instrumentation
Conventional & Graphical Programming
Components of LABVIEW, Tools & other Pallets, Color coding Code debugging,
Creating sub – VIs

**[G] For and While Loop**

The FOR & WHILE loop, Loop Behavior & Inter loop communication, Local & Global

**[H] The Structures**

Sequence structures, Case structures, Formula Nodes

**[I] Arrays and Clusters**

Arrays, Clusters, Inter conversions of Arrays & Clusters

**[J] Charts and Graphs**

Wave form charts, Resetting plots, Use of cursors, X-Y graphs

**[K] State machines**

What is a state machine, A simple state machine, Event structures, Full state machine

**[L] File input output**

File formats, File I/O functions, Path functions, File WRITE and READ

**[M] String handling**

String functions, LABVIEW string formats, Parsing of strings, Examples

**[N] Basics of data acquisition**

Classification of signals, Real world signals, Analog interfacing, Connecting the signal to the board, Bridge signal source

**[O] Data acquisition with LabVIEW, DAQ and Vis**

Measurement & Automation Explorer, The wave form data type, Use of simple VIs & DAQmx, Intermediate Vis, Express VI's-DAQ assistant, Analysis, Instrumentation

**[P] Interfacing instruments GPIB and RS 232**

RS 232 vs. GPIB – Handshaking, GPIB Interfacing, RS232c/RS485 Interfacing VISA

**[Q] Advanced topics in labVIEW**

Inter process communication,
Front panel activity, Data socket, programmatically controlling VI's

**C. LEARNING OUTCOMES**

At the completion of the course, students will be able to:

- perform computational and numerical calculations using simulation tools
- acquire, analyze and present data
- programmatically log data
- perform file level operations

**D. RECOMMENDED TEXTBOOKS**


[1] Virtual Instrumentation using LabVIEW, Jovitha Jerome, Prentice Hall India

[2] Programming in Scilab 4.1 By- Vinu V.Das, Newage publication


**E. REFERENCE BOOKS & NOTES**


[1] Notes on Scilab, Gary Bunting

[2] Introduction to Scilab, Michael Baudin, Scilab Consortium

[3] Virtual Instrumentation using LabVIEW, Sanjay Gupta & Joseph John, Tata McGraw Hill


**F. LIST OF EXPERIMENTS**

1) Introduction to LabVIEW
2) Using loops in LabVIEW
3) Arrays and Clusters in LabVIEW
4) Decision Making using Case Structures in LabVIEW
5) File Handling in LabVIEW
6) Introduction to Scilab
7) Matrix Algebra in Scilab
8) Using loops, logical operators in Scilab
9) Graphical data presentation in Scilab
10) File Handling in Scilab

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## PROCESS MEASUREMENT (IC-517)

## SEM-V (3rd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

To prepare the students to gain knowledge about the standards, principle, working and applications of process sensors and transducers

**B. DETAILED SYLLABUS**

**[A] PRESSURE MEASUREMENT:**
Manometers, Elastic type – Bourdon tube, diaphragm, bellows elements, Bell gauges, Solid State, Piezo- elastic and vibrating element type pressure transducer, Vacuum gauges Mechanical and electric types, differential pressure transmitter.

**[B] FLOW MEASUREMENT:**
Theory of flow system, Reynold's number, Variable pressure (Head) type meters-orifice, Orifice calculations and installation, Venturi tube, Pilot tube, Flow nozzle. Variable Area meters-rotameter, Open channel meters, Mass flow meters, Velocity meters, Quantity meters, Electomagnetic flow meter, turbine flow meters, Ultrasonic flow meters, Vortex flow, Anemometers, Flow markers, Laser anemometers, Flow measurement for solid materials.

**[C] LEVEL MEASUREMENT:**
Theory of level measurement, Float gauges, Differential pressure type level measurement technique, Level measurement by weighing, bubbler technique, thermal effect type, Capacitance type, Ultrasonic and radiation type level measurement techniques, level

measurement in open vessels and pressure vessels, Measurement of interface levels, Measurement of level of dry material.

**[D] TEMPERATURE MEASUREMENT:**
Liquid Gas and Vapour filled thermometers, Bimetal thermometers, Resistance Thermometers RTD, Thermisters, Thermo electric temperature measurement technique Thermocouples and thermopiles Radiation thermometers optical and electrical pyrometers Accuracy and response characteristic of different devices, Differential Temperature measurement.

**C. Text Books:**

1. Industrial Instrumentation By: D.P. Eckman. , CBS Publishers and Distributers
2. Principles of industrial instrumentation By: D Patranabis, Tata Mc Graw Hill
3. Instrumentation Devices and system By: Rangan, Sharma, Mani, McGraw Hill Education

**D. Reference Books:**

1. Instrumentation, Measurement and Analysis By: B.C. Nakra & K. K. Chaudhary , McGraw Hill
2. Mechanical And Industrial Measurements By: R. K. Jain, Khanna Publishers
3. Industrial Instrumentation Fundamentals By: Austin Fribance, Tata McGraw Hill publication
4. Industrial Flow Measurement, 3rd Edition, By: David W. Spitzer, ISA
5. Flow measurement methods and applications By: Jim E.Hardy, Jim O. Hylton, Tim E. McKnight, Carl J. Remenyik, Francis R. Ruppel, Wiley-Blackwell,
6. Temperature Measurement, 2nd Edition By: L Michalski, K Eckersdrof, J Kucharski, J McGhee, Wiley
7. Modern Sensors Handbook, By: Pavel Ripka, Wiley
8. Industrial Instrumentation- Principles & Design By: Tattamangalam R.Padmanabham, Springer
9. Instrumentation and Process Measurement By:W.Bolten, Universities Press
10. Instrumentation Measurement and Control By A.K. Ghosh, PHI

**E. LEARNING OUTCOMES:**

After completing this course students should be able to:

- Describe standards for process measurements
- Explain various sensors used for measurement of Temperature for industrial applications
- Explain various sensors used for measurement of Pressure for industrial applications
- Explain various sensors used for measurement of Flow for industrial applications
- Explain various sensors used for measurement of Level for industrial applications

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

**List of laboratory experiments:**

1. To find out time response of first and second order system
2. To find out input output characteristic of RTD
3. To find out time constant of given RTD
4. To find out input output characteristic of Thermocouple
5. To find out time constant of given Thermocouple
6. To find out characteristic of Thermistor
7. To measure temperature of an object using non contact thermometer
8. To find out characteristics of given strain gauge pressure transducer
9. To find out characteristics of given piezoelectric pressure transducer
10. To measure flow using orifice plate
11. To measure flow using Venturi tube
12. To measure level in a tank using hydrostatic level sensor

13 To measure level in a tank using Ultrasonic level sensor

14 To determine ON-OFF control characteristic using Thermistor

# Dharmsinh Desai University

## Faculty of Technology

## Department of Instrumentation and Control Engineering

**B.TECH. SEMESTER – VI (IC)**

**SUBJECT: INDUSTRIAL MANAGEMENT(IC602)**

**SYLLABUS & SCHEME**

| Teaching Scheme ( H / W ) | | | Exam Scheme ( Marks ) | | | | |
|---|---|---|---|---|---|---|---|
| Lect. | Tut. | Pra.(GD) | Theory (3 Hrs) | Sessional (1 hr 15 min) | Prac. | T.W | Total |
| 3 | 1 | 2 | 60 | 40 | ----- | 25 | 125 |

[A] **MANAGEMENT :**

Forms of business organization, Organization Structure, Industrial Management, Leadership, Inventory Control, Personnel Management, Marketing Management.

[B] **MANAGEMENT BY OBJECTIVES :**

Introduction – Steps in Setting up M.B.O., Problems in the Approach of M.B.O., Management of Participation, Management by Exception.

[C] **PRODUCTION AND QUALITY CONTROL :**

Production Planning and Control, Job Evaluation and Merit Rating, Production and Productivity, Quality Control.

[D] **WORK-STUDY :**

Work study and Productivity, Motion Study (Method study), Time study (Work Measurement).

[E] **MODERN MANAGEMENT TECHNIQUES :**

Gantt Charts, Critical Path Method (C.P.M.), Program Evaluation and Review Technique (P.E.R.T.).

[F] **INFORMATION SYSTEM AND CONTROL :**

Introduction, Definition, Need for Information System, Aims, Characteristics, Objectives of Good Management, Information System, Sources of Information, Application of Management Information System, Design of Management Information System, Development, Implementation of Management Information System, Levels of Management and Management Information System, Information handling.

[G] **LABOUR AND INDUSTRIAL ACTS :**

Welfare Organization, Industrial Relations and Trade unions, The Indian Factories Act, The Indian Electricity Rules, Industrial Disputes Act, Workmen's Compensation Act, The Trade Union Act.

[H] **ORGANISATION OF INSTRUMENTATION DEPARTMENT :**

Responsibilities of Department to Management, Consulting service to other Departments, Process Control Engineers, Process Control Research, Selecting and Training Personnel for Instrument Work, Labour Relations and Preventive Maintenance.

**Text Book :**

(1) Industrial Organization and Engineering Economics
By – T.R. Banga & S.C. Sharma (23rd Edition). 2005.
(2) Industrial Instrument Servicing Handbook By - Carrol

**Ref. Books :**

(1) Business Organization and ManagementBy – M.C.Shukla
(2) Managerial EconomicsBy – G.S. Gupta
(3) Elementary Economic TheoryBy – Dewett & Verma
(4) Management By – Stoner & Wankel ( 3rd Edition )

## INTENDED LEARNING OUTCOMES:

After completion of the course students should be able to:

- Describe the usefulness of a proper industrial management system
- Describe various ways for production and quality control
- Describe different labour and Industrial acts
- Describe various methods to organize an instrumentation department.

# Dharmsinh Desai University

## Faculty of Technology

## Department of Instrumentation and Control Engineering

**B.TECH. SEMESTER – VI (IC)**

**Elective 1: PROCESS INSTRUMENTATION(IC608)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| 3 | 1 | 2 | 60 | 40 | 25 | 25 | 150 |

**(A) SIGNAL CONDITIONING :**

Instrumentation amplifiers, Phase Sensitive Detector, V/F & F/V Converters, Filtering of Signals, Applications of DSP e.g. digital filters.

**(B) TELEMETERING :**

Incremental Current design, Alternating current systems, Direct current systems, Digital Telemetering.

**(C) P/I AND P/I CONVERTERS:**

Manometric transducers, Torque balance design, Oscillaor type, electro pneumatic transducers, Transducer positioners, magnetic converters, differential transformer converters.

**(D) CONTROLLERS :**

Controller principles, Analog, Digital & Hydraulic Controllers, Controller Tuning, Self-tuning controllers, Methods of specifying the controllers, Specifications of typical controllers.

**(E) CONTROL LOOP CHARACTERISTICS:**

Introduction, Single and multivariable control systems, Control system quality, Stability, Process loop tuning

**(F) CONTROL VALVE SIZING :**

Calculation of Control Valve Co-efficient & Case studies
for different services & fluids, Information about the Industry standards & recommended practices for Control Valves.

**Text Books :**


1. Process Control Instrumentation Technology, by C. D. Johnson (3rd Edition)
2. Instrumentation - Devices & Systems, by Rangan, Sarma & Mani.
3. Fundamentals of Digital Signal Processing by Lonnie C. Ludeman
4. Practical Industrial Data Networks: Design, Installation and Troubleshooting by Steve Mackay, Edwin Wright, Deon Reynders, and John Park; Elsevier Publication

**Reference Books :**


1. Measurement systems : Applications & Design, by Doeblin
2. Instrumentation measurement & analysis, by Nakra & Chaudhary
3. Mechanical & Industrial Measurement, by R. K. Jain
4. Analogue filter design, by Van Valkenburg
5. Applied Instrumentation in Process Industries, Vol. II, by Andrews
6. Transducers & Instrumentation, by D. V. S. Moorty, 1995.
7. Industrial Instrumentation Fundamentals, by Fribance


## INTENDED LEARNING OUTCOMES:

After completing this course students will learn:

- Design and operation of Analog, Digital, Hydraulic & Pneumatic PID Controllers
- Fundamentals and procedure of control valve sizing
- About Signal conditioning and different techniques of the same
- Different telemetering schemes

# Dharmsinh Desai University

## Faculty of Technology

## Department of Instrumentation and Control Engineering

**B.TECH. SEMESTER – VI (IC)**

**SUBJECT: ROBOTICS ENGINEERING(IC609)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| 3 | 1 | 2 | 60 | 40 | 25 | 25 | 150 |

**[A] Introduction**

Evolution of Robot and Robotics, Laws of Robotics, Progressive advancement in Robot, Robot Anatomy, Human Arm characteristics,

**[B] Co ordinate Frames ,Mapping & Transforms**

Co ordinate frames, Description of objects in space, Transformation of vectors, Inverting of Homogeneous Transforms, Fundamental rotation Matrices

**[C] Modeling of robot –Direct kinematic model**

Mechanical structure and notations, Description of links & joints, Kinematic modeling of the manipulator, Denavit- Hartenberg notation, Kinematic relationship between adjacent links Inverse Kinematics

**[D] Trajectory planning**

Joint space techniques, Cartesian space techniques

**[E] Robotic Actuators, sensor & vision**

Sensors in robots , Actuators, Kinds of sensors used in Robotics, Robotic vision

**[F] Robot Safety, Robot-Economy & installation**

Introduction, plant survey, potential safety hazards ,Safety planning check list, safety guidelines

**TEXT BOOKS:**

(1) Robotics and Control by I.K.Mittal & I.J.Nagrath ,Second reprint 2005 Tata Mc Grawhill

(2) Introduction to robotics by Saeed B.Niku ,first Indian reprint 2002, pearson education

**REFERENCE BOOKS:**

(1) Robotics by K. S. Fu , R. C. Gonzalez & C.S. G. Lee.

(2) Robotics principles & practice by K.C.Jain & L.N.Aggarwal, khanna publishers 2003 edition

## INTENDED LEARNING OUTCOMES:

After completion of the course students should be able to:

- Describe the history and evolution of robotics engineering
- Describe the kinematic modeling of a manipulator arm
- Describe vision sensors used for intelligent robots
- Describe various industrial applications of robots

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## MICROCONTROLLER APPLICATIONS (IC-610)

## SEM-VI (3rd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

- To prepare the students to design & develop microcontroller based applications using 8-bit AVR controllers

**B. DETAILED SYLLABUS**

**[A] AN AVR MICROCONTROLLER DESIGN**

A microcontroller Design, Testing the Design, Timing Subroutine, Lookup Tables Concept & Serial Data Communication

**[B] BASIC APPLICATIONS & PROGRAMMING**

Different types of Keyboard Interfacing & programming, Seven Segment Display interfacing & programming, LCD Interfacing & Programming, ADC Programming Keyboard, Internal ADC Programming & Sensor Interface, External Serial ADC & DAC, Relay, Optoisolator & Stepper Motor Interfacing & Programming, Input Capture & Wave Generation in AVR, PWM Programming & DC Motor Speed Control, MAX7221 Display Interface using SPI, DS1307 RTC Interface using I2C, RS232 & RS485 Bus Communication applications using UART

**[H] INDUSTRIAL APPLICATICATIONS**

**MEASUREMENT OF ELECTRICAL QUANTITIES & PROTECTION:**

Frequency, AC voltage, AC current, DC Voltage, DC Current, phase angle, power factor, AC Power, Over Current Relay

**MEASUREMENT & CONTROL OF PROCESS PARAMETER:**

Temperature, Pressure, Level & Flow

**APPLICATION CASE STUDIES:**

Traffic Control, Firing angle control of SCR, Process Controller, Machine Tool Control, Distributed Computer Control System, Industrial Control Boards

C. **LEARNING OUTCOMES**

At the completion of the course, students will be able to

- integrate & test Microcontroller based system
- write different application programs using Lookup table, Timing subroutine & Serial data subroutine
- interface & build applications using key board, LED Display, LCD Display, ADC, DAC , RTC with AVR Controllers
- use Serial Communications applications for networking applications
- build Industrial Applications using AVR Controller

**D. RECOMMENDED TEXTBOOKS**

1. The AVR Microcontroller & Embedded Systems, by Mahuammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Pearson Publication
2. Embedded Systems, by B. Kanta Ra, PHI
3. Fundamentals of Microprocessors & Microcomputers,by B. Ram, Dhanpat Rai Publications

**E. REFERENCE BOOKS AND STUDY MATERIAL**

1. Microprocessor Application in Control & Instrumentation by Bibbero
2. Programming and Customizing the AVR Microcontroller by Dhananjay Gadre

**F. LIST OF EXPERIMENTS**

1. Study of AVR Studio & Getting started with Embedded C Programming
2. Time Delay Subroutine
3. Measurement & Generation of Frequency
4. Internal ADC Programming
5. Interfacing of External DAC & Waveform generation
6. Different type of Keyboard Interfacing & Programming
7. Seven Segment Display Interfacing & Programming
8. LCD Interfacing & Programming
9. Serial Port UART Programming
10. RTD Interfacing & Programming
11. Mini Project Part-2 using AVR Microcontroller (Shall be demonstrated in practical exam)

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## POWER PLANT AUTOMATION (IC-612)

## SEM-VI (3rd Year)

## Program Elective-II

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

### A. OBJECTIVES OF THE COURSE

- To prepare students to acquire knowledge various types of power plants.
- To prepare students to acquire knowledge different control techniques for boiler and turbine.
- To prepare students to acquire knowledge about various interlocks and safety standards for turbine and generator.

### B. DETAILED SYLLABUS

**[A] Introduction to Power Plant**:
Plant overview, Role of Control and instrumentation in power plant, Classification of power plants: thermal, hydro, combined cycle and nuclear.

**[B] Boiler & Turbine Supervisory Control:**
Introduction, Operation, Drum level control, Combustion control , Turbovisory system, Measurement and analysis of gas, Super-heated steam temperature, Level, Pressure and Flow. Coordinated controls of boiler and turbine.

**[C] Power Plant Process:**
Boiler process, Turbine process, Fuel Handling Plant, Air Compressor, etc.

**[D] Power Plant Subsystem Automation**:
Control of mill throughput, Mill temperature control, Forced draught control, Feed pump control, Boiler-following-turbine load control, Advanced Gas Cooled Reactors (AGRs) .

**[E] Electrical Instruments and Metering**:
Recorders and Industrial Displays, Electrical Instruments and Metering Working of meters, Meter calibration.

[F] **Plant Optimization:**
Performance optimization of power plant with integrated Controls, Plant Optimization Performance measurement of power plant.

**[G]System Interlocks and Safety:**
Turbine Interlock and Protections, Interlock and Protections for Generator.

**C. LEARNING OUTCOMES**

After completion of the course students should be able to:

- Classify various power plants and understand the role of control and Instrumentation in power plant.
- To apply supervisory control techniques for boiler and turbine.
- Learn different power plant processes, viz. Turbine process, boiler process, etc.
- Describe various recorders, Industrial Displays, working of meters and Meter calibration.
- Measure plant optimization performance parameters
- Describe turbine interlock and protections for generators.

**D. RECOMMENDED TEXTBOOKS**

1. Modern Power Station Practice: Incorporating Modern Power System Practice: Vol - F Control and Instrumentation. / by British Electricity International.
2. Instrumentation Engg's Handbook on Process Control - Bela G. Liptak.
3. Power plant Engineering – P.K.Nag, Mc Graw Hill, 3rd edition

**E. REFERENCE BOOKS & NOTES**

1. Power plant instrumentation and control handbook – Swapan Basu and Ajaykumar Debnath, Academic Press, 1st edition
2. Standard Handbook of Powerplant Engineering – Thomas C. Elliot, Mc Graw Hill
3. Energy and Power Generation Handbook – K.R.Rao, ASME Press,

**F. LIST OF EXPERIMENTS**

1. Study of General layout of thermal power plant.
2. Study of Turbovisory system
3. Study of fuel handling system in coal based power plant.
4. Study of Control techniques for power plant process.
5. Study of drum level water control and swell and shrink phenomenon.
6. Study of air pollution by a thermal power plant.
7. Study of water pollution by a thermal power plant.
8. Study of various combustion process control.
9. Study of wireless monitoring of energy measurement.
10. Study of different Safety and Interlocking techniques for turbine and generator.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## PROCESS INSTRUMENTATION AND CONTROL (IC-613)

## SEM-VI (3rd Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

- To make students acquire knowledge about the concept of controller principles, algorithms and tuning methods, different types of pneumatic control valve construction, applications, selection and valve sizing

- To prepare students to analyze and design discrete and continuous controllers

**B. DETAILED SYLLABUS**

**[A] P/I AND P/I CONVERTERS:** Manometric transducers, Torque balance design, Oscillator type, electro pneumatic transducers, Transducer positioners, magnetic converters, differential transformer converters

**[B] CONTROLLER PRINCIPLES :** Introduction, process characteristics, control system parameters, discontinuous controller modes, continuous controller modes, composite control modes

**[C] CONTROL LOOP CHARACTERISTICS:** Introduction, control system configuration, Single and multivariable control systems, Control system quality, Stability, Process loop tuning

**[D] PNEUMATIC CONTROL VALVE AND ACTUATORS:** Introduction, operating mechanism of control valves, direction control valves, construction and working of control valves, Pneumatic Actuators, Selection of control valves and actuators

**[E] CONTROL VALVE CHARACTERISTICS:** Characteristics of control valves, rangeability, control valve selection, Sizing of control valves

**C. Text Books :**


1. Process Control Instrumentation Technology, By: C. D. Johnson, Pearson Education Ltd

2. Industrial Instrumentation Fundamentals By: Austin Fribance, Tata McGraw Hill publication

3. Applied Instrumentation in Process Industries, Vol. II, By: W.G. Andrews/H.B.Williams, Gulf Publication Company

4. Control system components By: M.D.Desai, Pearson Prentice Hall, Inc


**D. Reference Books :**


1. Measurement systems : Applications & Design By: Ernest Doeblin, McGraw Hill

2. Instrumentation measurement & analysis By: B.C. Nakra & K. K. Chaudhary , McGraw Hill

3. Mechanical & Industrial Measurement, By: R. K. Jain, Khanna Publishers

4. Transducers & Instrumentation, By: D. V. S. Moorty, PHI Learning Pvt.Ltd

5. Instrumentation - Devices & Systems, By Rangan, Sharma & Mani, Tata McGraw Hill publication

**E. LEARNING OUTCOMES:**

- After completing this course students will be able to:
- Explain different P/I and I/P converters
- Design and analyze P, PI, PD, PID Controllers
- Select and size appropriate pneumatic control valve based upon various selection parameters

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT**

List of laboratory experiments:

1 Response of P Controller

2 Response of PI Controller

3 Response of PD Controller

4 Response of PID Controller

5 Study of control calve cut sections

6 To study pneumatic system components

7 To find out characteristics of I/P converter

8 To find out characteristics of P/I converter

9 Study of control valve characteristics

10 Instrumentation Amplifier characteristics

# Dharmsinh Desai University

## Faculty of Technology

## Department of Instrumentation and Control Engineering

**B.TECH. SEMESTER – VII (IC)**

**SUBJECT: PROCESS CONTROL(IC703)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| 3 | 1 | 2 | 60 | 40 | 25 | 25 | 150 |

**[A] INTRODUCTION TO PROCESS CONTROL AND FUNDAMENTAL CONCEPTS:**

(1) Introduction to Process Control

(2) Evolution of Process Control

(3) Laplace Transform in Process Control

(4) Open loop v/s Closed loop systems

(5) Open loop response of Simple Systems

(6) Feedback v/s Feed Forward Control Configuration

**[B] STUDY OF OPEN LOOP RESPONSE OF SYSTEM AND ANALYSIS**

(1) Open loop response of simple systems

(2) Complex Control Systems

(3) Steps in synthesis of a control system

**[C] STUDY OF TRANSIENT RESPONSE OF SYSTEM AND CONTROL DYNAMICS**

(1) Transient response of control systems

(2) Level Control

**[D] CONTROL OF UNIT OPERATIONS:**

Boiler Controls, Distillation Column Controls, Compressor Controls, Steam Turbine Controls, Heat Exchanger Controls

**[E] CONTROL SCHEMES:**

Ratio Control, Cascade Control, Feed-Forward Control, Selector Control, Inverse Derivative Control, Split Range Control, etc.

**[F] ADVANCED PROCESS CONTROL:**

Advance Control Systems – Adaptive Control, Adaptive Control Configurations, Valve Position Control (VPC), Model Reference Adaptive Control (MRAC), Self Tuning Regulator (STR), Intelligent Control and Artificial Intelligence (AI), Features of Intelligent Control, Definition of AI, Introduction to Artificial Neural Networks (ANN) and Fuzzy Logic Control (FLC)

**TEXT BOOKS:**

1. Process Control, by Peter Harriot
2. Applied Instrumentation in Process Industries, Vol. I, by Andrews & Williams
3. Process Control–Principles and Applications by Surekha Bhanot, Publisher: Oxford University Press (2008), India.
4. Principles of Process Control by Patranabis
5. Automatic Control of Power & Process by Manifold
6. Instrument Engineer's Handbook – Process Control, by Bela G. Liptak (Liptak-II)
7. Process Modeling, Simulation & Control for Chemical Engineers by W. Luyben
8. Chemical Process Control by Stephanopoulos

**REF. BOOKS:**

1. Process Control, by Pollard
2. Principal of Industrial Measurement by Patranabis
3. Applied Instrumentation in Process Industries, Vol. II, by Andrews & Williams
4. Chemical Process Control by Shinskey
5. Chemical Process Control by Coughnour & Copel

**INTENDED LEARNING OUTCOMES**

After completing this course students should be able to:

- Study and learn fundamental and latest concepts of Industrial Process Control
- Study and learn industrial and laboratory grade process control and tuning techniques
- Study and develop process control system hardware and software
- Study and develop basic and advance process control strategies for control of rapid, complex and difficult to regulate reactions and processes
- Study and learn about Theoretical, Simulation based and Practical Laboratory based Process Control System design-development using Control Engineering Concepts

# Dharmsinh Desai University

## Faculty of Technology

## Department of Instrumentation and Control Engineering

**B.TECH. SEMESTER – VII (IC)**

**SUBJECT: INDUSTRIAL ELECTRONICS(IC707)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| 3 | 1 | 2 | 60 | 40 | 25 | 25 | 150 |

**(A) INDUSTRIAL DEVICES & APPLICATIONS :**

Polyphase Rectifiers, Resistance Welding, Power Amplifiers and R. F. Heating, Industrial Timer Circuits.

**(B) CONVERTERS & INVERTERS:**

Thyristor Converters & Inverters, D. C. Choppers, Cycloconvertors.

**(C) DRIVES:**

Thyristor controlled DC Drives, Thyristor Controlled AC Drives, Advances in Drives, Specifications of a typical drives.

**(D) ULTRASONICS:**

Introduction, Generation & applications of ultrasonic waves, Action & effects of ultrasonic waves, Soldering, Welding & drying by ultrasonic wawes.

**NOTE :** Numerical Examples & Objective questions should be prepared from textbooks.

**Text Books :**


1) A Text book on Power Electronics – Devices, Circuits, Systems and Applications, 2nd Edition, by Dr. H. C. Rai
2) Industrial Electronics, 11th Edition, by G. K. Mithal
3) Power Electronics By: M.D. Singh, K.B. Khandchandani
Tata Mcgrawhill, 2nd Edition

**Reference Books :**


1) Calculations in Industrial Electronics and Instrumentation, by V. K. M. John
2) Engineering Electronics, by John D. Ryder
3) Thyristor Engineering, by M. S. Berde
4) Power Electronics, by P. C. Sen
5) Thyristor : Theory and Applications, by R. K. Sugandhi & K. K. Sugandhi


## INTENDED LEARNING OUTCOMES:

After completing this course students should be able to:

- Understand the various applications of Power Semiconductor Devices like battery charger, UPS, HVDC, SMPS, Delay Circuits etc.
- Understand the application of Induction heating & Dielectric Heating
- Understand differentiate types of resistive welding
- Understand chopper & inverter
- Understand Cycloconverter & Dualconverter
- Understand DC & AC Drive

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## PROCESS CONTROL (IC-714)

## SEM-VII (B.Tech, 4th Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Ext** | **Sess.** | **TW** | **Prac** | **Total** | **Lect** | **Tut** | **Prac** | **Total** |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

- To teach the students fundamental concepts, terminology and evolution of process control along with control loop configuration
- To discuss the open and closed loop response of simple control systems and teach them the salient features and effects of P, PI, PD and PID control algorithms on the transient response of control systems
- To teach the students basics of complex control and level control explaining their importance
- To teach the students process details, identification of critical parameters, interaction among critical parameters as well as design of recommended control schemes for most widely utilized industrial process units using boiler, distillation column, steam turbine, compressor and heat exchanger as case study examples

- To make the students aware about limitations of basic PID control and necessities of control strategies for solving process control problems. To teach the students various control strategies such as Ratio, Cascade, Feed Forward, Split-range, Inverse derivative, Selector, etc. in problem-solution methodology
- To discuss higher level process complexities and teach the students the brief and introductory concepts of various advanced control strategies such as Adaptive control, Valve Position Control (VPC), Multi-variable control, Internal Model Control (IMC), Model Predictive Control (MPC), Artificial Intelligence (AI) and Fuzzy Logic Control (FLC)

**B. DETAILED SYLLABUS**

**[A] INTRODUCTION TO PROCESS CONTROL AND FUNDAMENTAL CONCEPTS:**

Introduction to process control, Evolution of process control, Laplace transforms in process control, open loop v/s closed loop systems, open loop response, feedback v/s feed forward control configuration

**[B] STUDY OF OPEN LOOP RESPONSE OF SYSTEM AND ANALYSIS:**

Open loop response of simple systems, Effects of P, PI, PD & PID controllers on the transient response of control systems, Complex control systems, Level control.

**[C] STUDY OF TRANSIENT RESPONSE OF SYSTEM AND CONTROL DYNAMICS:**

Transient response of control systems, Level control.

**[D] CONTROL OF UNIT OPERATIONS:**

Boiler controls, Distillation column controls, Compressor controls, Steam turbine controls, Heat exchanger controls

**[E] CONTROL SCHEMES:**

Ratio control, Cascade control, Feed-forward control, Selector control, Inverse-derivative control, Split range control, etc.

**[F] ADVANCED PROCESS CONTROL:**

Advance Control Systems – Adaptive Control, Valve Position Control (VPC), Multi-variable control, Introduction to Internal Model Control (IMC), Introduction to Model Predictive Control (MPC), Introduction to Artificial Intelligence (AI) and Fuzzy Logic Control (FLC).

**C. LEARNING OUTCOMES**

After successful completion of this course, student shall be able to:

- learn fundamental concepts of process control and basic loop configuration
- understand and interpret the open and closed loop response of simple control systems, as well as various control algorithms and their impacts
- learn basics of complex control and level control
- learn to study process and systematic stepwise design aspects of process control and apply them to design control schemes selected industrial process units as case study examples
- develop awareness regarding limitations and needs of basic PID control and various control strategies in problem-solution methodology
- develop understanding about higher level process complexities and basic brief concepts of various advanced control strategies

**D. RECOMMENDED TEXTBOOKS**

1. Process Control, by Peter Harriot
2. Applied Instrumentation in Process Industries, Vo. I & II, by Andrews & Williams
3. Process Control-Principles and Applications, by Surekha Bhanot

4. Principles of Process Control, by Patranabis
5. Automatic Control of Power & Process, by Manifold
6. Instrument Engineer's Handbook (Process Control), by BG Liptak (Vol. II)
7. Process Modeling, Simulation & Control for Chemical Engineers, by W. Luyben

**E. REFERENCE BOOKS**

1. Chemical Process Control, by Stephanopoulos
2. Process Control, by Pollard
3. Principal of Industrial Measurements, by Patranabis
4. Applied Instrumentation in Process Industries Vol. II, by Andrews & Williams
5. Chemical Process Control, by Shinskey
6. Chemical Process Control, by Coughnour & Copel

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

1. To study the response of Bare Thermometer
2. To study the response of Thermometer with thermowell
3. To study the open loop response of first order system
4. To study the open loop response of second order system
5. To study the response of Ratio Control Scheme

6. To study the response of Cascade Control Scheme
7. To study the response of Feed Forward Control Scheme
8. To study the response of First order Mixing Process
9. To study the response of Transportation Lag
10. To study the response of Single Tank and Two Tanks Systems

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

## ROBOTICS ENGINEERING (IC-715)

## SEM-VII (B.Tech, 4th Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

**A. OBJECTIVES OF THE COURSE**

- To make the students aware about importance of Roboticsin every field along with classification and terminologies.
- To teach the students about specifications, selection criteria and characteristics of different robotic systems of different fields like as Industry, Space, Agriculture, Home sector, Automation etc.
- To teach the students about various applications of Robotics in various field.

**B. DETAILED SYLLABUS**

**[A] Introduction**

Evolution of Robot and Robotics, Laws of Robotics, Progressive advancement in Robot, Robot Anatomy, Human Arm characteristics.

**[B] Co ordinate Frames ,Mapping & Transforms**

Co ordinate frames, Description of objects in space, Transformation of vectors, Inverting of Homogeneous Transforms, Fundamental rotation Matrices.

**[C] Modeling of robot –Direct kinematic model**

Mechanical structure and notations, Description of links & joints, Kinematic modeling of the manipulator, Denavit- Hartenberg notation, Kinematic relationship between adjacent links Inverse Kinematics.

**[D] Trajectory planning**

Joint space techniques, Cartesian space techniques

**[E] Robotic Actuators, sensor & vision**

Sensors in robots , Actuators, Kinds of sensors used in Robotics, Robotic vision

**[F] Robot Safety, Robot-Economy & installation**

Introduction, plant survey, potential safety hazards ,Safety planning check list, safety guidelines

**C. LEARNING OUTCOMES**

After successful completion of this course, student shall be able to:

- Develop awareness about needs ofdifferent devices & instruments for developing any robot with their design-development, classification and associated technical terminologies.
- Learn specifications and salient characteristics based choice making of any robotic system.

- Learn methods and applications in the every field.

**D. RECOMMENDED TEXTBOOKS**

**[1]**Robotics and Control by I.K.Mittal & I.J.Nagrath ,Second reprint 2005 Tata Mc Grawhill

**[2]** Introduction to robotics by Saeed B.Niku ,first Indian reprint 2002, pearson education

**E. REFERENCE BOOKS**

**[1]**Robotics by K. S. Fu , R. C. Gonzalez & C.S. G. Lee.

**[2]** Robotics principles & practice by K.C.Jain & L.N.Aggarwal, khanna publishers 2003 edition

**F. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

**List of laboratory experiments:**

1. To study about Robotics, Mapping and Transforms.
2. To study about Kinematic Modelling-I.
3. To study about Kinematic Modelling-II.
4. To study about Inverse Kinematic Modelling.
5. To study about Trajectory Planning -I.
6. To study about Trajectory Planning -II.
7. To study about Robotic Sensors- I.
8. To study about Robotic Sensors-II.
9. To study about Robotic Applications-I.
10. To study about Robotic Applications- II

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### PROJECT/INDUSTRIAL TRAINING (IC-801)

### SEM-VII (B.Tech, 4th Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| -- | -- | 28 | -- | -- | 100 | 300 | 400 | -- | -- | 14 | 14 |

The students will undertake project work for the period of one semester. They should design/develop & fabricate the project. They are supposed to prepared and submit a project report as a part of their term-work for the project and give seminars on their project work. The students may be sent to the industry for their project and they are to timely report to the department regarding monitoring and necessary guidance. They should arrange for demonstration of the project work at the time of examination They are to be examined based on viva and/or demonstration.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### PROJECT/INDUSTRIAL TRAINING (IC-801)

### SEM-VII (B.Tech, 4th Year)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| -- | -- | 28 | -- | -- | 100 | 300 | 400 | -- | -- | 14 | 14 |

The students will undertake project work for the period of one semester. They should design/develop & fabricate the project. They are supposed to prepared and submit a project report as a part of their term-work for the project and give seminars on their project work. The students may be sent to the industry for their project and they are to timely report to the department regarding monitoring and necessary guidance. They should arrange for demonstration of the project work at the time of examination They are to be examined based on viva and/or demonstration.

**B.TECH. SEMESTER – VIII (IC)**

**SUBJECT: SEMINAR(AF802)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| -- | -- | 8 | -- | 100 | -- | -- | 100 |

**B.TECH. SEMESTER – VIII**

**SUBJECT: PROJECT/INDUSTRIAL TRAINING (AF801)**

**SYLLABUS & SCHEME**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr 15 min) | Practical | T/W | Total |
| -- | -- | 28 | -- | -- | 300 | 100 | 400 |

The students will undertake project work for the period of one semester. They should design/develop & fabricate the project.

They are supposed to prepared and submit a project report as a part of their term-work for the project and give seminars on their project work. The students may be sent to the industry for their project and they are to timely report to the department regarding monitoring and necessary guidance.

They should arrange for demonstration of the project work at the time of examination They are to be examined based on viva and/or demonstration.

# Dharmsinh Desai University

## Faculty of Technology

## Department of Instrumentation and Control Engineering

### M. Tech.- II Sem. III

### SYLLABUS & SCHEME FOR THE SUBJECT: SEMINAR-I (MI-3XX)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| - | - | 4 | - | - | 50 | - | 50 | - | - | 2 | 2 |

**Seminar I**

The students are required to present Seminar on Project/given topic at every week.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### M. Tech.- II Sem. IV

**SYLLABUS & SCHEME FOR THE SUBJECT: SEMINAR-II (MI-4XX)**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| - | - | 4 | - | - | 50 | - | 50 | - | - | 2 | 2 |

**Seminar II** The students are required to present Seminar on Project/given topic at every week.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### M. Tech.- I Sem. I

**SYLLABUS & SCHEME FOR THE SUBJECT: PROCESS SENSORS AND CONTROLLERS (MI-1XX)**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

**A. OBJECTIVES OF THE COURSE**

To prepare the students to obtain useful and conceptual knowledge for sensor designs and application development and make them familiar with controller algorithms and computer network based modern control systems along with advancements in smart sensing and digital telemetry.

**B. DETAILED SYLLABUS:**

**[A] Process Sensors** Sensors for Temperature, Pressure, Flow, Level, Stress, Strain, Displacement transducers, Accelerometers, Application of sensors

**[B] Process Controllers & Actuators** Multi-variable control systems, Pneumatic, Hydraulic & Electrical Actuators, Control Valves.

**[C] Process Control Networks** Industrial Telemetry and Transduction concepts, HART protocol, Smart Transducers, Fieldbus, Foundation Fieldbus, PROFIBUS

**C. REFERENCE BOOKS:**


i.Process Control Instrumentation Technology by Curtis Johnson, 8th Edition, PHI.
ii. Instrument Engineer's Handbook by Bela G. Liptak, Vol. III, CRC Press.
iii.The Condensed Handbook of Measurement and Control by N. E. Battikha, 3rd Edition, ISA
iv.Fieldbuses for Process Control: Engineering, Operation and Maintenance, Jonas Berge, ISA
v.Foundation field bus by Ian Verhappen and Augusto Pereira, 2nd Edition, ISA
vi.SCADA: Supervisory Control and Data Acquisition, Stuart A. Boyer, 3rd Edition, ISA
vii. Process Instrumentation and controls Handbook (3rd Edition) by Douglus M. Considine, McGraw Hill Book Company.
viii.Industrial Control Handbook Volume-I Transducers by E.A. Parre, Collins, London.
ix. A course in Mechanical measurement & Instrumentation by A.K. Sawhney, Dhanpat Rai & Sons, Delhi.
x. Advanced PID Control, Karl J. Astrom and Tore Hagglund, ISA
xi. Automation Network Selection by Dick Caro, 2nd Edition, ISA

**D. LEARNING OUTCOMES:**

After completing this course, students should be able to:

- learn about designs of sensors and transducers of major industrial parameters
- learn to design and develop programs of digital controller algorithms
- obtain useful awareness regarding computer based modern control systems
- learn and understand latest technological advancements like smart transducers and fieldbuses

**E. LIST OF EXPERIMENTS**

1. To study Filter Design and Analysis tool
2. To develop various filters with given specifications
3. To study and understand functionality of Simulink
4. To study and plot response of proportional controller for given error
5. To study and plot response of PI controller for given error
6. To study and plot response of PID controller for given error
7. To find out characteristics of given Thermocouple
8. To find out characteristics of given RTD
9. To study working and principle of differential pressure transmitter
10. To determine ON-OFF control characteristic of temperature control loop
11. To measure flow using orifice plate
12. To measure level in a tank using hydrostatic level sensor

# Dharmsinh Desai University

## Faculty of Technology

## Department of Instrumentation and Control Engineering

### M. Tech.- I Sem. I

### SYLLABUS & SCHEME FOR THE SUBJECT: RESEARCH SKILLS (MI-1XX)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 1 | 0 | 2 | - | - | 50 | - | 50 | 1 | 0 | 1 | 2 |

### A. COURSE OBJECTIVE

**To make students acquire focus on a research problem using scientific methods**

- Learn methods to devise and design an experimentation set-up
- Learn basic instrumentation and data collection methods
- Learn strategies for report writing

### B. DETAILED SYLLABUS

**[A] Introduction to engineering research:** Definition, characteristics and types, basic research terminology, qualities of a researcher, research methods vs. methodology, overview of engineering research methods, Role of Research in Engineering, research ethics, intellectual property rights and scholarly publishing.

**[B] Research formulation:** Defining and formulating the research problem, selecting the problem, necessity of defining the problem, literature survey — significance in defining a problem, various sources, critical review, identifying gap areas from literature review and research databases, development of working hypothesis. Research design and data analysis: Research design − basic principles, need of research design, features of good design, important concepts relating to research design, observation and facts, laws and theories, method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis, strategies and tools, hypothesis testing, generalization and interpretation.

**[C] **Report writing:** Collecting Data, Processing Data, Types (thesis, report, journal papers etc.), qualities, structure and components of good technical document, use of software tools (Word processing, LATEX, etc.), illustrations and tables, bibliography, referencing and footnotes. Oral presentation − planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication

** Content of topic [C] are to be covered in Lab practices

### C. REFERENCE BOOKS


i. Research Methodology — Methods and Techniques, New Age International, 2014, By: Kothari. C.R

ii. Research Methodology — A Step-by-Step Guide for Beginners By: Kumar R.

iii. Statistics for Management, By-Richard I Levin amp; David S.Rubin, 7/e. Pearson Education, 2005.

iv. Business Research Methods, By-Donald R. Cooper, Pamela S. Schindler, 8/e, Tata McGraw-Hill Co.Ltd.,2006.

v. Random data: Analysis and Measurement Procedures, Bendat and Piersol, Wiley Interscience, 2001.
vi. Time Series Analysis and its Applications, Shumway and Stoffer, Springer, 2000.
vii. Spectral Analysis and its Applications, Jenkins, G.M., and Watts, D.G., Holden Day, 1986
viii. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
ix. Research design: Qualitative, quantitative, and mixed methods approaches. Creswell, John W. Sage publications, 2013.

**D. LEARNING OUTCOMES:**

At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Understand IPR protection
- Make use of word processing/ LATEX for report writing

**E. Laboratory Work Assignments based on-**

1. Critical Review of five referred journal papers
2. Hands on with word processing/LATEX
3. literature Search
4. Citation index services
5. Bibliography management tools(Mendeley/ Jabref)
6. plagiarism and plagiarism checker tools
7. IPR, patent search, patent documents

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### M. Tech.- I Sem. II

**SYLLABUS & SCHEME FOR THE SUBJECT: POWER ELECTRONICS SYSTEM DESIGN (MI-2XX)**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

**A. OBJECTIVES OF THE COURSE**

To prepare the students to design different inverter circuits and gain knowledge about different application oriented industrial drives

**B. DETAILED SYLLABUS**

**[A] Design of various inverters** – like parallel capacitor commutated inverter, series inverter, Mc Murray Bedford Inverter
Design of Device drivers circuits, Synchronized control circuits and free running control circuits Dual converter analysis & Design. Design of various device protection circuits
**[B] AC Drive** Induction motor drives Synchronous motor drives
**[C] Vector Controlled Induction Motor Drives** Introduction, Principle of vector Drive, Direct Vector Control, Indirect Vector Control
**[D] Permanent Magnet Synchronous and Brush less DC Motor Drives** Introduction, Control Strategies, PMSM, Reluctance motor drives

**C. REFERENCE BOOKS:**

i. Electric Motor Drives by R. Krishnan, PHI PublicationNew Delhi
ii. Power Electronics, Circuits, Devices & Applications by Muhammad H. Rashid (2nd Edition), PHI publication
iii. Power Electronics by Mohan, Undeland and Robbins, Wiley Publication, New York.
iv. Power Electronics by M.H. Rashid, PHI Publications, New Delhi

**D. LEARNING OUTCOMES:**

After completing this course students should be able to:

- Designing of Inverters
- Learn applications and basic fundamentals of vector drives, PMMC drives
- Application of AC drives in

**E. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

**List of laboratory experiments:**

1 To perform the operation of series inverter
2 To perform the operation of parallel inverter
3 To perform the operation of cycloconverters
4 To perform the operation of DC motor speed control
5 To study switch mode power supply
6 To carry project work on speed control of dc motor using pulse width modulation using PSIM
7 To perform single phase full wave-controlled bridge rectifier using PSIM
8 Project work on MOSFET based inverter for 15 watt Bulb.
9 Study project on line tracking Robot.
10 Technical study on battery operated vehicle drive .A review study
11 To study MATLAB & LABVIEW interface.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### M. Tech.- I Sem. II

**SYLLABUS & SCHEME FOR THE SUBJECT: NEURAL NETWORKS AND FUZZY LOGIC CONTROLS (MI-2XX)**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

**A. OBJECTIVES OF THE COURSE**

To prepare the students to gain knowledge of the Fuzzy sets, Fuzzy boolean algebra, Fuzzy logic based applications in control, Types of neural networks, their working principles and applications of neural networks in control.

**B. DETAILED SYLLABUS**

**[A] FUZZY LOGIC CONTROL:**

Introduction, sets, Boolean logic and algebra. Fuzzy sets, Fuzzy logic algebra. Fuzzy control.

**[B] NEURAL NETWORKS:**

Electronic neural networks. Fuzzy neural networks. Artificial Neural systems: Preliminaries, Fundamental concepts and modes of artificial neural systems, Single layer perceptron classifiers, single layer feedback networks, applications of neural algorithms.

**C. REFERENCE BOOKS:**


i. Introduction to applied fuzzy electronics, by Ahmad M. Ibrahim, PHI, New Delhi.
ii. Introduction to Artificial Neural systems by Jacek M. Zurada, Jaico Publishing House, (3rd Jaico Impression).
iii. Fundamental of Artificial Neural Networks, by Mohamad H. Hassoun, PHI, New Delhi.
iv. Fuzzy-Neural Control: Principles, Algorithms & Applications by Nie & Libnkens, PHI, New Delhi
v. Arificial Neural Networks, by B.Yegnanarayana, PHI New Delhi


**After completing this course students should be able to:**

- Describe and simulate fuzzy logic based systems in control.
- Describe and simulate neural network based systems in control.
- Describe and simulate adaptive neuro fuzzy based systems.
- Describe Implementation of VLSI using neural network.

**E. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD (IF APPLICABLE)**

**List of laboratory experiments:**

1 Fuzzy Logic Introduction
2 Fuzzy Sets
3 Fuzzy Logic and Algebra
4 Fuzzy Control
5 Fuzzy Logic Based Applications
6 Artificial Neural Network
7 Models of Neural Networks
8 Single Layer Perceptron Classifiers
9 Single Layer Feedback Networks
10 Artificial Neural Network Applications
11 Applications Based on Neuro - Fuzzy Systems

# Dharmsinh Desai University

## Faculty of Technology

## Department of Instrumentation and Control Engineering

### M. Tech.- I Sem. II

### SYLLABUS & SCHEME FOR THE SUBJECT: PEDAGOGY PRACTICE (MI-2XX)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| - | - | 2 | - | - | 50 | - | 50 | - | - | 1 | 1 |

**PEDAGOGY PRACTICE**

Each student will be required to submit one term paper about the trends in the subject chosen in consultation with faculty. He/She has to present a seminar intermittently regarding the progress of his/her studies.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### M. Tech.- I Sem. II

**SYLLABUS & SCHEME FOR THE SUBJECT: NANO TECHNOLOGY AND NANO SENSORS (MI-2XX)**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

## A. COURSE OBJECTIVES

To prepare students to gain knowledge about the important concept in nanotechnology and nano science along with making them familiar with various instruments used for nano scale analysis.

## B. DETAILED SYLLABUS

**[A] Introduction to Nanotechnology:**
Essence of Nanotechnology, Nano in daily life, Brief account of nano applications, Properties of nano materials.

**[B] Nano materials:**
Nano composites, Nanofying electronics, Sensing the environment, Energy and cleaner environment with nano technology.

**[C] Investigation and characterization: Generic Methodologies-** General classification of characterization methods, Microscopy techniques, Electron microscopy, Field ion microscopy, Scanning probe techniques, Spectroscopy techniques, Diffraction techniques, Summary of techniques for property measurement

**[D] Carbon nano structures:**
Introduction, Carbon molecules, Carbon clusters, Carbon nano tubes, Applications of carbon nano tubes, Gas phase culsters

**[E] Diagnosing personal health and medical applications:**
Lab on a chip, Understanding how pharmaceutical company develops drugs, Delivering a new drug the Nanotech way, Cooking cancer with nano cells,

**[F] Nano sensors:** Introduction, nanosensor Properties, Nanoscale organization of sensors, nanosensors based upon optical, chemical, physical properties, Quantum size effect, nano biosensors

**[G] Industrial applications of Nano Technology:** Nano technology application trends in Semiconductor manufacturing, medical applications, materials treatment (e.g. tires, fabrics, etc.), software design, telecommunications and petroleum sectors.

## C. REFERENCE BOOKS


i.Nanotechnology for Dummies by Richard Booker, Earl Boysen, Wiley Publishing Inc., 2006.
ii. Introduction to Nanotechnology by Charles P. Poole Jr., Frank J. Owens, John Wiley & Sons Publications, 2003.
iii. Nano: the essential by- T Pradeep
iv. Nano scale Science and technologies by- Robert Kelsall, Ian Hamley, Mark Geoghegan

v. Nano Materials- A.K.Bandyopadhyay New Age Publishers. India
vi. Sensors: Micro & Nano sensors, Sensor Market trends (Part 1&2) by H. Meixner.
vii. Between Technology & Science: Exploring an emerging field knowledge flows & networking on the nanoscale by Martin S. Meyer.
viii. Nano science & Technology: Novel structure and phenomena by Ping Sheng (Ed.) MEMS & MOEMS Technology and Applications- P. Rai Choudhury.
ix. Handbook of Applied Surface and Colloid Chemistry, Vol. 2, Edited by K. H. Chalmers, Contributed by Dr. DO Shah, John Willey & Sons publications.

**D. LEARNING OUTCOMES**

After completing this course students should be able to:

- Learn about applications of nano technology based devices in instrumentation measurement and remote sensing with special focus on biomedical and environmental monitoring domains
- Identify the difference between properties of nano materials and bulk materials
- Understand the working and principle of various instruments used for nano level analysis
- Get awareness of other application areas of nanotechnology and nano science

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### M. Tech.- II Sem. III

**SYLLABUS & SCHEME FOR THE SUBJECT: PROJECT (Phase-I) (MI-311)**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| - | - | 16 | - | - | 125 | 225 | 350 | - | - | 8 | 8 |

The student will undertake project work for the period of two semesters, out of which this is the first phase of the project. They should design/develop & fabricate the project. They are supposed to prepared and submit a project report as a part of their term-work for Phase-I of the project and give seminars on their project work. The students may be sent to the industry for their project and they are to timely report to the department regarding monitoring and necessary guidance.

They should arrange for demonstration of the project work at the time of examination (which may be partly). They are to be examined based on viva and/or demonstration. The project is to be continued and to be completed in the forth semester.

**M. Tech. Sem. III**
**SYLLABUS & SCHEME FOR THE SUBJECT**
**SEMINAR-III**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr) | Practical | T/W | Total |
| - | - | 2 | - | - | - | 50 | 50 |

**Seminar III**

The students are required to present Seminar on Project/given topic at every week.

# Dharmsinh Desai University

## Faculty of Technology

### Department of Instrumentation and Control Engineering

### M. Tech.- II Sem. IV

**SYLLABUS & SCHEME FOR THE SUBJECT: PROJECT (Phase-II) (MI-411)**

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Ext** | **Sess.** | **TW** | **Prac** | **Total** | **Lect** | **Tut** | **Prac** | **Total** |
| - | - | 20 | - | - | 150 | 300 | 450 | - | - | 10 | 10 |

The student will undertake project work for the period of one semester and this is the second phase of the project. They should design/develop & fabricate the project for Phase-II. They are supposed to prepared and submit a project report as a part of their term-work for Phase-II of the project and give seminars on their project work. The students may be sent to the industry for their project and they are to timely report to the department regarding monitoring and necessary guidance. They should arrange for demonstration of the project work at the time of examination. They are to be examined based on viva and/or demonstration.

The students should complete the project and should be completed the moderation at the time of final examinations.

**M. Tech. Sem. IV**
**SYLLABUS & SCHEME FOR THE SUBJECT**
**SEMINAR-IV**

| Teaching Scheme (H/W) | | | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorial | Practical | Theory (3 hrs) | Sessional (1 hr) | Practical | T/W | Total |
| - | 6 | - | - | - | - | 50 | 50 |

**Seminar IV**

The students are required to present Seminar on Project/given topic at every week.

# SYLLABI BOOK

# BACHELOR OF TECHNOLOGY
# INSTRUMENTATION AND CONTROL ENGINEERING

Department of Instrumentation and Control Engineering
Faculty of Technology
Dharmsinh Desai University
Nadiad – 387 001, Gujarat, India.

**http://www.ddu.ac.in**

**With effect from**
**AY. 2021-2022**

## TEACHING SCHEME FOR THE COURSE
## B. TECH. INSTRUMENTATION AND CONTROL
## (Admission Year 2021)

### B.Tech. Semester-1 (2021-2022)

| Subject | | AICTE Code Ref. | Teaching Scheme | | | Total | Credit | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | | Th. | Int. | TW | Prac. | Total |
| 1 | Mathematics -I | BSC103 | 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | - | 100 |
| 2 | Thermodynamics | ESC 209 | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 50 | - | 150 |
| 3 | Mechanics | BSC101 | 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | - | 100 |
| 4 | Elements of Electrical Engineering | ESC101 | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 50 | - | 150 |
| 5 | Computer Programming | ESC-103 | 2 | 0 | 3 | 5 | 3.5 | 40 | 0 | 50 | - | 90 |
| 6 | Workshop Practice -I | ESC104 | 0 | 0 | 2 | 2 | 1 | 0 | 0 | 50 | - | 50 |
| 7 | Environment Studies | MC-II | 2 | 0 | 0 | 2 | 0 | 40 | 0 | 0 | - | 40 |
| | | | **16** | **2** | **9** | **27** | **20.5** | **320** | **160** | **200** | **0** | **680** |

### B.Tech. Semester-2 (2021-2022)

| Subject | | AICTE Code Ref. | Teaching Scheme | | | Total | Credit | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | | Th. | Int. | TW | Prac. | Total |
| 1 | Mathematics -II | BSC104 | 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | - | 100 |
| 2 | Engineering Graphics | ESC102 | 3 | 0 | 3 | 6 | 4.5 | 60 | 40 | 50 | - | 150 |
| 3 | Chemistry | BSC102 | 3 | 0 | 0 | 3 | 3 | 60 | 0 | 0 | - | 60 |
| 4 | Basic Electronics | ESC201 | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 50 | - | 150 |
| 5 | Mechanics of Solids | ESC105b | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 50 | - | 150 |
| 6 | Workshop Practice -II | ESC | 0 | 0 | 3 | 3 | 1.5 | 0 | 0 | 50 | - | 50 |
| | | | **15** | **1** | **10** | **26** | **21** | **300** | **160** | **200** | **0** | **660** |

## B.Tech. Semester-3 (2022-2023)

| Subject | | AICTE Code Ref. | Teaching Scheme | | | Total | Credit | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | | Th. | Int. | TW | Prac. | Total |
| 1 | Mathematics -III | BSC201 | 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | 0 | 100 |
| 2 | Electronic Measurement | PCC(EC22) | 2 | 1 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 3 | Network Analysis | ESC(EC06) | 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |
| 4 | Digital Electronics | PCC(EC03) | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 5 | English | HSMC101 | 2 | 0 | 2 | 4 | 3 | 40 | 0 | 0 | 50 | 90 |
| 6 | Universal Human Values-II | HSMC301 | 3 | 0 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |
| | | | **16** | **3** | **8** | **27** | **23** | **340** | **160** | **75** | **125** | **700** |

## B.Tech. Semester-4 (2022-2023)

| Subject | | AICTE Code Ref. | Teaching Scheme | | | Total | Credit | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | | Th. | Int. | TW | Prac. | Total |
| 1 | Control Theory | PCC(EC19) | 2 | 0 | 2 | 4 | 3 | 60 | 0 | 25 | 25 | 110 |
| 2 | Analog Electronics | PCC(EC09) | 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |
| 3 | Power Electronics | PCC(ECEL14) | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 4 | Electrical Machines and Power | PCC(ESCXX) | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 5 | Control System Components | PCC(EC19) | 2 | 0 | 2 | 4 | 3 | 60 | 0 | 25 | 25 | 110 |
| 6 | Technical Communication Skills | HSMC201 | 2 | 0 | 2 | 4 | 3 | 40 | 0 | 0 | 50 | 90 |
| | | | **15** | **1** | **12** | **28** | **22** | **340** | **120** | **125** | **175** | **760** |

## B.Tech. Semester-5 (2023-2024)

| Subject | | AICTE Code Ref. | Teaching Scheme | | | Total | Credit | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | | Th. | Int. | TW | Prac. | Total |
| 1 | Microcontroller Fundamentals | PCC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 2 | Instrumentation Software Tools **(Program Elective I)** | PEC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| | Modeling, Simulation and Evolutionary Techniques **(Program Elective I)** | PEC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 3 | Sensors and Transducers | PCC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 4 | Process Measurement | PCC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 5 | Communication Systems **(Program Elective II)** | PEC | 2 | 1 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |
| | Cyber Physical Systems **(Program Elective II)** | PEC | 2 | 1 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |
| 6 | Entrepreneurship and Innovation | OEC | 2 | 0 | 1 | 3 | 2.5 | 60 | 0 | 25 | 25 | 110 |
| | | | **17** | **1** | **8** | **26** | **21.5** | **360** | **160** | **125** | **125** | **770** |

## B.Tech. Semester-6 (2023-2024)

| Subject | | AICTE Code Ref. | Teaching Scheme | | | Total | Credit | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | | Th. | Int. | TW | Prac. | Total |
| 1 | Microcontroller Applications **(Program Elective III)** | PEC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| | Embedded Systems **(Program Elective III)** | PEC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 2 | Instrumentation Systems | PCC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 3 | Power Plant Automation **(Program Elective IV)** | PEC | 2 | 1 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |
| | Analytical Instrumentation **(Program Elective IV)** | PEC | 2 | 1 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |
| 4 | Process Instrumentation and Control | PCC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 5 | Automation Systems Integration | PCC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 6 | Economics and Management | HSMC | 2 | 0 | 0 | 2 | 2 | 40 | 0 | 0 | 0 | 40 |
| 7 | Introduction to R Programming | OEC | 2 | 0 | 2 | 4 | 3 | 60 | 0 | 25 | 25 | 110 |
| | | | **18** | **1** | **10** | **29** | **24** | **400** | **160** | **125** | **125** | **810** |

## B.Tech. Semester-7 (2024-2025)

| Subject | | AICTE Code Ref. | Teaching Scheme | | | Total | Credit | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | | Th. | Int. | TW | Prac. | Total |
| 1 | Biomedical Instrumentation | PCC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 2 | Digital Signal Processing **(Program Elective V)** | PEC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| | Industrial Electronics & Drives **(Program Elective V)** | PEC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 3 | Advanced Control Theory & Design | PCC | 3 | 0 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |
| 4 | Process Control | PCC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 5 | Robotics Engineering **(Program Elective VI)** | PEC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| | Fundamentals of Machine Learning **(Program Elective VI)** | PEC | 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |
| 6 | Industrial Exposure & Practice | PROJ | 0 | 1 | 2 | 3 | 2 | 0 | 0 | 25 | 25 | 50 |
| 7 | Smart Instrumentation | OEC | 3 | 0 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |
| | | | **18** | **1** | **10** | **29** | **24** | **360** | **160** | **125** | **125** | **770** |

## B.Tech. Semester-8 (2024-2025)

| Subject | | AICTE Code Ref. | Teaching Scheme | | | Total | Credit | Exam Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lect | Tut | Prac | | | Th. | Int. | TW | Prac. | Total |
| 1 | Industrial Internship-Project | PROJ | 0 | 0 | 24 | 24 | 12 | 0 | 0 | 0 | 350 | 350 |
| 2 | Seminar | PROJ | 0 | 0 | 12 | 12 | 6 | 0 | 0 | 150 | 0 | 150 |
| | | | **0** | **6** | **36** | **36** | **18** | **0** | **0** | **150** | **350** | **500** |

**Total B.Tech IC Program Credit= 174**

## PROGRAM ELECTIVE OPTIONS

**Program Elective – 1**

1. Instrumentation Software Tools
2. Modeling, Simulation and Evolutionary Techniques

**Program Elective – 2**

1. Communication Systems
2. Cyber Physical Systems

**Program Elective – 3**

1. Microcontroller Applications
2. Embedded Systems

**Program Elective – 4**

1. Power Plant Automation
2. Analytical Instrumentation

**Program Elective – 5**

1. Digital Signal Processing
2. Industrial Electronics & Drives

**Program Elective – 6**

1. Robotics Engineering
2. Fundamentals of Machine Learning

## OPEN ELECTIVE OPTIONS

**Open Elective – 1**

1. Entrepreneurship and Innovation

**Open Elective – 2**

1. Introduction to R Programming

**Open Elective – 3**

1. Smart Instrumentation

**B. TECH. SEMESTER – I (CH/CL/IC/MH)**

**SUBJECT: (BS102) MATHEMATICS - I**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | - | - | 100 |

Reference Code BSC102

**DETAILED SYLLABUS**

**[1] CALCULUS**

Evolutes and involutes, Evaluation of definite and improper integrals; Beta and Gamma functions and their properties, Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule, Maxima and minima.

**[2] MATRICES**

Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Rank of a Matrix, Linear systems of equations, Determinants, Cramer's Rule, Inverse of a matrix, Gauss Elimination and Gauss Jordan method.

**[3] VECTOR SPACES**

Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Linear Independence of vectors, Diagonalization.

**[4] MULTIVARIABLE CALCULUS (DIFFERENTIATION)**

Limit, Continuity and Partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Vector Differential Calculus; Gradient, curl and divergence.

**TEXT / REFERENCE BOOKS**


1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.

2) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

3) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

4) D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

5) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

6) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

7) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

8) V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

**COURSE OUTCOMES**

After successful completion of the course, students will be able to:

Understand the concepts of linear algebra, Infinite series and Fourier series.

Implement vector differential calculus for solving engineering problem.

Apply methods for solving multivariate linear problems of engineering.

Apply methods for finding optimum value of function of several variables.

Evaluate eigenvalues and eigen vectors for analysing different engineering problems.

Construct Langrange's function for constraint linear optimize problem.

**COURSE ARTICULATION MATRIX**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 3 | 1 | 3 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 2 | 3 |
| **CO4** | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 3 |
| **CO6** | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| **Aveg.** | **3** | **3** | **2.5** | **2.5** | **2.3** | **2.5** | **1.7** | **1.5** | **2** | **2.8** | **2** | **2.7** |

**B. TECH. SEMESTER – I (CH/CL/IC/MH)**

**SUBJECT: (ES111) THERMODYNAMICS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 50* | - | 150 |

Reference Code ESC209

*TW Marks includes Viva based on TW

**DETAILED SYLLABUS**

**[1] INTRODUCTION**

Macroscopic versus microscopic view point, thermodynamic systems and control volume, thermodynamic properties, processes and cycles, homogeneous and heterogeneous systems, thermodynamic equilibrium, quasi-static process, pure substance, concept of continuum, temperature and zeroth law of thermodynamics, ideal gas and gas laws.

**[2] ENERGY AND ENERGY TRANSFER**

Forms of energy, energy transfer by heat and work, mechanical forms of work, first law of thermodynamics, energy conversion efficiencies

**[3] PROPERTIES OF PURE SUBSTANCES**

Pure substance, phases and phase change process, thermodynamic properties, property diagrams, ideal gas equation of state, van der waal equation, virial equation of state

**[4] ENERGY ANALYSIS OF A CLOSED SYSTEM PdV**

work in various quasi-static processes, energy balance, specific heats, internal energy, enthalpy and specific heats of solids, liquids and ideal gases

**[5] ENERGY ANALYSIS OF A OPEN SYSTEM**

Conservation of mass, flow work and energy of a flowing fluid, energy analysis of steady and unsteady flow systems.

**[6] SECOND LAW OF THERMODYNAMICS**

Introduction to second law, thermal energy reservoir, heat engine, refrigerator and heat pump, Clausis and Kelvin-Plank statement, perpetual motion machines, reversible and irreversible processes, Carnot and reversed Carnot cycle, , entropy principle and isentropic process, Tds and Maxwell relation

**[7] SEAM BOILERS**

Introduction, classification, mountings and accessories, classification and comparison of boiler draught systems 8 APPLICATIONS OF THERMODYNAMICS Construction and working of pumps, compressors, IC engine-Otto and Diesel engines, vapour compression refrigeration system, vapour absorption refrigeration system.

**TEXT / REFERENCE BOOKS**

1) Yunus A. Cengel, Michael A. Boles., “Thermodynamics- An engineering approach”, Tata McGraw Hill publishing co. ltd.

2.) Nag P.K., “Engineering Thermodynamics”, Tata McGraw Hill publishing co. ltd.

3.) Smith J.M., Van Ness H.C., Abbott M.M, “Introduction to chemical engineering thermodynamics”, McGraw Hill publishing co. Ltd.

4.) Sonntag. R.E., Borgnakke, C. and Van Wylen G.J., ”Fundamental of thermodynamics”, John Wiley and Sons.

5.) Moran M.J. and Shapiro H.N., “Fundamentals of engineering thermodynamics”, John Wiley and Sons.

**COURSE OUTCOMES**

After successful completion of the course, students will be able to:

| CO Number | Cognitive Level/Bloom’s Taxonomy | Statement |
|---|---|---|
| **CO1** | Analsye | Analyse heat, work and energy interaction for different process. |
| **CO2** | Understand | Discuss basic terminology of thermodynamics systems and interpret steady flow process. Describe applied machines. |
| **CO3** | Remember | Describe fundamentals of the first and second laws of thermodynamics and explain their significance to a wide range of systems. |
| **CO4** | Evaluate | Evaluate entropy changes in a various processes and determine the reversibility or irreversibility of a process. |
| **CO5** | Apply | Use different thermodynamics relations to obtain Maxwell relations to interpret various processes. |

**COURSE ARTICULATION MATRIX**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | | | | 1 | 1 | | | | | 2 |
| **CO2** | 3 | 3 | 1 | | 1 | | | | | | | 1 |
| **CO3** | 3 | 2 | | 1 | 2 | | 1 | 1 | | | 2 | 2 |
| **CO4** | 2 | 1 | 1 | | 2 | | | | | | | 1 |
| **CO5** | 1 | 1 | | | 1 | | | | | | | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

| CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 1 | 2 | |
| **CO2** | 3 | 1 | 1 |
| **CO3** | 3 | 2 | |
| **CO4** | 2 | | |
| **CO5** | 1 | 1 | |

**SUGGESTED LIST OF PRACTICALS**

| Sr. No. | Title |
|---|---|
| 1 | Study of modern steam boilers. |
| 2 | Study of boiler mountings and accessories. |
| 3 | Calorific values of fuel and its measurement. |
| 4 | Study of reciprocating and centrifugal pumps. |
| 5 | Study of reciprocating and centrifugal compressors. |
| 6 | Study of 4-stroke petrol engine (Otto cycle). |
| 7 | Study of 4-stroke diesel engine (Diesel cycle). |
| 8 | Study of vapour compression and vapour absorption refrigeration system. |
| 9 | Study of industrial piping system. |
| 10 | Study of basic flow regulating devices. |

**B. TECH. SEMESTER – I (CH/CL/IC/MH)**

**SUBJECT: (ES112) ELEMENTS OF ELECTRICAL ENGINEERING**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 50* | - | 150 |

Reference Code ESC101

*TW Marks includes Viva based on TW

## A. DETAILED SYLLABUS

**[1] DC CIRCUITS**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

**[2] AC CIRCUITS**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

**[3] TRANSFORMERS**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

**[4] ELECTRICAL MACHINES**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

**[5] ELECTRICAL INSTALLATIONS**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthling. Elementary calculations for energy consumption, power factor improvement. DC-DC buck and boost converters. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

**[6] SEMICONDUCTORS, DIODES AND APPLICATIONS**

Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) in brief.

## B. TEXT / REFERENCE BOOKS


[1] Basic Electrical, Electronics and Computer Engineering, R. Muthu Subramanian, S. Sali-vahanan, K. A. Muraleedharan, 2nd Edition, Tata McGraw Hill.

[2] Principles of Electronics, V. K. Mehta & Rohit Mehta, 11th Edition, S. Chand & Company.

[3] Electrical Technology (Vol: II), B. L. Theraja, A. K. Theraja, 23rd Edition, S. Chand & Company.

[4] Basic Electrical Engineering, D.P. Kothari, I. J. Nagrath, 3rd Edition, Tata McGraw Hill.


## C. COURSE OUTCOMES

At the end of the course, students should be able to

**CO1** Apply basic circuital law and simplify the network using reduction techniques. Apply KVL, KCL and Ohm's Laws to complex RLC networks to find response in any part of the network in form of node voltages and loop currents for given excitation. Apply superposition, Thevenin's and Norton's theorem to simplify the network and determine load voltage / current.

**CO2** The representation of alternating quantities. Analyse the single-phase AC circuits consisting of combinations of R, L and C.

**CO3** Acquire knowledge about the constructional details, principle of operation and applications of AC and DC machines.

**CO4** Gain knowledge for installation of electrical safety component and apply for the practical problems.

**CO5** Analyse basic quantities of simple magnetic circuits. Obtain equivalent circuit of a transformer for analysis of its performance.

**CO6** Analysis and Application of basic semiconductor devices.

## D. COURSE MATRIX

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 2 | | | 2 | | | 1 | | | | |
| CO2 | 1 | 3 | | | | | | 1 | | | | |
| CO3 | 3 | 2 | | | | 1 | 1 | | | | | |
| CO4 | 3 | 2 | 3 | | 2 | | | 1 | | | | |
| CO5 | 1 | 3 | 3 | 2 | 2 | | | | | | | |
| CO6 | 3 | 3 | | | | | | | | | | |

1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)

**B. TECH. SEMESTER – I (CH/CL/IC/MH)**

**SUBJECT: (BS103) MECHANICS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | - | - | 100 |

Reference Code ESC205

**DETAILED SYLLABUS**

| NO | TOPIC | L+T (hrs) | Cos |
|---|---|---|---|
| [1] | **Resultant force for 2D and 3D** force system, concept of free body diagrams | 14 | CO1, CO2 |
| [2] | **Equilibrium**<br>Equations for particles and rigid body subjected to 2D and 3D force system | 12 | CO1, CO2, |
| [3] | **Centroid and Centre of Gravity, Moment of Inertia** | 08 | CO3 |
| [4] | **Rotational Transformation of scalers and vectors**, Newton's Laws for particle motion, Potential Energy function F= - Grad V | 04 | CO4 |
| [5] | **Conservative and Non-Conservative Forces**, Conservation of momentum, angular momentum | 04 | CO4 |
| [6] | **Kinematics in a Coordinate System Rotating and Translating in a Plane** | 04 | CO5 |
| [7] | **Free Harmonic Motion:** damped harmonic motion, forced oscillation and resonance | 06 | CO5 |

**TEXT / REFERENCE BOOKS**


1) Engineering Mechanics, M. K. Harbola, 2nd Edition, Cengage Learning, 2013.

2.) Mechanics – J P Den Hartog, Dover Publications, 2003.

3.) Mechanical Vibrations - J P Den Hartog, Dover Publications, 1985.

4.) Theory of Vibrations with Applications – W. T. Thomson, 5th Edition, Pearson Education, 2008.

5.) Engineering Mechanics: Statics (V.1), Dynamics (V.2), J. L. Meriam and L. G. Kraige, 5th Edition, Wiley, 2017.

6.) Engineering Mechanics: Statics & Dynamics, Irving H. Shames, 4th Edition, Pearson Education, 2005.

7.) Vector Mechanics for Engineers: Statics (V.1), Dynamics (V.2), F. P. Beer and E. R. Johnston, 10th SI edition, McGraw Hill Education, 2017

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Able to provide students with exposure to the systematic methods for solving engineering problems. |
| **CO2** | Learn | Student will learn different various types of forces and force system. Effect of Force system and Equilibrium condition the factor affecting the Equilibrium. |
| **CO3** | Learn | Student will be able to learn of the Center of Gravity and Moment of Inertia of any type of the section of the body |
| **CO4** | Develop | To develop the understanding of modeling dynamic systems of engineering and ability to model the engineering components as particles to study their Kinematics. Application of work energy principle |
| **CO5** | Apply | Application of Newton's laws to particles and systems of particles. Fundamental understanding of vibrations and finding out natural frequency for mechanical systems |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 3 | 1 | 2 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 1 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 3 | 1 | 3 | 3 | 3 | 2 | 3 |
| **..** | | | | | | | | | | | | | | | |
| **Avg** | | | | | | | | | | | | | | | |

**B. TECH. SEMESTER – I (CH/CL/IC/MH)**

**SUBJECT: (ES113) COMPUTER PROGRAMMING**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 0 | 3 | 5 | 3.5 | 40 | - | 50* | - | 90 |

Reference Code ESC103

*TW Marks includes Viva based on TW

**A. DETAILED SYLLABUS**

**[1] INTRODUCTION**

Introduction to components of computer system, Idea of algorithm, Introduction to C, Constants, Variables & Data types in C, Managing input and Output operators

**[2] OPERATORS AND EXPRESSIONS**

C Operators: Arithmetic, relational, logical, increment °t, assignment and conditional, Arithmetic Expressions & Precedence Rule, Type conversion in C, Mathematical.

**[3] DECISION MAKING AND BRANCHING**

Decision making with If & If...else statements, goto statements.

**[4] DECISION MAKING AND LOOPING**

The while statement, the break statement & the do... while loop, the for loop, Jump within loops - Programs.

**[5] ARRAYS**

Array 1D, 2D, Character Array as String.

**[6] USER DEFINED FUNCTIONS**

Categories of Functions (Including using built in library), Call by Value, Parameter passing to function, Recursion.

**[7] STRUCTURE**

Defining structure, Assigning value to the structure members, Array of structure

**[8] POINTER**

Idea of pointer, declaration and Initialization of pointer, Passing address as function argument, Passing array to function using pointer. 9 FILE HANDLING

**B. TEXT / REFERENCE BOOKS**

1) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

2.) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

3.) Yashvant Kanetkar, Let Us C, 12th Edition, BPB Publication.

4.) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

## C. COURSE OUTCOMES

At the end of the course, students should be able to

**CO1** Recognize the fundamentals of programming such as variables, data types, operators and input output operations.

**CO2** Analyze and solve programming problems using decision making – branching and looping.

**CO3** Evaluate problems/programs using user defined function and arrays.

**CO4** Develop an application using the concepts of array, pointer, structure, and file management to solve engineering and/or scientific problems.

## D. COURSE MATRIX

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 2 | 3 | | | | 1 | | 1 | | 1 | | 1 |
| CO2 | 3 | 3 | | 2 | | 1 | | | 1 | 1 | | |
| CO3 | 2 | 2 | 1 | | | | | | | | | |
| CO4 | 2 | 2 | | 1 | | | | 1 | | | | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**B. TECH. SEMESTER – I (CH/CL/IC/MH)**

**SUBJECT : (SM101) ENVIRONMENTAL STUDIES (SM101)**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 2 | – | – | 2 | 0 | 40 | – | P/F | – | 40 |

## A. COURSE OVERVIEW

**Motivation:** Identify and analyze the current issues related to the environment, increase awareness and induce interest among students to propose ethically appropriate and economically feasible solutions for sustainable developmental activities.

**Objective:** The objective for this course is to bring awareness about sustainable development is a key to the future of mankind. Understanding, analyzing and proposing solutions to the contemporary environmental issues and problems of pollution, population explosion, solid waste disposal, environmental degradation, economic productivity, global warming, ozone layer depletion and loss of biodiversity.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **The multidisciplinary nature of environmental studies**<br>Definition, scope and importance & Need for public awareness | 1 | CO1<br>CO3 |
| [2] | **Natural resources**<br>**Renewable and non-renewable resource**: **Natural resources and associated problems**<br>Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams, and their effects on forests and tribal people<br>Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefit and problems<br>Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies<br>Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies<br>Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies<br>Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification<br>Role of an individual in conservation of natural resources. Equitable use of resources of sustainable lifestyles | 5 | CO1<br>CO2<br>CO3 |

| | | | |
|---|---|---|---|
| **[3]** | **Ecosystems**<br><br>1) Concept of an ecosystem, Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem<br>2) Ecological succession, Food chains, food webs and ecological pyramids<br>3) Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries) | 5 | CO1<br>CO2 |
| **[4]** | **Biodiversity and its conservation**<br>A. Introduction definition: Genetic, species and ecosystem diversity<br>B. Bio-geographical classification of India<br>C. Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels<br>D. India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India<br>E. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity | 5 | CO1<br>CO2 |
| **[5]** | **Environmental Pollution**<br>1. Definition, Causes, effects and control measures of:<br>2. Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards<br>3. Solid waste management, causes, effects and control measures of urban and industrial wastes<br>4. Role of an individual in prevention of pollution, Pollution case studies<br>5. Disaster management: floods, earthquake, cyclone and landslides | 5 | CO1<br>CO3<br>CO4 |
| **[6]** | **Social issues and the environment**<br>[5] From unsustainable to sustainable development, Urban problems related to energy<br>[6] Water conservation, rain water harvesting, watershed management<br>[7] Resettlement and rehabilitation of people: its problems and concerns. Case studies<br>[8] Environmental ethics: Issues and possible solutions<br>[9] Climate change: Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.<br>[10] Case studies<br>[11] Wasteland reclamation, Consumerism and waste products<br>[12] Environment Protection Act: Air (Prevention and Control of Pollution) Act, Water (Prevention &Control of Pollution) Act, | 5 | CO1<br>CO3<br>CO4 |

| | | | |
|---|---|---|---|
| | Wildlife Protection Act, Forest Conservation Act<br>[13] Issues involved in enforcement of environmental legislation<br>[14] Public awareness | | |
| **[7]** | **Human Population and the Environment**<br>**A.** Population growth, variation among nations, population explosion, Family Welfare Program, environment and human health, human rights, Value education<br>**B.** HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environmental and human health<br>**C.** Case studies | 4 | CO1<br>CO3<br>CO5 |
| **[8]** | **Field work**<br>1. Visit to a local area to document environmental assets (river/forest/ grassland/hill/mountain)<br>2. Visit to a local polluted site - Urban/Rural/Industrial/Agricultural<br>3. Study of common plants, insects, birds<br>4. Study of simple ecosystems – pond, river, hill, slopes etc. | | CO2<br>CO3<br>CO4<br>CO6 |
| | **Termwork:**<br>(a) Awareness Activities:<br>i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste<br>ii) Slogan making event<br>iii) Poster making event<br>iv) Cycle rally<br>v) Lectures from experts<br><br>(b) Actual Activities:<br>i) Plantation<br>ii) Gifting a tree to see its full growth<br>iii) Cleanliness drive<br>iv) Drive for segregation of waste<br>v) To live some big environmentalist for a week or so to understand his work<br>vi) To work in kitchen garden for mess<br>vii) To know about the different varieties of plants<br>viii) Shutting down the fans and ACs of the campus for an hour or so. | **(Pass/ Fail)** | CO1<br>CO2<br>CO3<br>CO4<br>CO5<br>CO6 |

## C. TEXT BOOKS


1. Erach Bharucha Textbook of Environmental Studies; Second Edition, Universities Press: Hyderabad, 2013.


## D. REFERENCE BOOKS


1.
2. Varandani, N. S. Basics of Environmental studies; Lambert Academic Publishing: Germany, 2013.

3.Basak, A. Environmental Studies; Dorling Kindersley: India, 2009.

4.Dhameja, S. K. Environmental studies; S. K. Kataria and Sons: New Delhi, 2007.

5.Rao, C. S. Environmental Pollution Control Engineering; Wiley publishers: New Delhi, 2006.

6.Brunner, R. C. Hazardous Waste Incineration; McGraw Hill: Michigan, 1989.

7.Clark, R. S. Marine Pollution; Clanderson Press Oxford: Bath, 2001.

8.Agarwal, K. C. Environmental Biology; Nidi Publ.: Bikaner, 2001.

9.Cunningham, W.P.; Cooper; Gorhani, T. H. E.; Hepworth, M.T., Environmental Encyclopedia; Jaico Publ. House: Mumbai, 2001.

10.De, A. K. Environmental Chemistry; Wiley Eastern: New Delhi, 2006.

11.Gleick, H. P. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security; Stockholm Env. Institute Oxford Univ. Press: New York, 1993.

12.Hawkins, R.E., Encyclopedia of Indian Natural History; Bombay Natural History Society: Bombay, 1987.

13.Heywood, V. H.; Waston, R. T. Global Biodiversity Assessment; Cambridge Univ. Press: Cambridge, 1995.

14.Mckinney, M.L.; School, R.M. Environmental Science systems & Solutions; Web enhanced edition: USA, 1996.

15.Miller, T.G. Jr.; Spoolman, S. E. Environmental Science; Cengage learning: Wadsworth, 2014.

16.Rao, M. N.; Datta, A.K. Waste Water treatment; Oxford & IBH Publ.: New Delhi, 1987.

17.Townsend, C., Harper, J.; Michael, B. Essentials of Ecology; Blackwell: Oxford, 2008.

18.Trivedi, R. K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II; B. S. Publications, Hyderabad, 2010.

19.Trivedi, R. K.; Goel, P. K. Introduction to air pollution; ABD Publishers: Jaipur, 2003.

20.Wanger, K. D., Environmental Management; W.B. Saunders Co. Philadelphia, USA, 1998.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Comprehension | **Recall, understand and interpret** the terminologies used in environmental studies correctly |
| **CO2** | Evaluate | **Relate** the importance of natural resources, biodiversity, hotspots and **deduce** the threats to biodiversity |
| **CO3** | Analysis | **Analyse** the factors causing environmental pollution, **formulate** the role of an individual in abatement and control of pollution, **improve** disaster management techniques |
| **CO4** | Evaluate | **Evaluate** the social issues involved in climate change, water conservation, rainwater harvesting, wasteland reclamation, consumerism and waste generation, environmental ethics, environmental laws and requirement of public awareness |
| **CO5** | Comprehension | **Understand** the issues related to population, family welfare programs, human health, value education, and role of IT in environment |
| **CO6** | Application | **Make use of** the field work including visits to local areas to document environmental assets, assess the polluted sites, study species and ecosystems in our surroundings |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| **CO2** | 1 | 2 | 1 | 1 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 3 |
| **CO6** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| **Avg** | 2.16 | 2.67 | 2.33 | 2.33 | 2.16 | 2.5 | 3 | 2.5 | 2.33 | 2.83 | 2 | 2.5 | 2.16 | 2.67 | 2.67 | 2.67 |

**B. TECH. SEMESTER – I (CH/CL/IC/MH)**

**SUBJECT: (ES114) WORKSHOP PRACTICE - I**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 0 | 0 | 2 | 2 | 1 | - | - | 50* | - | 50 |

Reference Code ESC104

*TW Marks includes Viva based on TW

**DETAILED SYLLABUS**

**[1]** Introduction To Workshop, Basic Workshop types

**[2]** Safety requirement in workshop, Safety rules

**[4]** To Understand "5S" Concept for Workplace

**[5]** Demonstration of Tin smithy Tools and it's exercise

**[6]** To make job for Tin smithy shop

**[7]** Demonstration of Plumbing tools, It's accessories.

**[8]** To make job for Plumbing shop

**[9]** Introduction to Fabrication shop, Welding Equipment

**[10]** To make job for Fabrication shop

**[11]** Introduction of Machine shop

**[12]** Introduction and Demonstration of Lathe machine

**[13]** Introduction and Demonstration of Milling and Radial Drilling m/c

**TEXT / REFERENCE BOOKS**

1) Equipment Manuals

**COURSE OUTCOMES**

**CO1** Understand basic house keeping and safety requirement while working in workshop.
**CO2** Identify and use tools / Accessories of different workshop departments which could result in skill improvement of students.
**CO3** Remember, analyse and apply theoretical and practical knowledge for prototype development by completing workshop assignments and jobs.
**CO4** Enhancing creativity by performing various practical tasks in different workshop trade.

**COURSE ARTICULATION MATRIX**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 |
| **CO2** | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 |
| **CO3** | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 |
| **CO4** | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

| CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 2 | 2 | 1 |
| **CO2** | 2 | 2 | 1 |
| **CO3** | 2 | 2 | 1 |
| **CO4** | 2 | 2 | 1 |

**B. TECH. SEMESTER – II (CH/CL/IC/MH)**

**SUBJECT: (BS203) MATHEMATICS - II**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | 0 | 100 |

Reference Code BSC104

**DETAILED SYLLABUS**

**[1] FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS AND INTRODUCTION TO HIGHER ORDER DIFFERENTIAL EQUATIONS**

Exact, linear and Bernoulli's equations, Introduction to second order linear differential equations with variable coefficients, Method of variation of parameters, Cauchy-Euler equation.

**[2] SERIES SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS BY POWER SERIES METHOD**

Introduction, Validity of series solution of the equation, General Method, Forms of series solution.

**[3] PARTIAL DIFFERENTIAL EQUATIONS**

Basic Concepts, Classification and Solutions of partial differential equations: Lagrange's linear equation of first order, Non-linear equations of first order- Charpit's method, Homogenous linear equations with constant coefficient to find the complementary functions and the particular integral, Introduction to non-homogenous linear equations with constant coefficients, Method of separation of variables.

**[4] MULTIVARIABLE CALCULUS (INTEGRATION)**

Multiple Integration: Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Introduction to Triple integrals (Cartesian), Vector line integrals, Vector surface integrals, Theorems of Green, Gauss and Stoke's.

**[5] LAPLACE TRANSFORM**

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions, Finding inverse Laplace transform by different methods, Convolution theorem, Evaluation of integrals by Laplace transform, Solving ODE by Laplace Transform method.

**TEXT / REFERENCE BOOKS**

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.

2.) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Ed. Pearson, 2002.

3.) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

4.) W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Prob-lems, 9th Edn., Wiley India, 2009.

5.) S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

6.) E. A. Coddington, An Intro. to Ordinary Differential Equations, Prentice Hall India, 1995.

7.) J. W. Brown & R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

8.) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Pub., 2008.

**B. TECH. SEMESTER – II (CH/CL/IC/MH)**

## SUBJECT: (ES203) ENGINEERING GRAPHICS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 3 | 6 | 4.5 | 60 | 40 | 50* | - | 150 |

Reference Code ESC102

*TW Marks includes Viva based on TW

**DETAILED SYLLABUS**

**[1] INTRODUCTION TO ENGINEERING DRAWING**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic section curves (Ellipse, Parabola, Hyperbola), Cycloidal Curves (Cycloid, Epicycloid, Hypocycloid), Involutes; Archemedian Spiral

**[2] SOLID GEOMETRY**

Projection of points, projection of lines and their applications. Projection of regular planes such as square, rectangle, triangle, circle, pentagon, hexagon, rhombus. Projection of right and regular solids inclined to both the planes (prisms, pyramids, cylinder and cone)

**[3] ORTHOGRAPHIC PROJECTIONS**

First angle and third angle projection methods, conversion of pictorial views into Orthographic projections with dimensioning, sectional orthographic projection, special sections

**[4] SECTION OF SOLIDS AND DEVELOPMENT OF SOLIDS**

Sections and Sectional Views of Right Angular Solids Covering, Prism, Cylinder, Pyramid, Cone

**[5] DEVELOPMENT OF SURFACES**

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

**[6] ISOMETRIC PROJECTIONS**

Principles of Isometric projection – Isometric Scale, Isometric projection and view, Conversion of orthographic views to isometric projections and views

**[7] WORKING ENVIRONMENT OF CAD SOFTWARE**

Menu bar, Quick access toolbar, Dashboard/Ribbon, Toolbars, Drawing space, Navigation bar (View controls: zoom, pan, orbit, ), Command prompt, Status bar, Drawing Area (Background, Crosshairs, Coordinate System), Shortcut Menu, Properties manager

**[8] DRAWING CUSTOMIZATION**

Setting up the drawing sheet (drawing sheet templates, drawing limits, drawing units etc.), Coordinate system (User coordinate system, Absolute and relative coordinates, Cartezian and Polar coordinates), Modes of drawing (Grid, Snap, Ortho, Osnap, Otrack, Polar tracking, Iso draft, etc.) Formatting (colors, line type, line weight, point style etc.)

**TEXT / REFERENCE BOOKS**

1) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

2.) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
3.) Shah P. J., (2014) Engineering Graphics, S. Chand Publishing
4.) Luzadder W., Duff J., (1992), Fundamentals of Engineering Drawing, Peachpit Press
5.) Gill P. S., (2009), Engineering Drawing, S. K. Kataria & Sons
6.) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

**SUGGESTED LIST OF PRACTICALS**

**Sr. No. Title**

1 Types of lines, Dimensioning methods and Dimensioning systems (Zero sheet)

2 Geometrical Constructions

3 Engineering Curves (Conics) and Orthographic Projection

4 Projections of Straight lines and Sectional Orthographic Projection

5 Engineering Curves: Cycloids & involute and Projections of right and regular Planes

6 Isometric Projection and Projections of right and regular solids

7 Archimedean spiral and Development of surfaces

**COURSE OUTCOMES**

After successful completion of the course, students will be able to:

| | |
|---|---|
| **CO1** | To understand primary concepts of Engineering Drawing and geometrical construction. |
| **CO2** | Demonstrate correct usage of methods, concepts, and theories to illustrate and solve problem of conic sections and plane and space curves |
| **CO3** | Illustrate correct usage of methods, concepts, and theories to solve problem of solid geometry. |
| **CO4** | Select an appropriate standard projection system, break down complex 3D problem into various orthographic and sectional orthographic views, and illustrate missing features and learn basis aspects of CAD software. |
| **CO5** | Generate isometric projection from two-dimensional drawing and prepare drawing in CAD software. |
| **CO6** | Create development of various parts/components in real life situation. |

**COURSE ARTICULATION MATRIX**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 |
| **CO2** | 3 | 1 | 1 | 1 | - | - | - | - | 1 | 1 | 1 | 2 |
| **CO3** | 3 | 2 | 1 | 1 | - | - | - | - | 1 | 1 | 1 | 2 |
| **CO4** | 3 | 2 | 1 | 1 | 2 | - | - | - | 1 | 1 | 1 | 2 |
| **CO5** | 3 | 2 | 1 | 1 | 2 | - | - | - | 1 | 2 | 1 | 2 |
| **CO6** | 3 | 2 | 1 | 1 | - | - | - | - | 1 | 2 | 1 | 2 |

| CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 1 | 1 | 1 |
| **CO2** | 2 | 2 | 1 |
| **CO3** | 2 | 1 | 1 |
| **CO4** | 2 | 2 | 2 |
| **CO5** | 2 | 2 | 2 |
| **CO6** | 2 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

**B. TECH. SEMESTER – II (CH/CL/IC/MH)**

## SUBJECT: (ES204) BASIC ELECTRONICS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 50* | - | 150 |

Reference Code ESC201

*TW Marks includes Viva based on TW

**A. DETAILED SYLLABUS**

**[1] TRANSISTOR & CHARACTERISTICS**

Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Di-vider Bias Configuration

**[2] FIELD EFFECT TRANSISTOR (FET)**

Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuit

**[3] TRANSISTOR AMPLIFIERS AND OSCILLATORS**

Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Cou-pling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Prin-ciple, Advantages of Negative Feedback, Topologies, Current Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift

**[4] OPERATIONAL AMPLIFIERS AND APPLICATIONS**

Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, and inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator, wein bridge oscillator.

**[5] DIGITAL ELECTRONICS FUNDAMENTALS**

Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification, Logic ICs, Implementation of combinational logic - half and full adder/subtractor, multiplexers, de-multiplexers

**[6] SENSORS & SIGNAL CONDITIONING CIRCUITS**

Types of sensors – pneumatic, electromagnetic, electronic, smart sensors. Diaphragm, bellows and bourdon tube, Resistive, Capacitive, Inductive, ultrasonic, LVDT, piezoelectric, optoelec-tronic transducers, thermocouple, RTD and thermistors, Application of sensors for flow, level, temperature and stress measurement, Bridge Circuit, Differential Amplifier, Instrumentation Amplifier

**B. TEXT / REFERENCE BOOKS**

1) Principles of Electronics, 11th Edition By V. K. Mehta & Rohit Mehta Publisher: S. Chand & Company

2.) Electrical & Electronic Measurement & Measuring Instruments, 17th Edition By A.K. Sawhney Publisher: Dhanpat rai

3.) M. M. Mano, "Digital logic and Computer design", Publisher : Pearson Education India.

**C. COURSE OUTCOMES**

At the end of the course, students should be able to

- **CO1** To understand fundamentals of transistor and analyse the transistor characteristics for different transistor configurations.
- **CO2** Designing the biasing circuit of BJT amplifier and its application.
- **CO3** Study the construction and characteristics of FET and its classifications.
- **CO4** Understand digital gates and apply Boolean algebra for minimization of Boolean expression and implement various combinational circuits.
- **CO5** Analyse the fundamental of op-amp and its applications.
- **CO6** Understand different types of sensors, its working principals and their applications

**D. COURSE MATRIX**

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 2 | 2 | | 2 | | | 1 | | | | |
| CO2 | 3 | 2 | | | | 1 | 1 | | | | | |
| CO3 | 2 | 3 | 2 | | | | | 1 | 1 | | | |
| CO4 | 3 | 2 | 3 | | 2 | | | 1 | 1 | 1 | | |
| CO5 | 2 | 3 | 2 | 2 | 2 | | | | 1 | 1 | | |
| CO6 | 2 | 2 | 3 | 2 | | | | | | | | |

1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High)

| | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | | | |
| **CO2** | | | |
| **CO3** | | | |
| **CO4** | | | |
| **CO5** | | | |
| **CO6** | | | |

**B. TECH. SEMESTER – II (CH/CL/IC/MH)**

## SUBJECT: (ES205) MECHANICS OF SOLIDS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 50* | - | 150 |

Reference Code BSC101

*TW Marks includes Viva based on TW

**DETAILED SYLLABUS**

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Concept of stress and strain, elasticity, generalized Hooke's law for 3D, concept of isotropy and homogeneity, plane stress and plane strain idealization, axial, volumetric and thermal stresses and strains | 12 | CO1, CO2 |
| [2] | Force-strain-deformation analysis for axial load, flexure, shear and torsion | 18 | CO3 CO4 |
| [3] | Mechanical properties of metals – elasticity, plasticity, strain hardening, hardness, toughness, fatigue, strain energy | 04 | CO1 |
| [4] | Transformation of stress and strain at a point, Principal stresses and strains, Mohr's Circle, strain rossete | 06 | CO5 |

**TEXT / REFERENCE BOOKS**

1) Strength of Materials: Part– I and II, Stephen Timoshenko, 3rd Edition, CBS Publisher, 2002.

2.) Strength of Materials, Sadhu Singh, 1st Edition, Khanna Book Publishing Company, 2016.

3.) Advanced Mechanics of Solid, L. S. Srinath, 3rd Edition, McGraw Hill Publication, 2017.

4.) Engineering Mechanics of Solids, E P Popov, 2nd Edition, Prentice Hall India Learning Pvt. Ltd, 2002.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Apply | Apply the fundamental concepts of force deformation and stress-strain relationships to basic engineering structures. |
| CO2 | Understand | The student will have the basic understanding of stress, strain & Deformation, Bending, Bending Stress in members. |
| CO3 | Apply | Ability to draw shear force diagram and banding moment for different types of beams |
| CO4 | Evaluate | To be able to determine the shear stress and twist in shafts subjected to torque |
| CO5 | Analyse | Apply the concept of principal stresses and theories of failure to determine stresses on a 2-D element. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 2 | 3 | 1 | 2 | 3 | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |
| **..** | | | | | | | | | | | | | | | |
| **Avg** | | | | | | | | | | | | | | | |

| | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | | | |
| **CO2** | | | |
| **CO3** | | | |
| **CO4** | | | |
| **CO5** | | | |

**B. TECH. SEMESTER – II (CH/CL/IC/MH)**

**SUBJECT: (BS204) CHEMISTRY**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 0 | 3 | 3 | 60 | - | - | - | 60 |

Reference Code BSC102

*TW Marks includes Viva based on TW

**DETAILED SYLLABUS**

**[1] ATOMIC AND MOLECULAR STRUCTURE**

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multi centre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

**[2] SPECTROSCOPIC TECHNIQUES AND APPLICATIONS**

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering.

**[3] INTERMOLECULAR FORCES AND POTENTIAL ENERGY SURFACES**

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

**[4] USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA**

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams

**[5] PERIODIC PROPERTIES**

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

**[6] STEREOCHEMISTRY**

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

**TEXT / REFERENCE BOOKS**

1) University chemistry, by B. H. Mahan

2.) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

3.) Fundamentals of Molecular Spectroscopy, by C. N. Banwell

4.) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

5.) Physical Chemistry, by P. W. Atkins

6.) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

## B. TECH. SEMESTER – II (CH/CL/IC/MH)

## SUBJECT: (ES206) WORKSHOP PRACTICE - II

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 0 | 0 | 3 | 3 | 1.5 | - | - | 50* | - | 50 |

Reference Code ESC104b

*TW Marks includes Viva based on TW

**A. DETAILED SYLLABUS**

• Introduction to Electrical Components: Switches, MCB, ELCB, Tube-light, Bulb, parallel connection of electrical components, wiring in fan and motor

• Introduction to Electronic Components: Active and passive components

• Use of basic source & measuring instruments (Power supply, function generator, CRO, DMM)

• Measure voltage, current, frequency, phase difference, power, power factor for single and three phase supply

• Identify various types of ports, cables and connectors

• Linux installation

• Network cabling and crimping for wired and wireless network

• PCB layout design (like proteus) Software installation and layout design using the same

• Solder and de-solder electronic components on PCB

• Identify and rectify open circuit and short circuit faults in PCB/system.

• Test assembled electronic circuit for various parameters and faults • To design a device for charging small battery during door opening and closing.

• To design a mobile charger using solar PC cell panel for offices and house hold.

• To design/develop an electronic weighing machine.

• To design/develop an electronic lock for house in the workshop.

• To design/develop and innovative electrical bell using electronics components

**MINI Project:**

Apart from above experiments a group of students has to undertake a mini project. Following are some examples for the same:

**B. TEXT / REFERENCE BOOKS**

1) Electronic Principles, Albert Malvino and David J. Bates, 7th Edition, McGraw Hill

2) Electronic Devices, Thomas L. Floyed, 7th Edition, Pearson

## B. TECH. SEMESTER – III (EC/IC)

## SUBJECT: MATHEMATICS – III

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 1 | 0 | 4 | 4 | 60 | 40 | 0 | 0 | 100 |

Reference Code BSC201a

### A. DETAILED SYLLABUS

1 **NUMERICAL METHODS:** Solution of algebraic and transcendental equations by regula-falsi method and Newton-Raphson's method, solution of linear simultaneous equations by Gauss-Jordan and Gauss-Seidel method, numerical methods to solve first order and first degree ordinary differential equations by Runge's method and Runge-Kutta method, numerical integration using trapezoidal rule, Simpson's one-third rule, and Simpson's three-eighth rule.

2 **FINITE DIFFERENCES AND INTERPOLATION:** Finite difference: Introduction to forward difference, backward difference, central difference, shift, and averaging operators. Newton's forward and backward difference interpolation formula, central difference interpolation formula by Stirling formula and Bessel's formula. Lagrange's interpolation formula for unequal interval. Numerical differentiation: Derivatives using forward difference, backward difference, and central difference (Stirling's) formula for tabulated values, maxima and minima of a tabulated function

3 **COMPLEX NUMBERS:** Definition, elementary operations, properties, Argand diagram, modulus, amplitude, De-Moivre's theorem, expand $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$ in powers of $\sin \theta$, $\cos \theta$, and $\tan \theta$ respectively, expand $\sin m\theta$, $\cos m\theta$, or $\sin m\,\theta \cdot \cos m\theta$ in a series of sines or cosines of multiples of $\theta$.

4 **PROBABILITY DISTRIBUTIONS AND STATISTICS:** Probability distributions: Binomial distribution, Poisson distribution, and normal distribution, calculation of errors: probable error and standard error, coefficient of correlation, rank correlation, lines of regression, curve fitting: method of least square approximation for straight line, parabola, second degree parabola, and non-polynomial approximation.

### B. RECOMMENDED TEXT / REFERENCE BOOKS


1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.

2) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

3) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

4) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

## C. COURSE OUTCOMES

| CO NUMBER | Statement |
|---|---|
| CO1 | |
| CO2 | |
| CO3 | |
| CO4 | |

## D. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | |
| CO6 | | | | | | | | | | | | |
| CO7 | | | | | | | | | | | | |
| CO8 | | | | | | | | | | | | |

## E. CO AND PSO MATRIX

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| CO1 | | | |
| CO2 | | | |
| CO3 | | | |
| CO4 | | | |
| CO5 | | | |
| CO6 | | | |
| CO7 | | | |
| CO8 | | | |

## B. TECH. SEMESTER – III (EC/IC)

## SUBJECT: ELECTRONIC MEASUREMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 1 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code EC22

### A. COURSE OVERVIEW

The creating sound background for understanding of operating principle, working and application of various electronic instruments. By offering these course department encourages to use sensors for measurement of various parameters like temperature, pressure, level and flow. Moreover, design and analysis of various bridge circuits and meter circuit utilized in electronic measurement.

### B. DETAILED SYLLABUS

| NO. | TOPIC |
|---|---|
| [1] | **MEASUREMENT AND ERROR**<br>Accuracy and Precision, Definitions, Significant Figures, Types of Error, Statistical Analysis, Probability of Errors, Limiting Errors , Problems. |
| [2] | **SYSTEM OF UNITS OF MEASUREMENTS**<br>Fundamental and Derived Units, System Of Units, Electric and Magnetic Units, International System of Units, Other System of Units, Conversion of Units. |
| [3] | **STANDARDS OF MEASUREMENTS**<br>Classification of Standards, Standards of Mass, Length and Volume, Time and Frequency Standards, Electrical Standards, Standards of Temperatureand Luminous Intensity, IEEE standards. |
| [4] | **BRIDGES AND THEIR APPLICATION**<br>Introduction, Wheatstone Bridge, Kelvin Bridge, Guarded Wheatstone Bridge, AC Bridges and their Application, Comparison Bridges, Maxwell Bridge, Hay Bridge, Schering Bridge, Unbalance Conditions, Wien Bridge, Wagner Ground Connection, Potentiometer. |
| [5] | **ELECTRONIC INSTRUMENTS FOR MEASURING BASIC PARAMETERS**<br>Amplified DC Meter, AC Voltmeter using Rectifiers, True RMS- Responding Voltmeter, Electronic Multimeter, Analog Voltmeter, Differential Voltmeters, Digital Voltmeters, Component Measuring Instruments, Q Meter, Vector Impedance Meter, Vector Voltmeter, RF Power and Voltage Measurement. |
| [6] | **OSCILLOSCOPES**<br>Introduction, Oscilloscope, Block Diagram, Cathode Ray Tube, CRT Circuits, Vertical Deflection System, Delay Line, Multiple Trace, Horizontal Deflection System, Oscilloscope Probes and Transducers, Oscilloscope Techniques, Special Oscilloscopes. |
| [7] | **ELECTROMECHANICAL INDICATING INSTRUMENTS**<br>Suspension Galvanometer, Torque and Deflection of the Galvanometer, Permanent-Magnet Moving coil Mechanism, DC Ammeters, DC voltmeters, Voltmeter Sensitivity, Series ohmmeter, Shunt ohmmeter, Multi meter or VOM, Calibration of DC Instruments, Thermo instruments, Electrodynamometers in Power Measurements, Watt Meter, Instrument Transformers |

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Electrical & Electronic Measurement & Measuring Instruments, A. K. Sawhney, 17th Edition, Dhanpat Rai & Co.
2) Electronic Instrumentation and Measurement Technique, Wlliam D. Cooper & Albert D. Helfrick, 5thEdition, Prentice Hall of India
3) Electronics Measurement & Instrumentation, R. K. Rajput, 1st Edition, Prentice Hall of India
4) Electronic Instrumentation, H. S. Kalsi, 2nd Edition, Tata McGraw Hill

## D. COURSE OUTCOMES

| CO NUMBER | Statement |
|---|---|
| **CO1** | Study of various parameters based on measurement and error. |
| **CO2** | Study of system units of Measurements like, fundamental and derived units, Electric and Magnetic units and conversion of units. |
| **CO3** | Design and extend meter circuit like DC Ammeter, DC Voltmeter & series type ohmmeter for given specification. |
| **CO4** | Illustrate the working of instrument for measuring AC parameters like voltage, current, power factor and energy. |
| **CO5** | Design DC bridges for measurement of low & medium value of resistance like Wheatstone bridge, kelvin's double bridge. |
| **CO6** | Design AC bridges for measurement of primary and secondary parameters of components. |
| **CO7** | Compare various voltmeters like amplified DC meter, AC voltmeter using rectifier, True rms responding voltmeter and electronic multimeter for improving accuracy of measurement. |
| **CO8** | Illustrate the working of various oscilloscope for measuring voltage, frequency and phase. Applications of various transducers used in measurement systems. |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | |
| CO6 | | | | | | | | | | | | |
| CO7 | | | | | | | | | | | | |
| CO8 | | | | | | | | | | | | |

## F. CO AND PSO MATRIX

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| CO1 | | | |
| CO2 | | | |
| CO3 | | | |
| CO4 | | | |
| CO5 | | | |
| CO6 | | | |
| CO7 | | | |
| CO8 | | | |

## B. TECH. SEMESTER – III (EC/IC)

## SUBJECT: NETWORK ANALYSIS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 1 | 2 | 5 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code EC06

### A. COURSE OVERVIEW

This course is designed to provide a complete overview of electric circuit analysis used in electronics engineering. The students can analyse electrical networks by understanding application of basic laws, theorems and transforms. The concept of this subject is useful to the students for understanding the concept of stability of the circuit and its frequency domain analysis.

### B. DETAILED SYLLABUS

| NO | TOPIC |
|---|---|
| [1] | **DEVELOPMENT OF THE CIRCUIT CONCEPT**<br>Introduction, Charge and Energy, The Relationship of Field and Circuit Concepts, The Capacitance Parameter, The Inductance Parameter, The Resistance Parameter, Units and scaling, Approximation of a Physical System as a circuit. |
| [2] | **CONVENTIONS FOR DESCRIBING NETWORKS**<br>Reference Directions for Current and Voltage, Active Element Conventions, the Dot Convention for Coupled Circuits, Topological Description of Networks. |
| [3] | **NETWORK EQUATIONS**<br>Kirchhoff's Laws, The Number of Network Equations, Source Transformations, Examples of the Formulation of Network Equations Loop Variable Analysis, Node Variable Analysis, Determinants: Minors and the Gauss Method, Duality. |
| [4] | **FIRST ORDER DIFFERENTIAL EQUATIONS**<br>General and particular solutions, Time constants, the integrating factor, More Complicated Networks. |
| [5] | **INITIAL CONDITIONS IN NETWORKS**<br>Why Study Initial Conditions? Initial Conditions in Elements, Geometrical Interpretation of Derivatives, A Procedure for Evaluating Initial Conditions, Initial State of a Network. |
| [6] | **DIFFERENTIAL EQUATIONS**<br>Second order equations, Internal Excitation, Higher order equations ;Internal Excitation, Networks Excited by External Energy Sources, Response as related to the s-Plane Location of Roots, General Solutions in terms of S,Q and ωn. |
| [7] | **THE LAPLACE TRANSFORMATION**<br>Introduction, The Laplace Transformation, Some Basic Theorems for the Laplace Transformation, Examples of the solution of problems with the Laplace Transformation, Partial Fraction Expansion, Heaviside's Expansion Theorem, Examples of Solutions by the Laplace Transformation. |
| [8] | **TRANSFORMS OF SPECIAL SIGNAL WAVEFORMS**<br>The Shifted Unit Step Function, The Ramp and impulse Functions, Waveform Synthesis, The Initial and Final Value of f (t) from F(s), The Convolution Integral, Convolution as Summation. |

**[9] IMPEDANCE FUNCTIONS AND NETWORK THEOREMS**

The concept of Complex Frequency, Transform Impedance and Transform Circuits, Series and Parallel Combinations of Elements, Superposition and Reciprocity, Thevenin's Theorem and Norton's Theorem.

**[10] NETWORK FUNCTIONS: POLES AND ZEROS**

Terminal Pairs or Ports, Network Functions for One Port and Two port. The Calculation of Network Function (1) Ladder Networks (2) General Networks, Poles and Zeros of Network Functions, Restrictions on Pole and Zero Locations for Driving-Point Functions, Restrictions on Pole and Zero locations for Transfer Functions, Time-domain Behaviour from the Pole & zero plot, Introduction to band pass, low pass, high pass and band reject filters.

**[11] TWO PORT NETWORKS**

Relationship of two port variables, short circuit admittance parameters, the open circuit impedance parameters, transmission parameters, the hybrid parameters, relationship between parameter sets, parallel connection of two port networks.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Network Analysis, M.E. Van Valkenburg, 3rd Edition, Prentice Hall of India Private Limited

2) Network Analysis and Synthesis, U. A. Patel, 3rd Edition, Mahajan Publication House.

3) Circuit Theory - Analysis & Synthesis, A. Chakraborty, 1st Edition, Dhanpatrai publication


## D. COURSE OUTCOMES

| CO NUMBER | Statement |
|---|---|
| **CO1** | Apply KVL, KCL and Ohm's Laws to complex RLC networks as well as coupled networks to find response in any part of the network in form of node voltages and loop currents for given excitation. |
| **CO2** | Compute response of the network for given excitation using classical method (solving differential equations). |
| **CO3** | Apply Laplace transformation and network theorem to complex RLC networks in order to simplify the network and determine load voltage/current. |
| **CO4** | Find Laplace transform of given time domain function/waveform and obtain response of the network using Laplace transform method. |
| **CO5** | Synthesized a stable electrical network with the help of network theorem and poles&zeros. |
| **CO6** | Find two port parameters for given network. |

## E. COURSE MATRIX

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 2 | 2 | | 2 | | | 1 | | | | 2 |
| CO2 | 3 | 2 | | | | 1 | 1 | | | | | 2 |
| CO3 | 2 | 3 | 2 | | | | | 1 | 1 | | | 2 |
| CO4 | 3 | 2 | 3 | | 2 | | | 1 | 1 | 1 | | 2 |
| CO5 | 2 | 3 | 2 | 2 | 2 | | | | 1 | 1 | | 2 |
| CO6 | 2 | 2 | 3 | 2 | | | | | | | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | | 2 | | | 1 | | | | 2 |
| **CO2** | 3 | 2 | | | | 1 | 1 | | | | | 2 |
| **CO3** | 2 | 3 | 2 | | | | | 1 | 1 | | | 2 |
| **CO4** | 3 | 2 | 3 | | 2 | | | 1 | 1 | 1 | | 2 |
| **CO5** | 2 | 3 | 2 | 2 | 2 | | | | 1 | 1 | | 2 |
| **CO6** | 2 | 2 | 3 | 2 | | | | | | | | 1 |

## F. CO AND PSO MATRIX

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | | | |
| **CO2** | | | |
| **CO3** | | | |
| **CO4** | | | |
| **CO5** | | | |
| **CO6** | | | |

## B. TECH. SEMESTER – III (EC/IC)

## SUBJECT: DIGITAL ELECTRONICS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code EC03

### A. COURSE OVERVIEW

Computer systems and digital communications have affected positively every aspect of our life. Digital Electronics is the foundation of these systems. On completion of the subject students will have the skills and confidence to conceive and implement a digital system. The objective of this course is to provide the fundamental concepts associated with the digital logic and circuit design. To apply the laws involved in the Boolean algebra for the simplification of logic functions which results in the minimization of hardware requirements. To design and analysis of combinational and sequential circuits utilized in the different digital circuits and systems.

### B. DETAILED SYLLABUS

| NO. | TOPIC |
|---|---|
| [1] | **INTRODUCTION TO LOGIC CIRCUITS**<br>Logic Gates & Networks, Truth Tables, Boolean Algebra, Synthesis using AND, OR and NOT Gates, NAND – NOR Logic Networks, Sum of Products and Product of Sums Forms, Introduction to Verilog. |
| [2] | **IMPLEMETATION TECHNOLOGY**<br>Transistor Switches, NMOS & CMOS Logic Gates, Negative Logic Systems, Introduction to PAL, PLA, CPLD & FPGAs, Voltage Levels in Logic Gates, Noise Margin, Dynamic Operation & Power Dissipation in Logic Gates, Fan-in and Fan-out, Transmission Gates, Transistor-Transistor Logic, Emitter - Coupled Logic. |
| [3] | **OPTIMIZED IMPLEMENTATION OF LOGIC FUNCTIONS**<br>Karnaugh Map Strategy for Minimization, Minimization of POS Forms, Multiple Output Circuits, Multilevel Synthesis, Analysis of Multilevel Synthesis. |
| [4] | **COMBINATIONAL CIRCUITS**<br>Multiplexers, Decoders, Encoders, Code Converters, Arithmetic Comparison Circuits |
| [5] | **SEQUENCIAL CIRCUITS**<br>Basic Latch, Gated SR Latch, Gated D Latch, Master Slave & Edge Triggered D Flip-Flops, T & JK Flip Flops, Registers, Counters, Reset Synchronization, BCD- Ring –Johnson Counters. |
| [6] | **SYNCHRONOUS SEQUENCIAL CIRCUITS**<br>Basic Design Steps, Mealy State Model, Design of Counter, FSM as an Arbiter Circuit, Analysis of Synchronous Sequential Circuits. |

### C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Fundamentals of Digital Logic with Verilog Design, Stephen Brown & Zvonko Vrenesic, Tata McGraw Hill

2) Digital Logic and Computer Design, Morris Mano, Prentice Hall of India

3) Fundamental of Digital Circuits, Anand Kumar, Prentice Hall of India

## D. COURSE OUTCOMES

| CO NUMBER | Statement |
|---|---|
| **CO1** | Analyse and calculate parameters such as noise margin, input –output voltages, fan-out, and speed power product, power dissipation for ECL and TTL logic families. Implement the Boolean functions using CMOS gates. |
| **CO2** | Attempt SOP to POS conversion (& vice versa) for implementation of Boolean expressions using AND-OR-INVERT functions as well as universal gates. Also to optimize the Boolean expressions either by applying Boolean algebra or by using minimization techniques as K-Map method and Tabulation Method with "don't care" conditions up to 6 variables. |
| **CO3** | Implement various combinational circuits like Multiplexers, Decoders, Encoders, Code Converters, and Arithmetic Comparison Circuits using basic gates. Design and Implement basic combinational blocks of a digital computer using multiplexers, decoder, PLA, PAL and verify the circuit implementations with the help of simulation tool. |
| **CO4** | Implement a basic memory element using flip-flops and understand the characteristics of various flip-flop designs and compare them with respect to their timing relationship, hardware requirement and limitations. |
| **CO5** | Differentiate Combinational and Sequential circuits. Design and analyse FSMs using sequential circuits. Reduce hardware requirement of FSMs by minimizing state table. Analyse Mealy and Moore machine designs using timing waveforms. |
| **CO6** | Construct sequential circuits like asynchronous/ synchronous counters, shift registers and counters for timing signal generation. |

## E. COURSE MATRIX

| **Course Outcome (CO's)** | **Program Outcomes (PO's)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Domain Specific (PSO)** | | | | | **Domain Independent (PO)** | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| CO1 | 3 | 2 | 3 | 2 | | 1 | 1 | | | | | |
| CO2 | 3 | 3 | 3 | 2 | | 1 | 3 | | | | 1 | 1 |
| CO3 | 3 | 3 | 2 | 1 | | 1 | 3 | | | | 1 | 1 |
| CO4 | 3 | 3 | 3 | 1 | | 1 | 1 | | | | 1 | 1 |
| CO5 | 3 | 1 | 3 | 3 | 3 | 2 | 3 | | 1 | | 1 | |
| CO6 | 3 | 3 | 3 | 2 | 3 | 1 | 3 | | 1 | | 2 | |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**F. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | | 1 | 1 | | | | | |
| **CO2** | 3 | 3 | 3 | 2 | | 1 | 3 | | | | 1 | 1 |
| **CO3** | 3 | 3 | 2 | 1 | | 1 | 3 | | | | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 1 | | 1 | 1 | | | | 1 | 1 |
| **CO5** | 3 | 1 | 3 | 3 | 3 | 2 | 3 | | 1 | | 1 | |
| **CO6** | 3 | 3 | 3 | 2 | 3 | 1 | 3 | | 1 | | 2 | |

**G. CO AND PSO MATRIX**

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | | | |
| **CO2** | | | |
| **CO3** | | | |
| **CO4** | | | |
| **CO5** | | | |
| **CO6** | | | |

## B. TECH. SEMESTER – III (IC)
## SUBJECT: (HS301) UNIVERSAL HUMAN VALUES-II

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 0 | 3 | 3 | 60 | - | - | - | 60 |

Reference Code HSMC

**A. COURSE OBJECTIVE**

Universal human values is a course which help the student to see the need for developing a holistic perspective of life. To sensitize the student about the scope of life – individual, family, society and nature/existence. Strengthening self-reflection. To develop more confidence and commitment to understand, learn and act accordingly.

**B. DETAILED SYLLABUS**

**[1] COURSE INTRODUCTION**

Need, Basic Guidelines, Content and Process for Value Education Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels

**[2] UNDERSTANDING HARMONY IN THE HUMAN BEING**

Harmony in Myself! Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya

**[3] UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY**

Harmony in Human-Human Relationship Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

**[4] UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE**

Whole existence as Co-existence : Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence

**[5] IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS**

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order

**C. RECOMMENDED TEXT / REFERENCE BOOKS**

21.R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
22.JeevanVidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
23.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
24.The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
25.Small is Beautiful - E. F Schumacher.
26.Slow is Beautiful - Cecile Andrews
27.Economy of Permanence - J C Kumarappa
28.Bharat Mein Angreji Raj - PanditSunderlal

## D. COURSE OUTCOMES

| CO NUMBER | SKILL | STATEMENT |
|---|---|---|
| **CO1** | Application | To start exploring themselves: get comfortable with each other and with the teacher; they start appreciating the need and relevance for the course |
| **CO2** | Application | To note that the natural acceptance (intention) is always for living in harmony, only competence is lacking |
| **CO3** | Application | To present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them |
| **CO4** | Application | To grasp the right utilization of their knowledge in their streams of Technology/Engineering/Management/any other area of study to ensure mutual fulfilment. E.g. mutually enriching production system with rest of nature |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 3 | 1 | 1 | 0 | 2 |
| **CO2** | 0 | 0 | 1 | 0 | 0 | 3 | 1 | 3 | 2 | 2 | 1 | 1 |
| **CO3** | 0 | 0 | 2 | 0 | 0 | 3 | 2 | 2 | 2 | 2 | 0 | 1 |
| **CO4** | 0 | 0 | 1 | 0 | 0 | 3 | 2 | 3 | 1 | 2 | 2 | 1 |

| | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 1 | 0 | 0 |
| **CO2** | 0 | 1 | 0 |
| **CO3** | 0 | 1 | 0 |
| **CO4** | 1 | 0 | 0 |

**B. TECH. SEMESTER – IV (IC)**

**SUBJECT: (IC410) CONTROL THEORY**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 0 | 2 | 4 | 3 | 60 | - | 25 | 25 | 110 |

Reference Code EC19

## A. COURSE OVERVIEW

This course is designed to provide complete overview of control theory used in an Instrumentation and Control engineering. The students can differentiate between an open loop and closed control systems, find transfer function of control systems using a block diagram reduction technique and a signal flow graph technique, find sensitivity and stability of a linear control system, analyse control systems using time domain and frequency domain analysis techniques and co-relate time domain and frequency domain specification terms.. The concept of this subject is useful to the students for understanding the concept of control systems, sensitivity and stability and its time domain and frequency frequency domain analysis.

## B. DETAILED SYLLABUS

| NO | TOPIC |
|---|---|
| 1 | **INTRODUCTION:** Open loop and closed loop control system, Servomechanism, Historical development of control system, - sampled data & digital control system, Multivariable control system, Application in non engineering field. |
| 2 | **MATHEMATICAL MODELS OF PHYSICAL SYSTEMS:** Introduction, Differential equation of physical systems, Transfer functions, Block diagram algebra, signal flow graph. (Note: Problems on electrical, mechanical & electromechanical systems only.) |
| 3 | **FEEDBACK CHARACTERISTICS OF CONTROL SYSTEMS:** Feedback and non feedback systems, reduction of parameter variations by use of feedback, control over system dynamics by use of feedback, effects of disturbance signals by use of feedback, linearizing effect of feedback, regenerative feedback, Basics of Feed forward Control System with example. |
| 4 | **TIME RESPONSE ALALYSIS, DESIGN SPECIFICATION AND PERFORMANCE INDICES CONCEPTS OF STABILITY AND ALGEBRAIC CRITERIA:** Introduction, standard test signals, time response of first order system, time response of second order system, steady state errors and error constants, effects of adding zero to a system, design specifications and constructions for second and higher order systems, performance indices, examples, concepts and conditions for stability, Huwitz's and Routh's stability criteria, relative stability criteria. |
| 5 | **THE ROOT LOCUS TECHNIQUE:** Introduction, Rules of construction of root loci, sketching of root locus and applications |
| 6 | **FREQUENCY DOMAIN ANALYSIS & STABILITY:** Frequency domain specifications, correlation between time and frequency domain specifications, Bode plot, Polar plot. Concept of stability, R H criterion, Nyquist stability. |

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Control System Engineering: By Nagrath & Gopal
2) Control systems Engineering: By – U. A. Patel, Mahajan Publishing House
3) Problems and Solutions of Control Systems With Essential Theory: by Jairath, CBS Publisher
4) Modern Control Engineering: By K. Ogata , Prentice Hall
5) A course in control engineering: By A. Subbarao and Parag R. Desai. Dhanpat Rai Publications Ltd.
6) Automatic Control System: By S.N.Verma , Khanna Publications
7) Feedback Control Systems: By Di Staffeno

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Application | Understand the classification of control system and basic components of closed loop and open loop control system. |
| **CO2** | Application | Apply basic concept of mathematical modeling and understand the FEEDBACK CHARACTERISTICS of control system |
| **CO3** | Analysis | Understand and analyze LTI Systems using various stability analysis techniques. |
| **CO4** | Analysis | Analyze time and frequency response of control system |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | 2 | | 1 | 1 | 1 | | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 1 | 2 | | 1 | 1 | | 1 | 1 | | |
| **CO3** | 2 | 2 | 1 | 1 | | | | | 1 | | 1 | |
| **CO4** | 2 | 2 | 2 | 1 | | | | 1 | | | | 1 |

## F. CO AND PSO MATRIX

| PSO CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 2 | 2 | 3 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 2 | 2 | 2 |
| **CO4** | 2 | 2 | 2 |

## B. TECH. SEMESTER – IV (IC)
## SUBJECT: (IC411) ANALOG ELECTRONICS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 1 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code EC09

### A. COURSE OVERVIEW

The course is designed for a smooth transition from the world of physics to electronics and computations for the first-year students of different branches of engineering; the course combines basic electrical circuit and electronics components into a single unified treatment and provides a strong background to understand the role of electronics in contemporary world of system designs.

This course provides the concepts associated with Transistor fundamentals, biasing of BJTs and MOSFETs using basic circuits. Technical details of the typical circuits that are used in our day-to-day life like rectifiers, voltage regulators, and amplifiers are discussed in this course. The sensors useful for automation in different engineering fields are also shown as integral part of electronic circuits in this subject.

### B. DETAILED SYLLABUS

**NO TOPIC**

**[1] FREQUENCY RESPONSE OF AMPLIFIERS**

Effect of Coupling and Emitter Bypass Capacitors on Low frequency response, The RC-Coupled Amplifier, The Hybrid Pi Transistor Model at High Frequencies, Variations of Hybrid Pi Parameters, The CE short-circuit Current Gain, The Generalized Voltage-Gain Function, Single-Stage CE Transistor Amplifier Responses, The Gain-Bandwidth Product, Emitter Follower at High Frequencies, High-Frequency Response of Two Cascaded CE Transistor Stages, Step Response of an Amplifier.

**[2] FIELD EFFECT TRANSISTORS**

The Junction Field-Effect Transistor, The JFET Volt-Ampere Characteristics, Fabrication of JFETs, The Enhancement Metal-Oxide-Semiconductor Field-Effect, Transistor (MOSFET), The Depletion MOSFET, Biasing the Field-Effect Transistor, The JFET or MOSFET Small-Signal Model, The JFET as Voltage-Controlled Resistor (VCR).

**[3] OPERATIONAL_AMPLIFIER CHARACTERISTICS**

The Basic Operational Amplifier, The Differential Amplifier, The Emitter-Coupled Differential Amplifier, Transfer Characteristics of a Differential Amplifier, Operational Amplifier Design Techniques, Offset Error Voltages and Currents, Measurement of Operational Amplifier Parameters, Frequency Response of Operational Amplifiers

**[4] Operational AMPLIFIER SYSTEMS**

Basic Operational Amplifier Applications, Differential (Instrumentation) Amplifiers, AC-Coupled Amplifier, Analog Integration and Differentiation, Electronic Analog Computation, Active Filters, Active Resonant Band pass Filters, Precision AC/DC Converters, Sample-and-Hold Systems, Logarithmic and Exponential Amplifier, Digital-to-Analog(D/A) Converters, Analog-to-Digital(A/D) Converters, Instrumentation Amplifier.

**[5] WAVESHAPING AND WAVEFORM GENERATORS**

Clipping (Limiting Circuits), Clipping at Two Independent Levels, Comparators, Applications of Comparators, Regenerative Comparators (Schmitt Trigger), Square- Wave and Triangular-Waves Generators, Pulse Generators, Voltage Time-Base Generators,Astable and monostable multivibrator using op-amp, Sinusoidal Generators, The Phase-Shift Oscillator, A General Form of Oscillator Configuration, The Wien Bridge Oscillator, Crystal Oscillators, Timer 555- Astable and Monostable mode

**[6] POWER CIRCUITS AND SYSTEMS**

Large-Signal Amplifiers, Harmonic Distortion, Amplifier Classification, Efficiency of a Class A Amplifier, Class B Push-Pull Amplifiers, Class AB Operation, Regulated Power Supplies, series voltage regulator

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Jacob Millman & Christos C. Halkias, Integrated Electronics, 1st Edition, Tata McGraw Hill
2) Robert L. Boylstead& Louis Nashelsky, Electronic Devices &Circuit Theory, 8th Edition, Prentice Hall of India
3) K. R. Botkar, Integrated Circuits, 9th Edition, Khanna Publications
4) Op - Amp and Linear Integrated Circuits, Ramakant A. Gayakwad, 4th Edition, Pearson Education


## D. COURSE OUTCOMES

| CO NUMBER | Statement |
|---|---|
| **CO1** | Analyse class A, Class B, Class AB and Push-Pull amplifier in terms of operating characteristics, harmonic distortion and power efficiency. |
| **CO2** | Design regulated power supply to provide constant voltage with specified minimum load current for the given specification. |
| **CO3** | Computation of transfer gain, input and output impedance of various types of negative feed-back amplifiers. |
| **CO4** | Develop OPAMP circuits to perform mathematical operations like addition, subtraction, multiplication, division, integration, differentiation, logarithm, antilogarithm |
| **CO5** | Design different types of waveform generators using discrete components and OPAMP and IC 555 like astable and Monostable Multivibrator |
| **CO6** | Design analog active filters using OPAMP and Sinusoidal Oscillator for given frequency and gain. |

## E. COURSE MATRIX

| COURSE OUTCOME (CO'S) | PROGRAM OUTCOMES (PO'S) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DOMAIN SPECIFIC (PSO) | | | | | DOMAIN INDEPENDENT (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 2 | 3 | | | | 1 | | 1 | | 1 | | 1 |
| CO2 | 3 | 3 | | 2 | | 1 | | | 1 | 1 | | |
| CO3 | 2 | 2 | 1 | | | | | | | | | |
| CO4 | 2 | 2 | | 1 | | | | 1 | | | | |
| CO5 | 3 | 3 | | | | 1 | 1 | | 1 | | | |
| CO6 | 2 | 3 | | 1 | | | | | | | | 1 |
| 1: SLIGHT (LOW) , 2: MODERATE (MEDIUM), 3: SUBSTANTIAL (HIGH) | | | | | | | | | | | | |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | 1 | | 1 | | 1 | | 1 |
| CO2 | 3 | 3 | | 2 | | 1 | | | 1 | 1 | | |
| CO3 | 2 | 2 | 1 | | | | | | | | | |
| CO4 | 2 | 2 | | 1 | | | | 1 | | | | |
| CO5 | 3 | 3 | | | | 1 | 1 | | 1 | | | |
| CO6 | 2 | 3 | | 1 | | | | | | | | 1 |

## F. CO AND PSO MATRIX

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| CO1 | | | |
| CO2 | | | |
| CO3 | | | |
| CO4 | | | |
| CO5 | | | |
| CO6 | | | |

## B. TECH. SEMESTER – IV (IC)
## SUBJECT: (CI413) ELECTRICAL MACHINES & POWER

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code ESC

### A. COURSE OVERVIEW

This course provides fundamental concepts associated with working and analysis of electrical machines. This also includes concepts to analyse the mechanism of electrical power generation, transmission and distribution. After studying this course, the students will be able to identify and troubleshoot electrical faults in switchgear.

### B. DETAILED SYLLABUS

**NO TOPIC**

**[1] DC MACHINES**

**DC Generator & DC Motor**

Operating Principle and Types of DC generator &motor, Losses in DC Generator, Power Stages in DC Generator, Maximum Efficiency and Power in DC Generator, Generator Characteristics, Speed control of DC motor

**[2] AC MACHINES**

**Single Phase Transformer**

Working Principle, Construction, Characteristics of an Ideal Transformer, EMF Equation, Transformer Load Analysis, Transformer Parameters, Equivalent Circuit, Open Circuit & Short Circuit Tests, Efficiency, Regulation, All day efficiency, Parallel Operation of transformer.

**Three Phase Induction Motors**

Working Principle, Construction, Relation between Torque & Rotor Power Factor, Starting Torque and Running Torque of Motor, Effect of Change in Supply Voltage on Starting Torque, Torque Slip Characteristics, Induction Motor as a Generator, Power Stages, Starting Methods of Induction Motor, Speed Control of Induction Motors

**Single Phase Motors**

Introduction and Broad Classifications, Self-Starting Mechanism, AC Series Motor and Universal Motors.

**Alternators**

Working Principle, Construction, Factors Affecting Alternator Size, Alternator on Load, Synchronous Reactance, Vector Diagrams, Voltage Regulation by EMF Method, Parallel Operation of Alternators.

**[3] ELECTRICAL POWER GENERATION**

Schematic Arrangement of Various Power Plants - Thermal, Hydro, Nuclear, Diesel and Gas Turbine Based Power Plant, Structure of Electric Power System, Load Curves, Important Terms and Factors, Load Duration Curves, Types of Loads, Wind energy: types, power in the wind, types of wind turbine generators, Solar Energy: types of solar cell, A generic photovoltaic cell, from cells to modules to array, physics of shading, Introduction to major types of PV system, Maximum Power point tracker, Concentrating Solar Power (CSP) Technologies, Introduction to smart grid

**[4] POWER FACTOR IMPROVEMENT**

Power Triangle, Disadvantages and Causes of Low Power Factor, KVAR Calculations, Importance of Power Factor Improvement, Most Economical Power Factor.

**[5] TRANSMISSION LINE & UNDER GROUND CABLES**

Classification of Transmission Line & Under Ground Cables, Main Components, Conductor Materials,

Types of Insulators, String Efficiency and Its Improvement, Construction of underground Cables

**[6] INTRODUCTION TO SWITCH GEAR**

Essential Features of Switchgear, Switchgear Equipment - Circuit Breaker, Fuses, Relay, Principle and Methods of *arc* Quenching in Circuit Breaker, Desirable Characteristics of Fuse Element, Fuse Element Materials, Theory of Protective Relays, Fundamental Requirements of Protective Relay, Calculation of Relay Operating Time, The Bus Bar Arrangement, Faults in Power System.

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Electrical Technology (Vol: II), B. L. Theraja& A. K. Theraja, 23rd Edition, S. Chand & Company Ltd.
2) Principles of Power System, V. K. Mehta &Rohit Mehta, 4th Edition, S. Chand & Company Ltd.
3) Theory and Performance of Electrical Machine, V.B. Gupta, 13th Edition, Laxmi Publications
4) Electrical Engineering, R.K. Rajput, 1st Edition, Laxmi Publications
5) Course in Power System, J. B. Gupta, 10th Edition, S. K. Kataria& Sons.
6) Switchgear and Protection, J. B. Gupta, 2nd Edition, S. K. Kataria& Sons.


## D. COURSE OUTCOMES

| CO NUMBER | Statement |
|---|---|
| **CO1** | Evaluate important parameters such as efficiency and regulation of transformer. |
| **CO2** | Analyze the operation of induction motor and determine important parameters. |
| **CO3** | Analyze the operation of generator and determine its voltage, current, power. |
| **CO4** | Analyze the operation of various power stations and find out load curves parameter. |
| **CO5** | Understand the importance of power factor improvement in power system and compute the transmission line parameter. |
| **CO6** | Apply the knowledge of various protective devices against electrical faults. |

**E. COURSE MATRIX**

| Course Outcome (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Domain Specific (PSO) | | | | | Domain Independent (PO) | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 2 | 1 | | | | | | 1 | 2 | | |
| CO2 | 3 | 2 | | | 1 | | | | 2 | 1 | | |
| CO3 | 3 | 2 | | | | | | | 1 | 1 | | |
| CO4 | 3 | 2 | | | | | | | | 1 | | |
| CO5 | 3 | 2 | 2 | | | | 2 | | | | | |
| CO6 | 3 | 2 | 2 | | | 1 | 1 | 1 | | | | 1 |
| 1: Slight (Low) , 2: Moderate (Medium), 3: Substantial (High) | | | | | | | | | | | | |

**E. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | | | | | | 1 | 2 | | |
| **CO2** | 3 | 2 | | | 1 | | | | 2 | 1 | | |
| **CO3** | 3 | 2 | | | | | | | 1 | 1 | | |
| **CO4** | 3 | 2 | | | | | | | | 1 | | |
| **CO5** | 3 | 2 | 2 | | | | 2 | | | | | |
| **CO6** | 3 | 2 | 2 | | | 1 | 1 | 1 | | | | 1 |

**F. CO AND PSO MATRIX**

| PSO CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | | | |
| **CO2** | | | |
| **CO3** | | | |
| **CO4** | | | |
| **CO5** | | | |
| **CO6** | | | |

## B. TECH. SEMESTER – IV (IC)
## SUBJECT: (IC412) POWER ELECTRONICS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 5 | 60 | 40 | 25 | 25 | 150 |

Reference Code PCC

### A. COURSE OVERVIEW

Industrial automation has been contributing immensely in the growth of the manufacturing seector and country at large. At field level, power electronics is playing a game changer role in automatic adjustments of final control elements. On completion of this course, students will learn and develop skills to understand and implement a thyristor based control system. The objective of this course is to provide the fundamental concepts associated with the construction and working of thyristor based circuits. To study the design and to analyze industry grade high power circuits utilized in the different automatic systems is one of the main goals of this course.

### B. DETAILED SYLLABUS

**NO TOPIC**

**1 POWER ELECTRONICS APPLICATIONS**
Introduction, Thyristor applications, Advantages and disadvantages of thyristor converter systems, Power semiconductor converters

**2 POWER SEMICONDUCTOR DEVICES**
Introduction, Power semiconductor devices, Power diode, Types of power diodes, Performance parameters of power diodes, Series operation of power diodes, Parallel operation of power diodes, Hybrid devices

**3 THYRISTOR PRINCIPLES AND CHARACTERISTICS**
Introduction, Thyristor construction, Thyristor operation and characteristics, Firing circuit design considerations, Requirements of firing circuits, Thyristor transient characteristics, Thyristor types, Series and parallel operations of thyristors, Ratings of thyristors, Relative performance of power electronic devices

**4 TRIGGERING DEVICES**
Introduction, Triggering devices, Uni Junction Transistor (UJT), Characteristics and applications of UJT, Programmable Uni-junction Transistor (PUT), DIAC, Silicon Controlled Switch (SCS), Silicon Unilateral Switch (SUS), Silicon Bilateral Switch (SBS)

**5 REGULATORS AND POWER SUPPLIES**
Introduction, Filter voltage regulation and ripple voltage, Voltage multiplier circuits, Zener voltage regulators, Complete voltage regulated power supply, IC voltage regulators

**6 THYRISTOR COMMUTATION CIRCUITS**
Introduction, Turn-off characteristics, Commutation of a thyristor, Natural commutation, Forced commutation, Conditions for commutation, Classification of forced commutation methods-Class A, B, C, D, E and F type commutation

**7 THYRISTOR TRIGGERING CIRCUITS**
Introduction, Requirements of triggering circuits, Thyristor firing circuits, Pulse transformer triggering, Control of converter, Firing angle control, Firing SCR by UJT, TRIAC firing circuit, Phase control of SCR by Pedestal and Ramp

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) A Textbook on Power Electronics, Harish C. Rai, Galgotia Publications
2) Power Electronics, MD Singh and KB Khanchandani, Tata McGraw Hill Publication
3) Power Electronics, PC Sen, Tata McGraw Hill Publication
4) Thyristor: Theory and Applications, RK Sugandhi and KK Sugandhi, New Age Pub.
5) An Introduction to Thyristors and their applications, Ramamurthy, East West Pub.

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| CO1 | Understand<br>Analyse | Gain knowledge of the family of semiconductor devices and compare the operational characteristics of various power semiconductor devices |
| CO2 | Understand<br>Analyse | Gain knowledge of the series and parallel operations of power diodes and their applications. |
| CO3 | Understand<br>Analyse | Understand the construction and principles of operation of thyristors and their firing considering SCR as case study, understand the ratings and relative performance |
| CO4 | Understand<br>Apply<br>Analyse | Understand the fundamentals of thyristor triggering and typical characteristics of various triggering devices, understand various thyristor firing techniques |
| CO5 | Understand<br>Analyse | Understand the fundamentals of thyristor commutation, understand various thyristor commutation methods |
| CO6 | Understand<br>Apply<br>Analyse | Understand the operation of various regulators and their applications in power supply circuits |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |
| **CO6** | | | | | | | | | | | | |

**F. CO AND PSO MATRIX**

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| CO1 | | | |
| CO2 | | | |
| CO3 | | | |
| CO4 | | | |
| CO5 | | | |
| CO6 | | | |

**B. TECH. SEMESTER – IV (IC)**

**SUBJECT: (IC-414) CONTROL SYSTEM COMPONENTS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 0 | 2 | 4 | 3 | 60 | | 25 | 25 | 110 |

A. **COURSE OVERVIEW:** This course provides knowledge about various electrical, mechanical, electromagnetic and hydraulic components used in control systems.Understanding the principle, construction, working and applications of these components is a very important and crucial part of plant engineering specially in process and manufacturing industries.

B. **DETAILED SYLLABUS**

**NO TOPIC**

**[A] INTRODUCTION TO CONTROL PROBLEM**

Control systems: Terminology and basic structure, the genesis and essence of feedback control theory, Feedback control structure.

**[B] MECHANICAL COMPONENTS**

**CAMS AND FOLLOWERS:** Introduction, Components of Cam, Types of Cam, Types of Followers, Classifications, Cam Motions, Cam Terminology, Cam Profile

**GEARS, CLUTCHES, BREAKS:** Introduction of Gears, Clutches, Brake.

**[C] ELECTRO-MECHANICAL COMPONENTS**

**SERVO MOTOR:**Introduction, DC Servomotors, AC Servomotors

**STEPPER MOTORS:**Introduction, PM type Stepper Motor, VR type Stepper Motor, Hybrid Stepper Motor, Disc Magnet Stepper Motor, Applications of Stepper Motors

**UNIVERSAL MOTOR:**Construction, Operation, Speed control

**SWITCHES:** Single pole, double pole, electro mechanical Switches

**SOLENOIDS:** Introduction, Construction, Working, Selection and different types of Solenoid.

**[D] OPTO-ELECTRONIC DEVICES**

Classification, Photo conductive, Photo Voltaic & Photoemissive sensors , Liquid Crystal Display.

**[E] SAFETY AND AUXILIARY COMPONENTS**

**RELAYS:** Introduction, Classification of Relays, Relay Circuits, Construction of Relay, Logic Relay, Optoelectronic Relay, Relay Problems & Remedies, Relay Race, Actuation & Release Time,Characteristics of Electromechanical Relay, Dynamic Characteristics of Reed Relay

**POTENTIOMETER:** Introduction, Type of Potentiometers, Applications, Selection of Potentiometers.

**TACHOMETERS:**Introduction, Characteristics requirement, DC Tachogenerator, AC Tachogenerator, Tachometer Applications, characteristics of Tachogenerator

**[F] HYDRAULIC SYSTEMS**

Introduction, Advantages & Disadvantages of Hydraulic Systems, Components of Hydraulic System, Classification of Hydraulic Systems, Pump-Controlled Hydraulic System, Pump Controlled Hydraulic Motor, Hydraulic Transmission Lines, Hydraulic Power Supply, Hydraulic Valves.

C. **RECOMMENDED TEXT/REFERENCE BOOKS**

[1] Control systems components, By: M.D. Desai, PHI publication, 2008
[2] Control systems principle and design, 4th Edition, By: M.Gopal, Tata McGraw-Hill Education publication, 2015
[3] Electronic Devices and Circuits – An Introduction, By: Mottershed, Prentice hall publication, 1997
[4] Modern Control Technology: Components and systems, By: Kilian, Cengage Learning publication, 1996
[5] Mechanical & Industrial Measurements, 11th Edition,By: R. K. Jain, Khanna Publishers, 2011

**D. COURSE OUTCOMES**

After completion of the course students should be able to:

| **CO Number** | **Skill** | **Statement** |
|---|---|---|
| CO1 | Understand | Understand and analyze the construction and operation of mechanical and electromechanical control system components |
| CO2 | Understand | Understand and apply the standards and characteristics for selection of mechanical and electromechanical control system components |
| CO3 | Analyze | Understand and analyze the construction and operation of safety and auxiliary control system components and identify control system problems |
| CO4 | Apply | Understand and apply the standards and characteristics for selection of safety and auxiliary control system components and identify control system problems |
| CO5 | Analyze | Understand and analyze the construction and operation of hydraulic and opto electronic control system components |
| CO6 | Apply | Understand and apply the standards and characteristics for selection of hydraulic and opto electronic control system components |

## E. COURSE MATRIX

| POs<br>COs | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 3 | 1 | 1 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 3 |
| CO02 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 1 | 2 | 3 |
| CO03 | 3 | 3 | 1 | 1 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 3 |
| CO04 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 1 | 2 | 3 |
| CO05 | 3 | 3 | 1 | 1 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 3 |
| CO06 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 1 | 2 | 3 |
| **AV** | **3** | **3** | **1.5** | **1.5** | **2** | **2.5** | **2.5** | **1** | **2** | **1** | **2** | **3** |

| | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 3 | 2 | 3 |
| **CO2** | 3 | 2 | 3 |
| **CO3** | 3 | 2 | 3 |
| **CO4** | 3 | 2 | 3 |
| **CO5** | 3 | 2 | 3 |
| **CO6** | **3** | **2** | **3** |
| **Av** | **3** | **2** | **3** |

## F. LIST OF EXPERIMENTS

| **Sr. No.** | **Experiment** |
|---|---|
| 1 | To find out characteristics of potentiometer |
| 2 | To study Cams and Follower |
| 3 | To study various types of switches |
| 4 | To study different types of gears. |
| 5 | To Study the construction & operation of DC Relay |
| 6 | To study the Bouncing Characteristics of a relay |
| 7 | To study construction and working of solenoid |
| 8 | To measure speed of motor using photoelectric type & magnetic type sensor |
| 9 | To study basic components and circuits of hydraulic system |

| | |
|---|---|
| 10 | To study the characteristics of following opto electronic devices |

## B. TECH. SEMESTER – IV (IC)

## SUBJECT: (HS402) TECHNICAL COMMUNICATION SKILLS

| Teaching Scheme (Hours/Week) | | Credits | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Total** | | **Ext** | **Sess.** | **TW** | **Prac** | **Total** |
| **2** | **0** | **2** | **4** | **3** | **40** | **-** | **-** | **50** | **90** |

Reference Code HSMC201

### A. COURSE OVERVIEW

The course is designed to help students learn technical communication and ethics in engineering. It helps students to understand the importance of self development and moral reasoning along with building positive self esteem.

### B. DETAILED SYLLABUS

**NO. TOPIC**

**[1] INTRODUCTION**
Basics and importance of Technical Communication, General and Technical Communication, objectives and Characteristics of Technical Communication, Process of Communication, interpersonal and organisational Communication levels, Non-verbal communication.

**[2] TECHNICAL WRITING**
Writing technical reports, technical proposals, Formal letters, memos, Email, Email etiquettes, Business letters, Research papers and technical descriptions, application letter writing, resume writing, follow-up letter writing, Minutes of meeting, Making notes.

**[3] TECHNICAL COMMUNICATION**
Effective public Speaking, Formal Presentations, Presentation aids, Interviews, Group discussions, Telephone Etiquettes.

**[4] ENGINEERING ETHICS**
Ethics and excellence in Engineering, Role and responsibility of engineer, Moral reasoning and Code of ethics.

**[5] SELF DEVELOPMENT AND SELF-ESTEEM**
Importance of Attitude, Goal setting, Self-esteem, Steps to building positive Self-esteem

### C. RECOMMENDED TEXT / REFERENCE BOOKS


29.Raman Sharma, Technical Communications, 3rd Edition, Oxford Publication, London
30.David F. Beer and David McMurrey, Guide to writing as an Engineer, 3rd Edition, John Willey, NewYork
31.Shiv Khera, You Can Win, Macmillan Books, New York
32.Diane Hacker, Pocket Style Manual, Bedford Publication, New York
33.Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York
34.Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi
35.Xebec, Presentation Book, TMH New Delhi


### D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Describe Verbal and Non Verbal aspects of Communication |
| **CO2** | Apply | Write technical documents for professional communication |
| **CO3** | Apply | Practice etiquettes in communication at workplace |
| **CO4** | Apply | Demonstrate ethics and moral reasoning in engineering |

| | | |
|---|---|---|
| **CO5** | Apply | Practice positive attitude and set long term/short term goals |
| **CO6** | Apply | Plan self development and build positive self esteem |

**E. COURSE MATRIX**

| CO | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 |
| **CO2** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 |
| **CO3** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 1 |
| **CO4** | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 0 | 2 | 1 | 1 |
| **CO5** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 2 |
| **CO6** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 2 |

| | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 0 | 0 | 0 |
| **CO2** | 0 | 0 | 0 |
| **CO3** | 0 | 0 | 0 |
| **CO4** | 1 | 0 | 0 |
| **CO5** | 0 | 0 | 0 |
| **CO6** | 1 | 0 | 1 |

**F. LIST OF EXPERIMENTS**

1) Formal Letter writing
2) Resume writing
3) Formal Presentation
4) Role Play
5) Group Discussion
6) Public speaking exercise
7) Case studies related to Self development, Ethics
8) Meeting conduction and writing minutes of meeting
9) Mock Interview
10) Book review

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC5XX) MICROCONTROLLER FUNDAMENTALS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PCC**

**Type of Course:** Program Core

**Prerequisite:** Basic Programming, Digital Electronics

**Rationale:** Microprocessors are used extensively in the design of any computing facility. On the other hand, microcontrollers are single chip computers, integrating processor, memory and other peripheral modules into a single System-on-Chip (SoC). The use of microcontrollers in industrial and domestic electrical devices has become ubiquitous over the past decade. Engineers associated with the Instrumentation/Electrical domain need to have an understanding of such embedded systems, both hardware and software. This subject will equip students with programming and analytical skills required for embedded system implementation. Specifically, the students would be able to comprehend 8 bit microcontroller and microprocessor architectures.

**.A. OBJECTIVES OF THE COURSE**

- To understand architecture of embedded systems and features of AVR microcontrollers
- To equip with skills required for microcontroller system implementation
- To write assembly and C programs for AVR microcontrollers as per requirement

**.B. DETAILED SYLLABUS**

**[A] INTRODUCTION TO MICROPROCESSOR & MICROCONTROLLER**

Introduction to Microprocessors, Basic information about Instruction Set & Assembly Language, Introduction to CISC & RISC Architecture, Difference between Microprocessor & Microcontroller and Example Application Discussion

**[B] MICROPROCESSOR 8085 ARCHITECTURE, MEMORY & I/O DEVICES INTERFACING**

Microprocessor Architecture & Its Operation, Memory Devices, I/O Devices, Logic Devices for Interfacing, Memory Interfacing, I/O Interfacing, Timing diagram & Applications

**[C] AVR ARCHITECTURE & ASSEMBLY LANGUAGE PROGRAMMING**

Architecture, Memory Map & Registers of AVR, Assembly Programming, Data Move Instructions and I/O Port Programming, Branch & Call Operations, Arithmetic Instructions and Programs

**[E] AVR TIMERS & INTERRUPTS**

Programming Timers 0, 1 and 2, Counter Programming, Timer Programming in C, AVR Interrupts, Programming of Timer & External Hardware Interrupts, Interrupt Priority, Interrupt Programming in C, Serial Port Connection of ATMEGA & Programming in C and Assembly Language

**[E] BASICS OF SERIAL COMMUNICATION**

Basics of Serial Port Communication, SPI & I2C Bus

### .C. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | To conceptually comprehend microprocessor and microcontroller architectures/systems |
| CO2 | Apply | To utilize/apply features of embedded system and build programming logic/logical flowcharts |
| CO3 | Create | To write/create assembly language and C programs for AVR microcontrollers |

### .D. Mapping of CO's and PO's

| POs<br>COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | * | * | * | * | | | | | | | | * |
| CO2 | | | * | * | * | * | | | | | | |
| CO3 | | | * | * | * | | | | | | | |

### .E. CO PO Matrix

| POs<br>COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 1 | | | | | | | | 2 |
| CO2 | | | 3 | 2 | 3 | 1 | | | | | | |
| CO3 | | | 3 | 3 | 3 | | | | | | | |

.F. CO PSO Matrix

| PSOs<br>COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| CO1 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 3 |

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.G. RECOMMENDED TEXTBOOKS

36. Microprocessor Architecture, Programming and Applications with the 8085, by R. S. Gaonkar, Penaram International Publishing (India) Private Limited.

37. The AVR Microcontroller & Embedded Systems, by Mahuammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Pearson Publication.

.H. REFERENCE BOOKS AND NOTES

1) Embedded Systems, by B. Kanta Ra, PHI.
2) Fundamentals of Microprocessors & Microcomputers ,b y B. Ram, Dhanpat Rai Publications.
3) Microprocessor Application in Control & Instrumentation by Bibbero
4) Programming and Customizing the AVR Microcontroller by Dhananjay Gadre

.I. LIST OF EXPERIMENTS

1. Introduction to 8085 microprocessor
2. Microprocessor : Pin functions , Data operations and Timing Diagrams
3. Introduction to AVR/Atmel Studio
4. Basics of AVR Assembly Language
5. Advanced Data Transfer
6. Branching & Looping
7. Arithmetic, Logical Instructions & Programs

8. I/O port programming & Programming Logic
9. AVR Timers/Counters
10. Introduction to AVR microcontroller kit

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC-5XX) INSTRUMENTATION SOFTWARE TOOLS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PEC**

**Program Elective I**

**A. COURSE OVERVIEW**

Simulation and GUI development are amongst most important areas of instrumentation. While, simulation provides an opportunity to study the aspects that are physically unrealizable and feasible, GUI development enables user-friendly operation of a process interface. The course provides learning of Simulation and GUI Designing software. Using simulation software, the students can design-develop models, study, analyze and solve engineering problems to consolidate theoretical learning. Using GUI development platform, simple-effective-user friendly GUIs can be designed and implemented to cater to need-based custom solutions and facilitate human-machine interaction.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] Introduction to Scilab**

The Scilab, Scilab architecture, Installation and setting up Scilab, Scilab environment, Syntax

**Scilab data types**

Constants, Constant matrices, String matrices, Polynomials, Boolean operations, Matrix operations

**[2] Programming with Scilab**

Programming structures: Operators–General, Arithmetic, Conditional, Boolean type operators

Structures–Conditional, Loop structures: FOR loop, DO WHILE Loop, Functions, Selected data types

**[3] Graphics under Scilab**

The graphics window, The media, Plotting parameters, 2D plotting, Graphics library

**[4] Formatted Input and Output (Lab content)**

Scilab environment, General display commands, Output commands, Input commands, Commands for files

**[5] Introduction to LabVIEW**

Introduction, Advantages of LabVIEW, Software environment, Creating and saving a VI, Front panel toolbar, Block Diagram toolbar, Palettes – Tools, controls and functions palettes, Front Panel controls and indicators, Block diagram – terminals, nodes, functions, SubVIs, Express Vis and wires, Data types, Data flow diagram

**Modular Programming**

Introduction, Modular programming in LabVIEW, Build a VI front panel and block

diagram, Icon and connector pane, Creating an icon, Building a connector pane, Displaying SubVIs and express Vis as icons or expandable nodes, Creating SubVIs from sections of a VI, opening and editing SubVIs

**[6] Repetition and Loops**

Introduction, FOR loops, WHILE loops,

**Arrays**

Introduction, Arrays in LabVIEW, Creating one-dimensional array controls, indicators and constants, Creating two-dimensional arrays

**Clusters**

Introduction, Creating cluster controls, indicators and constants, Order of cluster elements, Cluster operations, Assembling-Disassembling clusters, Conversions between Arrays and Clusters

**Structures**

Introduction, Case structures, Formula nodes

**[7] Graphical system design (Lab content)**

Introduction, Graphical System Design (GSD) model, Design flow with GSD, Virtual Instrumentation, Virtual Instrument (VI) and Traditional Instrument, Hardware and software in VI, VI for test, control and design, GSD using LabVIEW, Graphical programming and textual programming

**Plotting data (Lab content)**

Introduction, Types of waveforms, Waveform graphs, Waveform charts, Waveform data type, XY graphs

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Virtual Instrumentation using LabVIEW, Jovitha Jerome, Prentice Hall of India
2) Programming in Scilab 4.1 by Vinu V. Das, Newage Publication
3) Notes on Scilab, Gary Bunting
4) Introduction to Scilab, Michael Baudin, Scilab Consortium
5) Virtual Instrumentation using LabVIEW, Sanjay Gupta & Joseph John, Tata McGraw Hill

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To understand the significance and use of modelling-simulation and Graphical Use Interface (GUI) design |
| **CO2** | Application | To write simulation program using SCILAB software and to write graphical programs for GUI development |
| **CO3** | Application | To build models for simulation study and data acquisition applications to cater customized requirements |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **CO2** | 2 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 2 | 0 | 2 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

## L. CO AND PSO MATRIX

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| CO1 | | | |
| CO2 | | | |
| CO3 | | | |

## M. LIST OF EXPERIMENTS

1. Introduction to LabVIEW
2. Using loops in LabVIEW
3. Arrays and Clusters in LabVIEW
4. Decision Making using Case Structures in LabVIEW
5. File Handling in LabVIEW
6. Introduction to Scilab
7. Matrix Algebra in Scilab
8. Using loops and logical operators in Scilab
9. Graphical data presentation in Scilab
10. File handling in Scilab

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC-5XX) MODELING, SIMULATION, AND EVOLUTIONARY TECHNIQUES**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PEC**

Program Elective I

**D. COURSE OVERVIEW**

Novel techniques are emerging for mathematical optimization of control systems aiming to overall enhancement of manufacturing units. Using computer or microprocessor based control systems; such techniques are first simulated and then implemented to solve long pending process control problems of the industry. This course provides knowledge about modeling and simulation of various types of controllers. Using this learning, students can learn to build and analyze different models of controllers and advanced control algorithms leading to intelligent process control strategies.

**E. DETAILED SYLLABUS**

**NO TOPIC**

**[1] Introduction:**

Introduction, Objectives of the course, Overview of the course, Classification of Systems, Models, Purposes of Modelling, Classification of Models, Modelling Techniques, System Variables.

**[2] Simulation:**

Explanations of System, Modelling and Simulation, Classification of System Models, Step-wise Procedure for Simulation Study, Advantages and Disadvantages of Simulation, Basic Flow Chart for Simulation Study

Monte-Carlo Simulation Technique, Step-wise Procedure for Monte-Carlo Simulation Technique, Verification and Validation of Simulation Models, Various techniques of model validation.

**[3] Fuzzy Logic Control (FLC):**

Introduction, Fuzzification and Defuzzification of models, Fuzzy sets and set operations, Elementary Fuzzy Operators, Step-wise Procedure for Design of FLC using Matlab, Detailed Explanation of Matlab Fuzzy Logic Toolbox and its usage, Design of Fuzzy Controller, Design of Fuzzy Logic based Controller

**[4] Artificial Neural Networks (ANN):**

Architecture Introduction to ANN, ADALIN, Learning method Delta Rule, MSE based Training to ADALIN, Adaptive Filtering, Tapped Delay Line, Adaptive Filter, Basic ANFIS, ANFIS Learning Algorithms, Step-wise Procedure to setup ANFIS using Matlab Takagi-Sugeno FIS, Mamdani FIS, Mamdani v/s Sugeno

**[5] Evolutionary Techniques:**

Introduction to Genetic Algorithms (GA), Darwin's Observation, Darwin's Theory – Natural Selection, Terminology of GA, Applications of GA, Controller optimization using GA, Kohonon's Self Organizing Map (SOM), Hopfield Neural Network

## F. RECOMMENDED TEXT / REFERENCE BOOKS


[15] Process Control–Principles and Applications by Surekha Bhanot, Publisher: Oxford University Press.

[16] Introduction to Artificial Neural Systems by Jacek M. Zurada, West Publishing Company, USA.

[17] Advanced Control Engineering by Ronald S. Burns, Butterworth-Heinemann Publishers, USA.

[18] Genetic Programming – On the Programming of Computers by Means of Natural Selection by John R. Koza, A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England.

[19] Optimization of PID controller using Ant Colony and Genetic Algorithms by Unal, Tpuz and Erdal, 2013 edition, Springer

[20] Design of Fuzzy Controllers by Jan Jantzen, Tutorial Paper, Department of Automation, Technical University of Denmark, Denmark.

[21] G. D. Sousa, B. K. Bose, "A Fuzzy Set Theory based Control of a Phase-controlled Convertor DC Machine Drive", IEEE Trans., Vol. IA – 30, no. I, pp. 34-44.

[22] Process Control and Optimization, Instrument Engineer's Handbook, Volume II by Bela G. Liptak, 2006 Edition, Taylor and Francis, CRC Press, USA.

[23] Aris R., "Mathematical Modelling, Vol. 1: A Chemical Engineering Perspective (Process System Engineering)", Academic Press, 1999.

Referred Research Publications:

- M. Godoy Simoes, Bimal K. Bose and Ronald J. Spiegel, "Fuzzy Logic based intelligent control of a variable speed cage machine wind generation system", IEEE Trans. on Power Electronics, Vol. 12, pp. 87-95, Jan. 1997.

- M. Godoy Simoes, Bimal K. Bose and Ronald J. Spiegel, "Design and Performance Evaluation of a Fuzzy Logic based Variable Speed Wind Generation System", IEEE Trans. on Industry Applications, Vol. 33, pp. 956-965, July-Aug. 1997.

+Class Notes and Discussions in Theory and Laboratory Sessions


## G. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To understand the significance and use of simulation based study and choice of suitable models and techniques |
| **CO2** | Application | To learn and apply Fuzzy Logic Control (FLC) for customized needs |
| **CO3** | Application | To learn and apply Artificial Neural Network(s) (ANN), Genetic Algorithms (GA) to suit custom requirements |

## H. COURSE MATRIX

| POs COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **CO2** | 2 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 2 | 0 | 2 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

## F. CO AND PSO MATRIX

| PSO<br>CO | **CO1** | **CO2** | **CO3** |
|---|---|---|---|
| **PSO1** | | | |
| **PSO2** | | | |
| **PSO3** | | | |

## G. LIST OF EXPERIMENTS

1. Introduction to Modeling and Simulation
2. Modeling of simple process control systems
3. Evolutionary techniques, classification, and application criteria
4. Fuzzy Logic: concepts, terminologies, and application development
5. Fuzzy Logic: design and implementation
6. Genetic Algorithms: concepts, terminologies, and application development
7. Genetic Algorithms: design and implementation
8. Artificial Intelligence and Neural Networks: concepts, design and application development
9. Adaptive system design and tuning approaches
10. Case study: classical, Fuzzy Logic, Genetic Algorithms and ANFIS

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC5XX) SENSORS AND TRANSDUCERS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PCC**

## A. COURSE OVERVIEW

Sensors and Transducers is a prominent course to make the students aware about importance of measurement in control system design-development along with classification and terminologies of measurement Techniques and to learn about specifications, selection criteria and characteristics of instrumentation measurement systems

## B. DETAILED SYLLABUS

**NO. TOPIC**

**[1] FUNDAMENTAL INSTRUMENTATION**

Basic concepts of measurement , Fundamental elements of measurement system, Applications of instrumentation systems, Classification of Instruments, Standards & calibration, Errors & Uncertainties in performance parameters, Static performance parameters, Impedance loading & matching, Selection of the instrument, Formulation of system equations, Dynamic response

**[2] INDUSTRIAL MEASUREMENT**

Displacement Measurement: Introduction, Principles of transduction (variable resistance, inductance, reluctance and capacitance type transducers), digital transducers, measurement of Acceleration

Speed Measurement: Introduction, Mechanical tachometers: Revolution counter, Centrifugal force tachometer, Resonance tachometers, Electric tachometers: Eddy current type tachometers, Electric Generator type tachometers, Contactless type tachometers, Frequency type tachometers, Ignition type tachometers, Stroboscopic tachometers, Pneumatic type speed transmitting elements, Measurement of Speed, Frequency and Short Time Intervals by direct application of frequency standards by comparative methods.

**[3] PROCESS PARAMETERS MEASUREMENT**

Measurement of Humidity, Specific gravity and Viscosity, Measurement of pH & conductivity.

**[4] STRAIN MEASUREMENT**

Introduction, Factors affecting strain measurements, Types of strain gauges, Theory of operation of resistance strain gauges, Types of electrical strain gauges, Materials for strain gauges, Gauging techniques and other factors, Strain gauge circuits

**[5] VIBRATION MEASUREMENT**

Introduction, Characteristics of vibration, Analysis of vibration sensing devices, Vibration sensing devices, Signal conditioners, Shock measurements, System characteristics, Vibration exciters, Calibration

**[6] BASICS OF ANALYTICAL INSTRUMENTS**

Basic elements of analytical instruments, Basic Introduction mass Spectrometers, IR Spectrophotometers and UV Spectrophotometers, Introduction of chromatography – Gas Chromatography

## C. RECOMMENDED TEXT / REFERENCE BOOKS

.Instrumentation Devices & Systems by Rangan, Sharma & Mani, 2nd edition-2005
.Mechanical & Industrial Measurement by: R.K. JAIN, 11h Edition- 2004
.Handbook of Analytical Instruments by: RS Khandpur, 16th reprint -2005
.Instrumentation Measurement & Analysis by: B.C. NAKRA & K. K. CHAUDHRY,3rd edition-2013
.Mechanical & Industrial Measurement by: R.K. JAIN, 11th Edition-2004
.Handbook of Analytical Instruments by: R. S. KHANDPUR
.Instrumentation devices & systems by RANGAN, SHARMA & MANI
.Industrial Instrumentation Fundamentals by: A.E.FRIBANCE

## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Develop awareness about needs of measurement systems along with their design-development, classification and associated technical terminologies |
| **CO2** | Synthesis | Aware about criteria to design measurement system |
| **CO3** | Application | Develop measurement system for different process parameters as per standards. |
| **CO4** | Understand | Understand static & dynamic characteristics of instruments |
| **CO5** | Analysis | Learn methods and applications in the field of analytical instrumentation. |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | | | | | | | | |
| **CO2** | 3 | 2 | 1 | 1 | | | | | | | | |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | 3 | 2 | | | | | | | |
| **CO5** | 2 | 2 | | 2 | 1 | 3 | | | | | | 1 |

| | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 2 |
| **CO5** | 2 | 1 | 1 |

**F. LIST OF EXPERIMENTS**

1. Demonstrate the characteristics of Linear Variable Displacement Transformer
2. To Perform the characteristics of Light Dependent Resistor
3. To Perform the characteristics of Strain Gauge
4. Demonstrate the characteristics of Capacitive Pick-up
5. Observe characteristics of Piezoelectric Pick-up
6. Demonstrate the working of Proximity Switch
7. Measurement of pH of different solutions using Combination Electrode.
8. Measurement Of Conductivity Using Conductivity Cell (DIGITAL).
9. Measurement of Relative Humidity.
10. Gas Chromatography

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC-5XX) PROCESS MEASUREMENT**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PCC**

**A. COURSE OVERVIEW:** This course provides knowledge about the measurement of process parameters like Pressure, temperature, Flow and Level. Measurement of these parameters is a very important and crucial part of plant engineering specially in process and manufacturing industries. Further, the knowledge of the measuring equipment is very essential for Instrumentation and control engineering students.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[A] PRESSURE MEASUREMENT:**

Manometers, Elastic type – Bourdon tube, diaphragm, bellows elements, Bell gauges, Solid State, Piezo-elastic and vibrating element type pressure transducer, Vacuum gauges Mechanical and electric types, differential pressure transmitter, ISA/ANSI/IEC Standards for pressure measurement devices

**[B] FLOW MEASUREMENT:**

Theory of flow system, Reynold's number, Variable pressure (Head) type meters-orifice, Orifice calculations and installation, Venturi tube, Pilot tube, Flow nozzle. Variable Area meters-rotameter, Open channel meters, Mass flow meters, Velocity meters, Quantity meters, Electomagnetic flow meter, turbine flow meters, Ultrasonic flow meters, Vortex flow, Anemometers, Flow markers, Laser anemometers, Flow measurement for solid materials, ISA/ANSI/IEC Standards for flow measurement devices

**[C] LEVEL MEASUREMENT:**

Theory of level measurement, Float gauges, Differential pressure type level measurement technique, Level measurement by weighing, bubbler technique, thermal effect type, Capacitance type, Ultrasonic and radiation type level measurement techniques, level measurement in open vessels and pressure vessels, Measurement of interface levels, Measurement of level of dry material, ISA/ANSI/IEC Standards for level measurement devices

**[D] TEMPERATURE MEASUREMENT:**

Liquid Gas and Vapour filled thermometers, Bimetal thermometers, Resistance Thermometers RTD, Thermisters, Thermo electric temperature measurement technique Thermocouples and thermopiles Radiation thermometers optical and electrical pyrometers Accuracy and response characteristic of different devices, Differential Temperature measurement, ISA/ANSI/IEC Standards for temperature measurement devices

**C. RECOMMENDED TEXT/REFERENCE BOOKS**


[1] Industrial Instrumentation, D.P. Eckman. , CBS Publishers and Distributers
[2] Principles of industrial instrumentation , D Patranabis, Tata Mc Graw Hill
[3] Industrial Instrumentation and Control, S.K.Singh, Tata Mc Graw Hill
[4] Instrumentation Devices and system , Rangan, Sharma, Mani, McGraw Hill Education
[5] Instrumentation, Measurement and Analysis , B.C. Nakra & K. K. Chaudhary , McGraw Hill
[6] Mechanical And Industrial Measurements, R. K. Jain, Khanna Publishers
[7] Modern Sensors Handbook, Pavel Ripka, Wiley
[8] Industrial Instrumentation- Principles & Design , Tattamangalam R.Padmanabham, Springer

[9] Instrumentation and Process Measurement , W.Bolten, Universities Press
[10] Instrumentation Measurement and Control , A.K. Ghosh, PHI

## D. COURSE OUTCOMES

After completion of the course students should be able to:

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Describe working principle and operation of various transducers/sensors for process measurements applications |
| **CO2** | Understand | Describe the construction of various instruments used for measurement of process parameters like pressure, temperature, level and flow in automation and control |
| **CO3** | Analyze | Describe and analyze various standards and characteristics of the sensors for process parameters like pressure, temperature, level and flow in automation and control |
| **CO4** | Apply | Describe features of measuring devices for selection, calibration, installation and commissioning of instrumentation systems. |

## E. COURSE MATRIX

| POs COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 0 | 1 | 3 | 2 | 1 | 1 | 0 | 2 |
| **CO2** | 3 | 3 | 2 | 1 | 0 | 1 | 2 | 1 | 1 | 1 | 0 | 2 |
| **CO3** | 3 | 3 | 3 | 2 | 0 | 1 | 2 | 1 | 1 | 1 | 0 | 2 |
| **CO4** | 3 | 3 | 2 | 2 | 0 | 1 | 3 | 2 | 1 | 1 | 0 | 2 |

## F. CO AND PSO MATRIX

| PSO CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 2 | 1 | 2 |
| **CO2** | 2 | 1 | 1 |
| **CO3** | 2 | 1 | 2 |
| **CO4** | 1 | 1 | 1 |

## G. LIST OF EXPERIMENTS

1. To find out input output characteristic of RTD
2. To find out time constant of given RTD
3. To find out input output characteristic of Thermocouple
4. To find out time constant of given Thermocouple
5. To find out characteristic of Thermistor
6. To measure temperature of an object using non contact thermometer
7. To find out characteristics of given strain gauge pressure transducer
8. To find out characteristics of given piezoelectric pressure transducer
9. To measure flow using orifice plate
10. To measure flow using Venturi tube
11. To measure level in a tank using hydrostatic level sensor
12. To measure level in a tank using Ultrasonic level sensor

## B. TECH. SEMESTER – V (IC)

## SUBJECT: (IC5XX) COMMUNICATION SYSTEMS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 1 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |

**Reference Code PEC**

**Type of Course:** Program Elective-II

**Prerequisite:** Analog Electronics

**Rationale:** In the modern world, communication is crucial for exchange of information. Modern communication relies on efficient hardware and is based on analog and digital techniques. This course will equip students with the knowledge of communication techniques and hardware components.

### A. OBJECTIVES OF THE COURSE

- To understand the basic concepts of communication systems and protocols
- To familiarize students with analog and digital communication
- To impart knowledge about hardware components involved in fundamental and modern communication systems.

### B. DETAILED SYLLABUS

**[A] INTRODUCTION TO COMMUNICATION SYSTEMS**

Introduction to Communication, Elements of Communication System, Need for Modulation, Electromagnetic Spectrum & Typical Applications, Basic Terminologies in Communication Systems, Signal Representation & Analysis

**[B] AMPLITUDE MODULATION**

Principles of Amplitude Modulation (AM), AM modulating circuits, AM Modulator & Demodulator Circuits, Basics of AM Transmitters & Receivers.

**[C] ANGLE MODULATION**

Introduction, Principal of FM, Sinusoidal FM & Analysis, Non-Sinusoidal Modulation : Deviation Ratio, Phase Modulation, Comparison between PM & FM, Sinusoidal PM, Digital PM, Angle Modulators & Demodulators, FM Transmitters & Receivers

**[D] DIGITAL COMMUNICATION**

Introduction, Information Capacity, Bits, Bit Rate, Baud, and Mary Encoding, Amplitude-Shift Keying, Frequency-Shift Keying, Phase-Shift Keying, Quadrature-Amplitude Modulation, Bandwidth Efficiency, Carrier Recovery, Clock Recovery, Differential Phase-Shift Keying, Probability of Error and Bit Error Rate. Error Performance

**[E] PULSE MODULATION**

Introduction, Pulse Amplitude Modulation, Pulse Code Modulation, Differential PCM, Delta Modulation, Pulse Frequency Modulation, Pulse Time Modulation, Pulse Position Modulation, Pulse Width Modulation

**[F] FIBER OPTICS**

Introduction, History of Optical Fiber Communications, Optical Fibers versus Metallic, Electromagnetic Spectrum, Block Diagram of an Optical Fiber Communications System, Optical Fiber Types, Light Propagation, Optical Fiber Configurations, Optical Fiber Classifications, Cable Facilities, Losses in Optical Fiber Cables, Light Sources, Optical Sources, Light Detectors, Lasers

**[H]INTRODUCTION TO DATA COMMUNICATIONS AND NETWORKING**

Introduction & History, Data Communications Network Architecture, Protocols and Standards, Standard Organization for Data Communication, Layered Network Architecture, Data Communication Circuits, Serial & Parallel Data Transmission, Data Communication Circuit Arrangement, Data Communication networks

**[I]FUNDAMENTAL CONCEPTS OF DATA COMMUNICATIONS**

Introduction, Data Communications Codes, Bar Codes, Error Control, Error Detection, Error Correction, Character Synchronization, Data Communications Hardware, Data Communications Circuits, Line Control Unit, Serial Interfaces (RS232 & RS485), Data Communications Modems

## D. COURSE OUTCOMES

After completion of the course students should be able to:

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To understand fundamentals of communication systems and data communication models |
| **CO2** | Analyze | To understand and analyze different modulation techniques and study of various protocols for data communication in industrial networking |
| **CO3** | Analyze | To understand hardware, circuits for implementation of modulation techniques and study fiberoptics data communications. |

## E. COURSE MATRIX

Mapping of CO's and PO's (number grading)

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO 7** | **PO8** | **PO 9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 0 | 0 | 2 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| CO2 | 2 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO3 | 3 | 0 | 0 | 3 | 3 | 2 | 0 | 2 | 2 | 0 | 0 | 3 |

**F. CO AND PSO MATRIX**

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 2 |

**G. RECOMMENDED TEXTBOOKS**

[1] Electronics Communication, Roddy & Coolen, Pearson Prentice Hall, Inc.
[2] Advanced Electronic Communications Systems, Wayne Tomasi, Pearson Education Limited.
[3] Electronic Communication Systems, George Kennedy, Tata McGraw-Hill Education Pvt. Ltd.

**H. REFERENCE BOOKS AND NOTES**

[1] Modern digital ananlog communication system, B.P.Lathi
[2] Electronic Communication Systems, William Schweber, PHI Publication.
[3] Communication systems, Simon Haykins, John Wiley Publication.

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC-5XX) CYBER PHYSICAL SYSTEMS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 2 | 1 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |

**Reference Code PEC**

**Type of Course:** Program Elective-II

**A. COURSE OVERVIEW**

Cyber Physical System (CPS) plays crucial role in today's industry, where automation is generally achieved by interdisciplinary mode involving various branches of engineering to solve real life problems. It improves the standard of living of human life. It provides challenges to implement next generation systems leading to solutions showing future trends, application area and challenges.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] Introduction to Cyber Physical Systems**

Cyber-Physical Systems (CPS) in the real world , Basic principles of design and validation of CPS, Industry4.0, Auto SAR, IIOT implications, Building Automation, Medical CPS

**[2] CPS-Environment**

Human and CPS, Human Computer Interface(HCI),Hardware and Software Co-Design CPS HW platforms - Processors, Sensors, Actuators, CPS Network – Wireless Hart, CAN, Automotive Ethernet, CPS Sw stack- RTOS, Scheduling Real Time control tasks

**[3] CPS Engineering**

CPS Models, Low level Control, Mid High Level Control and Automation, From features to software components, CPS performance Analysis- effect of scheduling, bus latency, Sense and actuation faults on control performance, network congestion Architecture and Design Language

**[4] CPS Analysis and Verification**

Advanced Automata based modeling and analysis, Basic introduction and examples, Timed and Hybrid Automata Formal Analysis: Flow pipe construction, reachability analysis, Analysis of CPS Software, Weakest Pre-conditions, Hybrid Automata Modeling: Flow pipe construction using SpaceX and Phaver tools, CPS SW Verification: Frama-C

**[5] CPS Security**

Information and Cyber Security basics, Privacy in CPS, Threats to CPS in various domains such as Automotive, Medical, Industrial control etc.,CPS Attack models

**C. RECOMMENDED TEXT / REFERENCE BOOKS**


1) Principles of Cyber-Physical Systems, Rajeev Alur, MIT Press
2) Introduction to Embedded Systems-A Cyber-Physical System Approach, Sanjit Seshia, MIT Press
3) Verification and Control of Hybrid Systems: A Symbolic Approach, P. Tabuada, Springer-Verilog

**D. COURSE OUTCOMES**

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To develop awareness regarding Cyber Physical System and its design and implementation in various applications |
| **CO2** | Understand | To familiarize regarding CPS environment, Human Computer Interaction design aspects and relevant hardware-software |
| **CO3** | Understand | To study implementation technologies for CPS engineering design |
| **CO4** | Understand | To learn CPS modelling, analysis and security aspects for CPS |

**E. COURSE MATRIX**

| POs COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| **CO2** | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **CO3** | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **CO4** | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

**F. CO AND PSO MATRIX**

| **PSO CO** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 2 |
| **CO4** | 2 | 2 | 2 |

**B. TECH. SEMESTER – V (IC)**

**SUBJECT: (IC-5XX) ENTREPRENEURSHIP AND INNOVATION**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 2 | - | 1 | 3 | 2.5 | 60 | 0 | 25 | 25 | 110 |

**Reference Code OEC**

## A. COURSE OVERVIEW

This Innovation and Entrepreneurship course focuses on the interconnection between entrepreneurial thinking and innovation. Specifically, we look at models used in Silicon Valley to grow both start-up companies as well as innovation inside large organizations. This course addresses critical areas for successful growth, including design thinking, open innovation, business models, product-market fit, and financing. This course will teach you how to think like an entrepreneur and provide you with the models, tools, and frameworks to further develop your business or idea.

## B. DETAILED SYLLABUS

**NO TOPIC**

**[1] INTRODUCTION TO SUSTAINABLE ENTREPRENURSHIP**

Sustainability, Innovation and Society: Sustainability: The Concept for Modern Society, Challenges for the Future; Innovation and Entrepreneurship: The Invisible Cycle; Sustainability, Ethical Perspectives; International Perspective on Entrepreneurship.

**[2] BUSNESS RELATED CONCEPTS AND CSR STRATEGY**

Business Related Concepts: Entrepreneurship: A Driver for Innovation, Next Stage of Responsible Business; Entrepreneurship: Introducing Shared Innovation into the Business Model; the Evolution of CSR from Compliance to Sustainable Entrepreneurship; How to Design CR Strategies that Optimize Impact for Business and Society.

**[3] CORPORATE CAPABILITY MANAGEMENT**

Implementation and Instruments: Embedding Entrepreneurship in Companies: The Eternal Internal Challenge; Fostering Sustainable Innovation within Organizations; Corporate Capability Management: Collective Intelligence in Use for Improvement on a Company's Sustainability, Innovativeness and Competitiveness.

**[4] SOCIAL ENTREPRENURSHIP**

New perspectives: Social Entrepreneurship/ Responsible Entrepreneurship; Sustainability and SMEs: The Next Steps; Risk Management Issues; Marketing issues; funding a venture; presentation on idea generation by students for their business; writing, refining and
presenting the business model for the proposed business idea.

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Weidinger, C. (2014). Sustainable Entrepreneurship Business Success through Sustainability. Springer. Leal-Millan, A., Peris-Ortiz, M., & Leal-Rodríguez, A. L. (2018). Sustainability in Innovation and Entrepreneurship. Springer International Publishing: Cham, Switzerland.
2) Sharma, S., Starik, M., & Wuebker, R. (2008). Sustainability, innovation and entrepreneurship: introduction to the volume.
3) Nicolopoulou, K., Karatas-Ozkan, M., Janssen, F., & Jermier, J. M. (Eds.). (2016). Sustainable entrepreneurship and social innovation. Taylor & Francis.
4) Wagner, M. (Ed.). (2017). Entrepreneurship, innovation and sustainability. Routledge.
5) Larson, A. (2011). Sustainability, innovation, and entrepreneurship

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Analysis | Understand and imbibe the concepts of sustainability and sustainability entrepreneurship opportunities that arise even in crisis situations |
| **CO2** | Synthesis | Learn ecological problems facing local and global communities and recognize. |
| **CO3** | Analysis | Evaluate the rewards and risks of undertaking Sustainable Entrepreneurship |
| **CO4** | Application | Learn to exploit opportunities in the form of innovative products, services, and production processes that alleviate social or environmental conditions. |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 0 | 0 | 0 | 3 | 3 | 1 | 1 | 0 | 0 | 3 |
| **CO2** | 0 | 3 | 3 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| **CO3** | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 0 | 0 | 0 | 2 |
| **CO4** | 0 | 0 | 3 | 2 | 0 | 2 | 3 | 2 | 0 | 0 | 0 | 1 |

## F. CO AND PSO MATRIX

| **PSO<br>CO** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 3 | 2 | 3 |
| **CO2** | 2 | 2 | 2 |
| **CO3** | 2 | 1 | 2 |
| **CO4** | 1 | 1 | 1 |

**B. TECH. SEMESTER – VI (IC)**

**SUBJECT: (IC-6XX) MICROCONTROLLER APPLICATIONS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PEC**

**Type of Course:** Program Elective-III

**Prerequisite:** Basic Programming, Digital Electronics, Microcontroller Fundamentals

**Rationale:** Microcontrollers are widely used in various applications to control products, devices, processes and systems and hence it is important for students involved with the domain of Instrumentation and Control as well as Automation. This subject will equip students with skills required to conceive and implement microcontroller based system.

**A. OBJECTIVES OF THE COURSE**

- To utilize features of microcontroller system for various applications
- To design/implement required hardware circuits for sensing/measurement and control
- To write assembly and C programs for AVR microcontrollers for interfacing hardware components

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] AN AVR MICROCONTROLLER DESIGN**
Aspects of microcontroller design, Testing the Design, Timing Subroutine, Lookup Tables Concept

**[2] PROGRAMMING DISPLAYS**
LCD Pin diagram, LCD Interfacing, LCD Datasheet, LCD Timing diagram, LCD Programming : 8 bit mode, Programming and Interfacing : 4 bit mode, Seven Segment Display: Interfacing & programming

**[3] DATA ACQUISITION**
Different types of Keyboard, Keyboard Programming Issues, Keyboard programming logic, Keyboard Interfacing & programming, ADC Characteristics, Concept of Successive Approximation, ADC Programming, Internal ADC Programming, Sensor Interfacing and signal conditioning, DAC interfacing, Programming DAC for signal generation

**[4] ACTUATION**
Relay, Relay Interfacing, Optoisolators, Stepper Motor Construction, Interfacing & Programming, Stepper motor control : Normal 4 step sequence, Wave drive 4 step sequence, Half step 8 step sequence, Input Capture programming, Wave Generation in AVR , PWM Programming & DC Motor Speed Control, Multiplexers, Decoders, Encoders, Code Converters, Arithmetic Comparison Circuits

**[5] SERIAL**
Serial Data Communication, Serial Peripheral Interface, MAX7221 Display Interface using SPI, Inter IC bus, DS1307 RTC Interface using I2C, RS232 & RS485 Bus Communication applications using UART.

**[6] OTHER APPLICATIONS**
Measurement of frequency, Voltage, Current, Power, Temperature, Pressure, Level & Flow

**C. RECOMMENDED TEXT / REFERENCE BOOKS**

1) The AVR Microcontroller & Embedded Systems, by Mahuammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Pearson Publication
2) Embedded Systems, by B. Kanta Ra, PHI
3) Fundamentals of Microprocessors & Microcomputers ,b y B. Ram, Dhanpat Rai Publications
4) Microprocessor Application in Control & Instrumentation by Bibbero
5) Programming and Customizing the AVR Microcontroller by Dhananjay Gadre

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Analysis | To understand, analyse criteria/features of microcontroller according to applications |
| **CO2** | Application | To design signal conditioning circuits, understand hardware components and protocols |
| **CO3** | Application | To develop high level and assembly language programs using internal organization of AVR architecture based microcontroller and build applications. |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| **CO2** | 3 | 0 | 3 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## F. CO AND PSO MATRIX

| **PSO<br>CO** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 2 |

**F. LIST OF EXPERIMENTS**

1. Introduction to AVR microcontroller kit
2. Buzzer test with delay
3. I/O Interfacing
4. LCD Display
5. Keyboard Interfacing
6. ADC Interfacing & LCD Display
7. Motion Control using L293 Driver IC
8. Real Time Clock display using DS1307
9. ULN 2003 high current driver Interfacing
10. Serial Communication using RS232

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PEC**

**Type of Course:** Program Elective-III

**Prerequisite:** Basic Programming, Digital Electronics

**Rationale:** Microcontrollers are single chip computers, integrating processor, memory and other peripheral modules into a single System-on-Chip (SoC). Engineers associated with the Instrumentation/Electrical domain need to have an understanding of such embedded systems, both hardware and software. This subject will equip students with programming and analytical skills required for embedded system implementation. Specifically, the students would be able to comprehend ARM controller architectures.

**A. OBJECTIVES OF THE COURSE**

- To understand architecture of ARM microcontrollers
- To equip with skills required for microcontroller system implementation
- To write programs for ARM microcontrollers as per requirement

**B. DETAILED SYLLABUS**

**[A] TECHNICAL OVERVIEW OF ARM CORTEX M3 & M4 PROCESSORS**

General Information & Features of ARM Processors

**[B] ARM ARCHITECTURE**

Introduction, Programmer's model, Application Program Status Register (APSR), Memory Exceptions & Interrupts, System Control Block, Debug, Reset & Reset Sequence, Architecture Over view of STM324xx Cortex M4, Introduction to Memory & Bus Architecture

**[C] INSTRUCTION SET**

Introduction & Comparison of Instruction set of M4 Processor, Understanding Assembly Language Syntax, Unified Assembly Language, Instruction Set , Cortex M4 Specific Instruction Set, Barrel Sifter

**[E] MEMORY SYSTEM**

Memory System Feature, Memory Map, Interfacing of Processor to memory & peripherals, memory requirement, Data Alignment & Unaligned data access support, Bit band Operation ,Memory access permission & attributes, Memory barriers & memory system in microcontroller, Embedded flash memory interface of STM32, Overview of memory protection unit

**[E] EXCEPTIONS AND INTERRUPTS**

Overview of Exceptions & Interrupts, Types of Exceptions, Interrupt management, Priority & Vector Table, Interrupt Input & Pending Behaviours, Exception Sequence Overview , NVIC Registers for interrupt control,

SCB Registers for interrupt & exception Control, Special Registers for Exception or Interrupt masking, Examples & Software Interrupts, Exception Handling in C, Exception Sequence, Exception Handling Optimisation.

**[F]FLOATING POINT OPERATION & DSP**

Floating Point data Presentation, FPU of Cortex M4, Lazy stacking, Floating Point operation in C, Floating point exceptions, DSP on a microcontroller, Dot product, Cortex-M4 DSP instructions, Writing optimized DSP code. Writing optimized DSP code

**[G]INTRODUCTION TO CORTEX M4 PERIPHERALS**

Power Control, Reset & Clock Control, System Configuration Controller, General Purpose Digital I/O, Watch Dog Timer, Basic Timer, General Purpose Timers, Advanced Control Timers, Real Time Clock, Analog to Digital Converter, PWM & DMA Controller

**C. COURSE OUTCOMES**

After completion of the course students should be able to:

i To conceptually comprehend advanced microcontroller architectures/systems

ii To utilize/apply features of embedded system and build programming logic/logical flowcharts

iii To write/create assembly language and C programs for AVR microcontrollers

**D. Mapping of CO's and PO's (number grading)**

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **CO2** | 0 | 0 | 3 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 0 | 0 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**E. CO AND PSO MATRIX**

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 2 |

**F. RECOMMENDED TEXTBOOKS**

1. The Definitive Guide to ARM® CORTEX® -M3 and CORTEX® -M4 Processors (Third Edition) By: Joseph Yiu, Newnes, Elsevier
2. Embedded Systems By: B. Kanta Rao , PHI Learning Private Limited.
3. STM32F4xx Reference Guide By: Silicon Technologies

**G. REFERENCE BOOKS AND NOTES**

1. Mastering STM32 ,A step-by-step guide to the most complete ARM Cortex-M platform, using a free and powerful development environment based on Eclipse and GCC, By: Carmine Noviello

**H. LIST OF EXPERIMENTS**

1. Getting Started with Integrated Development Environment ( Student Edition Open Source)
2. System Clock & Configuration Programming
3. Digital I/O Programming
4. General Purpose Timer & Time Delay Applications in C
5. Advanced Timer Applications Programming in C
6. DMA Application Programming in C
7. ADC Application Programming in C
8. UART Application Programming in C
9. SPI & I2C Programming in C
10. Temperature Monitoring

## B. TECH. SEMESTER – VI

## SUBJECT: (IC6XX) INSTRUMENTATION SYSTEMS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PCC**

### A. COURSE OVERVIEW

This course provides useful information regarding standard P&I diagrams and their interpretation. This course also provides useful information for standard instrument installation practices and safety instruments and related aspects. The course also provides knowledge about DCS architecture, networking fundamentals and application of industrial networking for automatic industrial process control.

### B. DETAILED SYLLABUS

**NO TOPIC**

**[1] INTRODUCTION & SYMBOLS**

Introduction to instrumentation system, Standard instrumentation system symbols, Symbols for Distributed Control Systems, Standard P & I diagrams for typical instrumentation systems.

**[2] INSTRUMENT AIR SYSTEMS**

Sizing criteria, Pressure level, air supply source, compressor systems, dryers, Distribution systems, case purging for electrical area classification

**[3] CONTROL CENTRES AND CONTROL PANELS**

Control rooms, layout, Uninterruptible power supply, electrical classifications, Control panel types, graphical displays, Panel inspection

**[4] INDUSTRIAL NETWORKING**

An introduction to networking in process automation, Serial Communication, communication formats,error checking, encoding, communication modes, Serial interface standards, RS-232, RS-422, RS-485, USB, HART network, Field buses, MODBUS, PROFIBUS, FOUNDATION, Infrared, Radio and Wireless LAN networks, Introduction to OLE and OPC.

**[5] DISTRIBUTED DIGITAL CONTROL SYSTEMS**

Introduction, History, Architecture of DCS, Architecture of DCS components – like Process Control Units, Single Loop & Multi Loop Controllers, Man-Machine Interface, Key-board units, Engineering unit etc., Typical graphics display used in DCS, Architecture of some popular DCS.

**[6] INSTALLATION PRACTICE**

Installation practice for commissioning, maintenance & renovation of a plant. Documents required for installation of instrumentation systems. Testing of different instruments. Industry Standards & Recommended Practices for the installation & maintenance of various Instruments.

**[7] SAFETY DEVICES**

Pressure safety valves, pressure relief valves, pressure switch, rupture disc, flame arrester, intrinsic safety

**C. RECOMMENDED TEXT/REFERENCE BOOKS**

1) Applied Instrumentation in Process Industries, Vol. I and II by Andrews & Williams
2) Instrument Engineer's Handbook (Process Control), by B. G. Liptak
3) Computer based industrial control, by Krishnakant, 1997 edition
4) PC-based Instrumentation Concepts and Practice by N. Mathivanan

**D. COURSE OUTCOMES**

| CO NUMBER | SKILL | STATEMENT |
|---|---|---|
| **CO1** | Application | To understand, interpret, design and apply P and I diagrams |
| **CO2** | Understand | To understand instrument air systems and control room supply systems |
| **CO3** | Understand | To study and understand working of safety devices and standard installation procedures for instruments |
| **CO4** | Analysis | To study, compare, and analyze distinguishing architectures of popular DCS and industrial networking |

**E. COURSE MATRIX**

| POs COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 0 | 3 | 0 | 0 | 0 | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 2 | 1 | 1 |
| **CO3** | 3 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 2 | 1 | 1 |
| **CO4** | 3 | 2 | 2 | 0 | 3 | 0 | 0 | 0 | 2 | 2 | 1 | 1 |

**F. CO AND PSO MATRIX**

| PSO CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 3 | 2 |
| **CO2** | 2 | 2 | 2 |
| **CO3** | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 3 |

**F. LIST OF EXPERIMENTS**

1. Instrumentation symbols and their interpretation
2. Uninterruptible Power supply.
3. P and I diagrams using Smart Draw – software tool
4. Compressor for Instrument Air supply system
5. Pressure switch
6. Air Filter and Regulator unit for instrument air supply
7. Strip Chart Recorder
8. Application of MODBUS communication
9. HART protocol and its applications
10. DCS architecture

**B. TECH. SEMESTER – VI (IC)**

**SUBJECT: (IC6XX) POWER PLANT AUTOMATION**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 2 | 1 | - | 3 | 3 | 60 | 0 | 0 | 0 | 60 |

**Reference Code PEC**

**Type of Course:** Program Elective-IV

**Prerequisite:** Measurement Techniques, Process Measurement

**Rationale:** Core subject for Instrumentation and Control Engineering undergraduate course. Modern Power Plant are having DCS/PLC systems. The purpose is to lessen the various automated control process in the power plant process. Also to add up as various numbers of process are going on it is quite difficult to maintain each and every process manually.

**A. OBJECTIVES OF THE COURSE**

- To prepare students to acquire knowledge various types of power plants.
- To prepare students to acquire knowledge different control techniques for boiler and turbine.
- To prepare students to acquire knowledge about various interlocks and safety standards for turbine and generator.

**B. DETAILED SYLLABUS**

**[A] Introduction to Power Plant:**

Plant overview, Role of Control and instrumentation in power plant, Classification of power plants: thermal, hydro, combined cycle and nuclear.

**[B] Boiler & Turbine Supervisory Control:**

Introduction, Operation, Drum level control, Combustion control, Turbovisory system, Measurement and analysis of gas, Super-heated steam temperature, Level, Pressure and Flow. Coordinated controls of boiler and turbine.

**[C] Power Plant Process:**

Boiler process, Turbine process, Fuel Handling Plant, Air Compressor, etc.

**[D] Power Plant Subsystem Automation:**

Control of mill throughput, Mill temperature control, Forced draught control, Feed pump control, Boiler-following-turbine load control, Advanced Gas Cooled Reactors (AGRs) .

**[E] Electrical Instruments and Metering:**

Recorders and Industrial Displays, Electrical Instruments and Metering Working of meters, Meter calibration.

**[F] Plant Optimization:**

Performance optimization of power plant with integrated Controls, Plant Optimization Performance measurement of power plant.

**[G]System Interlocks and Safety:**

Turbine Interlock and Protections, Interlock and Protections for Generator.

## C. COURSE OUTCOMES

| CO NUMBER | SKILL | STATEMENT |
|---|---|---|
| **CO1** | Understand | To understand, thermal power plant and nuclear power pant and understand the role of control and instrumentation in power plant. |
| **CO2** | Understand | To understand, solar power plant and wind power pant and understand the role of control and instrumentation in power plant. |
| **CO3** | Understand | To s understand various thermal power plant optimization performance parameters |

## D. Mapping of CO's and PO's (number grading)

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 1 | 2 | 0 | 1 | 1 |

## E. CO AND PSO MATRIX

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 2 | 2 |
| **CO2** | 2 | 2 | 2 |
| **CO3** | 2 | 1 | 1 |

## F. RECOMMENDED TEXTBOOKS

[1] Modern Power Station Practice: Incorporating Modern Power System Practice: Vol. F- Control and Instrumentation. / by British Electricity International
[2] Instrumentation Engg's Handbook on Process Control- Bela G. Liptak
[3] Power plant Engineering – P. K. Nag, Mc Graw Hill, 3rd edition

## G. REFERENCE BOOKS AND NOTES

**[1]** Power plant instrumentation and control handbook – Swapan Basu and Ajaykumar Debnath, Academic Press, 1st edition
**[2]** Standard Handbook of Power plant Engineering– Thomas C. Elliot, Mc Graw Hill
**[3]** Energy and Power Generation Handbook – K. R. Rao, ASME Press

**B. TECH. SEMESTER – VI(IC)**

**SUBJECT: (IC6XX) ANALYTICAL INSTRUMENTS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 2 | 1 | 0 | 3 | 3 | 60 | 00 | 00 | 00 | 60 |

**Reference Code PEC**

**Type of Course:** Program Elective-IV

## A. COURSE OVERVIEW

Analytical Instruments is a course to make the students aware about importance of analytical instruments to control quality of food, chemicals and pharmaceutical and beverages. The latest techniques such as GC, Spectrometers etc. have been included. The knowledge gained in this subject will help the students to work in this field.

## B. DETAILED SYLLABUS

**NO. TOPIC**

**[1] Spectrophotometers: UV - VIS – IR**
Electromagnetic radiation, beer-Lambert law, Absorption Instruments, Colorimeters, Spectrophotometers, Sources of error in Spectrophotometric Measurement, Calibration.

**[2] Spectrophotometers: IR, Raman & Photo acoustic and photo thermal**
Infrared Spectroscopy, Basic Components of Infrared spectrophotometers, Sample Handling Technique Fourier Transform Infrared Spectroscopy, Calibration, Attenuated Total Reflection Technique, Raman Spectrometers, Photo acoustic and photo thermal Spectrometers.

**[3] Gas Chromatograph, Liquid Chromatograph & Mass Spectrometers:**
Chromatography, Basic Parts of a Gas Chromatograph, Methods of Measurements of Peak Areas, Liquid chromatography, types of LC, Amino Acid Analyzers. Basic Mass Spectrometers, Types of Mass Spectrometry, Components of Mass Spectrometers, Resolution, Application of Mass Spectrometry.

**[4] Flame Photometers & X-Ray Spectrometers:**
Principle, Constructional Details of Flame Photometers, Clinical Flame Photometers,Accessoriesfor Flame Photometers, Interferences in Flame Photometry, Procedure for Determination.

**[5] Electron and Ion Spectroscopy:**
Surface Spectroscopic Techniques, Electron Spectroscopy, Instrumentation for ElectronSpectroscopy, Ion Spectroscopy, Instrumentation for Ion Spectroscopy, Radio chemical Instruments, Automated Biomedical Analysis Systems.

**[6] Gas Analyzer & Industrial Gas Analyzers:**
Blood pH measurement, CO2 & O2 Analyzer, gas analyzers, para-magnetic O2 analyzer, magnetic wind analyzer, IR gas analyzer.

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1) Handbook of Analytical Instruments by: R. S. KHANDPUR
2) Instrumentation methods by B. K. Sharma
3) Analytical Instrumentation by Bela G. Liptak
4) Laboratory Instrumentation by Mary C. Haven (Author), Gregory A. Tetrault(Author), Jerald R. Schenken (Author)

## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Develop awareness about needs of different Analytical instruments for measuring different parameters for analysis and testing of the products, classification and associated technical terminologies. |
| **CO2** | Analyse | Compare specifications and salient characteristics based choice making of analytical instruments and methods and applications in the field of Analytical instrumentation. |
| **CO3** | Analyse | Develop awareness of measuring different strategies with analytical instruments and acquired the knowledge about its importance for the analysis and testing of any product/material with the help of different analytical instruments. |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 |
| **CO2** | 3 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 3 | 1 | 3 | 2 | 0 | 1 | 2 |

| **PSO<br>CO** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 2 | 2 | 1 |
| **CO2** | 2 | 2 | 2 |
| **CO3** | 3 | 2 | 2 |

**B. TECH. SEMESTER – VI (IC)**

**SUBJECT: (IC6XX) PROCESS INSTRUMENTATION AND CONTROL**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PCC**

**Type of Course:** Program Core

**Prerequisite:** Measurement techniques, Process measurement and control theory

## A. COURSE OVERVIEW

Core subject for Instrumentation and Control Engineering undergraduate course. Using proper instrumentation and control systems maintain the proper ratio of ingredients, regulate temperatures and monitor outputs. Without this standard of control, products would vary and quality would be impaired. With improved quality comes higher levels of safety.

## B. DETAILED SYLLABUS

**NO TOPIC**

**[1] P/I AND I/P CONVERTERS**
Manometric transducers, Torque balance design, Oscillator type, electro pneumatic transducers, Transducer positioners, magnetic converters, differential transformer converters

**[2] CONTROLLER PRINCIPLES**
Introduction, process characteristics, control system parameters, discontinuous controller modes, continuous controller modes, composite control modes

**[3] CONTROL LOOP CHARACTERISTICS**
Introduction, control system configuration, Single and multivariable control systems, Control system quality, Stability, Process loop tuning

**[4] PNEUMATIC CONTROL VALVE AND ACTUATORS**
Introduction, operating mechanism of control valves, direction control valves, construction and working of control valves, Pneumatic Actuators, Selection of control valves and actuators

**[5] CONTROL VALVE CHARACTERISTICS**
Characteristics of control valves, rangeability, control valve selection, Sizing of control valves

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Process Control Instrumentation Technology, By: C. D. Johnson, Pearson Education Ltd
2) Industrial Instrumentation Fundamentals By: Austin Fribance, Tata McGraw Hill publication
3) Applied Instrumentation in Process Industries, Vol. II, By: W. G. Andrews/H. B.Williams, Gulf Publication Company
4) Control system components By: M. D. Desai, Pearson Prentice Hall, Inc
5) Measurement systems: Applications & Design By: Ernest Doeblin, McGraw Hill
6) Instrumentation measurement & analysis By: B.C. Nakra & K. K. Chaudhary, McGraw Hill
7) Mechanical & Industrial Measurement, By: R. K. Jain, Khanna Publishers
8) Transducers & Instrumentation, By: D. V. S. Moorty, PHI Learning Pvt.Ltd
9) Instrumentation-Devices & Systems, By Rangan, Sharma & Mani, Tata McGraw Hill publication

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Application | Understand the basic hardware components used in feedback control system design |
| **CO2** | Application | Design and analyze P, PI, PD, PID Controllers |
| **CO3** | Understand, Analysis | Understand and identify the criteria for selection for pneumatic control valve upon various selection parameters. |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| **CO2** | 3 | 0 | 3 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| **CO3** | 3 | 0 | 3 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |

## F. CO AND PSO MATRIX

| **PSO<br>CO** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 2 | 2 | 3 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 2 | 2 | 2 |

## G. LIST OF EXPERIMENTS

1 To perform the working of the given I to P Converter.

2 To perform the working of the given P to I Converter.

3 To study and develop various controller simulations using Simulink

4 To simulate the Proportional controller.

5 To simulate the Proportional Integral controller.

6 To simulate the Proportional Integral Derivative controller.

7 To study various control valve cut sections

8 To study various Pneumatic actuators

9 To study various Pneumatic Control valves

10 To perform characteristics of Control valves

**B. TECH. SEMESTER – VI (IC)**

**SUBJECT: (IC6XX) AUTOMATION SYSTEM INTEGRATION**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PCC**

## A. COURSE OVERVIEW

Automation System Integration course makes a bridge between academics and industries in automation field. This subject is introduced to make students aware about the concept and components of Automation system and make students aware about basics of communication protocols used for automation application and also to enable students to write PLC program for a given application and also prepare the students to develop automation application using PLC and SCADA.

## B. DETAILED SYLLABUS

**NO. TOPIC**

**[1] PROGRAMMABLE LOGIC CONTROLLER**

**The PLC: A Overall look :-**Introduction, Manufacturing and assembly process , PLC advantages and Disadvantages, Overall PLC system , CPU and Programmers , PLC Input/output modules, Solid state memory

**General PLC programming Procedures**

**Devices connected with PLC I/O modules :-**Input/output on/off switching devices **,** Input/ output Analog devices

**Programming on/off inputs to produce on/off outputs**

**Relation to digital gate logic to contact/coil logic**

**Creating ladder diagrams from process control descriptions**

**PLC Basic functions :-**PLC timer, counter, arithmetic functions

**PLC Intermediate functions :-**PLC Number comparison functions **,** Numbering systems and PLC number conversion functions

**Data Handling Functions:-**PLC skip and master control relay functions, JUMP functions, PLC data moves.

**PLC functions working with bits:-** Digital bits, Sequential, controlling a robot with PLC, Matrix functions

**Advanced PLC functions :-** Analog PLC operations, PID control of continuous process, networking of PLCs

**PLC Installation, Trouble shooting and maintenance**

**PLC Auxiliary Commands and Functions** Monitor Mode function, Force mode function, functions for different programming formats, print functions, Selection of PLC, Industrial control and rise of PLC, PLC versus PC, factors to consider in selecting a PLC

**PLC Installation Practices** Installation Practices, Consideration of the operating environment, receiving check, testing and assembly, electrical connections, grounding and suppression considerations, circuit protection and wiring, troubleshooting PLC malfunctions, PLC maintenance

**[2] DATA ACQUISITION SYSTEM**

Introduction of Data Acquisition system, sampling concept, digital to analog converters, analog to digital converters, Block diagram, Protections in DAS, Isolation in DAS, Data Acquisition Configuration

**[3] SYSTEM INTEGRITY LEVEL IN AUTOMATION SYSTEMS**

Conceptual design stage, ISA conceptual design stage, IEC 615108 on conceptual design, skills and resources, basic SIS configuration, shared functions, technology choices, pneumatics relays, safety relay, solid state systems,

**[4] SAFETY PLC**

Programmable systems for the logic solver, upgrading of PLCs for safety applications, characteristics of safety PLCs, hardware characteristics of safety PLC, software characteristics of safety PLC, design of safety PLC, Triple Modular Redundant (TMR) systems, safety PLC with 1oo3 architecture, communication features of safety controllers, classification and certification , SIS architecture conventions

**[5] BASICS OF SCADA CONFIGURATION**

Basic & Advance configuration of WONDERWARE SCADA, Detail study of SCADA configuration building blocks

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) Programming Logic Controllers- Principles and applications, By John W. Webb & Ronald Reis, PHI, fifth Edition (2006)
2) PC based Instrumentation – Concepts and practice By N.Mathivanan, PHI, 2007 Edition
3) Practical Industrial safety, Risk Assessment and Shutdown Systems By- Dave Macdonald, Elsevier science technology,
4) User manual for Wonderware InTouch SCADA development software
5) Programming Logic Controllers- Programming methods and applications
   By John R. Hackworth & Frederick D. Hackworth Jr. , Pearson Education, Low Price Edition
6) Programming Logic Controllers and Industrial Automation – An Introduction,
   By Madhu chhanda, Samarjit sen Gupta, Tata Mc Graw Hill


## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Describe the basic architecture of automation systems incorporating PLC, DAQ and SCADA |
| **CO2** | Application | Describe, design and develop PLC programs using ladder diagrams. |
| **CO3** | Create | Design and develop industrial automation applications using PLC |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 1 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 0 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 2 |

## F. CO AND PSO MATRIX

| PSO<br>CO | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 |

## G. LIST OF EXPERIMENTS

1. Introduction to Wonderware InTouch SCADA
2. Study of basic features of SCADA
3. Study of Advanced features of SCADA
4. Programming in SCADA using scripts
5. Study and understand RSLogix 500 software.
6. Development of ladder program using bit instructions
7. Development of ladder program using Timer Functions
8. Development of ladder program using counter and compare Functions
9. Development of ladder program using Advance (Arithmetic) Functions
10. Development of ladder program using Advance (Analog) Functions
11. Development of ladder program using Advance (Program control and Sequencer) Functions
12. Project Development

**B. TECH. SEMESTER – VI (IC)**

**SUBJECT: (IC6XX) ECONOMICS AND MANAGEMENT**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 0 | 0 | 2 | 2 | 40 | 0 | 0 | 0 | 40 |

**Reference Code: HSMC**

## A. COURSE OVERVIEW

\

To acquire knowledge of economics to facilitate the process of economic decision making. Acquire knowledge on basic financial management aspects. Develop the skills to analyze financial statements. This course introduces the basic concepts of management and organisation structure of an industry, Material management cost analysis, engineering economics and project management.

## B. DETAILED SYLLABUS

**NO TOPIC**

**[1] INTRODUCTION**

Introduction: The Scope and Method of Managerial economics –Fundamental Economics concepts – Managerial Economics with other subjects – Objectives of the Firm

**[2] DEMAND AND SUPPLY ANALYSIS**

Meaning, Types and Determinants – Demand estimation- Demand elasticities for decision making – Business and Economic forecasting: Qualitative and Quantitative methods – Supply analysis: Meaning, elasticities and determinants – Market equilibrium and price determination

**[3] PRODUCTION ECONOMICS**

Production and Production function – Types – Estimation – Returns to Scale – Economies and Diseconomies of Scale and Economies of Scope. Factor Inputs – Input-Output Analysis

**[4] MARKET STRUCTURE**

Perfect Competition – Imperfect Competition: Monopoly – Monopolistic – Oligopolistic Strategy, Cartels, Cournot, Kinked Demand and Price Leadership. Oligopolistic Rivalry & Theory of Games – Measurement of economic concentration – Policy against monopoly and restrictive trade practices – Competition Law – Pricing Practices: Objectives – Determinants – Pricing Methods – Government Policies and Pricing

**[5] INTRODUCTION TO MICRO ECONOMICS**

Circular Flow of Income and Expenditures – Components of National Income and its significance – Measuring Gross Domestic Product (GDP) – Inflation and Business Cycles – Government Fiscal and Monetary Policy – Balance of payments – Foreign exchange markets

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1) P.L. Mehta – Managerial Economics Analysis, Problems and cases, Sultan Chand & Co. Ltd., 2001
2) Peterson and Lewis: Managerial Economics, 4th Ed., Prentice Hall , 2004
3) Dholakia and Oza: Microeconomics for Management Students, 2nd Edition, Oxford University Press
4) Gregory Mankiw: Principles of Microeconomics, Havcourt Asia Publishers, 2001
5) Mote and paul – Managerial Economics, Tata McGraw Hill, 2001

## D. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Analysis | Evaluate the economic theories, cost concepts and pricing policies |
| **CO2** | Analysis | Understand the market structures and integration concepts |
| **CO3** | Analysis | Understand the measures of national income, the functions of banks and concepts of globalization. |
| **CO4** | Analysis | Apply the concepts of financial management for project appraisal |
| **CO5** | Analysis | Understand accounting systems and analyze financial statements using ratio analysis |
| **CO6** | Analysis | Understand the impact of inflation, taxation, depreciation. Financial planning, |

## E. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 3 | 3 |
| **CO2** | 0 | 1 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 0 |
| **CO3** | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 2 |
| **CO4** | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| **CO5** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 3 |
| **CO6** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |

## F. CO AND PSO MATRIX

| **PSO<br>CO** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 2 | 2 | 2 |
| **CO2** | 3 | 2 | 2 |
| **CO3** | 2 | 2 | 2 |
| **CO4** | 2 | 1 | 1 |
| **CO5** | 2 | 2 | 2 |
| **CO6** | 2 | 1 | 1 |

**B. TECH. SEMESTER – VI (IC)**

**SUBJECT: (IC6XX) INTRODUCTION TO R PROGRAMMING**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 2 | 0 | 2 | 4 | 3 | 60 | 0 | 25 | 25 | 110 |

**Reference Code OEC**

**Type of Course:** Open Elective

**Prerequisite:** Basic Programming, C Programming

**Rationale:** Since the world is marching towards a future that would be highly dependent on to data in order to analyze, evaluate the underlying information. R is an open source programming language which is widely accepted and used for data analysis and graphics design. R lets you clean, organize, analyze, visualize, and report data in new and more powerful ways. In this course the students will learn how to program in R and how to use R for data analysis.

**A. OBJECTIVES OF THE COURSE**

- To utilize R for basic programming
- To employ R programming for statistical analysis
- To familiarize R programming as a tool for data visualization and representation.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] INTRODUCTION**

Introduction, Overview and History, R Console Input and Evaluation, Data Types, Reading Tabular Data, Textual Data Formats, Subsetting, Vectorized Operations

**[2] PROGRAMMING IN R**

Control Structures - If-else, Control Structures - For loops, Control Structures - While loops, Control Structures - Repeat, Next, Break, Functions, Scoping Rules, Statistical analysis in R : Descriptive Statistics, Measures of Central Tendency and variability, Skewness, Correlations, Simple Linear Regression

**[3] LOOP FUNCTIONS & DEBUGGING**

Loop Functions – lapply, apply, mapply, tapply, split ; Diagnosing problems, Basic Tools

**[4] DATA VISUALIZATION**

Using ggplot, Enhancing visualizations, Aesthetics, Saving visualizations

**C. RECOMMENDED TEXTBOOKS**


1. R for Data Science, Hadley Wickham, Garrett Grolemund, O' Reilly Publications.
2. The Book of R, Tilman M. Davies, No Starch Publications.
3. Learning Statistics with R, Daniel Joseph Navarro, Lulu Press Incorporated.
4. Hands on Programming with R,Garett Grolemund, , O' Reilly Publications.

## D. REFERENCE BOOKS AND NOTES

.1. Advanced R, Hadley Wickham, CRC Press.

## E. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Analysis | To comprehend critical programming language concepts |
| **CO2** | Analysis | To analyse data and discover meaningful information |
| **CO3** | Application | To implement techniques for data analysis and visualization |

## F. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **CO2** | 0 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## G. CO AND PSO MATRIX

| **PSO<br>CO** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 2 |

## G. LIST OF EXPERIMENTS

1. Study of basic Syntaxes in R
2. Vector data objects operations
3. Matrix, array and factors and perform va in R
4. Use of data frames in R
5. Data manipulation with R
6. Data Manipulation with dplyr package
7. Data Manipulation with data.table package
8. Control structures in R
9. Data Visualization with ggplot
10. Lab Project

## B. TECH. SEMESTER – VII (IC)

## SUBJECT: (IC-7XX) BIOMEDICAL INSTRUMENTATION

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**Reference Code PCC**

**TYPE OF COURSE:** Program Core
**PREREQUISITE:** Knowledge of Instrumentation and Measurement

### A. COURSE OVERVIEW

The course is designed to give the basic concepts of Instrumentation involved in medical field and human physiology. Biomedical Instrumentation is application of technology for Medical field. During the course, students will explore Electro-physiological measurements, medical imaging etc. The course will make the students understand the devices used in diagnosing the diseases.

### B. DETAILED SYLLABUS

| NO | TOPIC |
|---|---|
| [1] | **Measurement, Recording and Monitoring:**<br>**Fundamentals of Medical Instrumentation:**<br>Anatomy and Physiology, Physiological system of Body, Sources of Biomedical Signals, Basic Medical Instrumentation System, Performance requirement of Medical Instrument system, General Constraints of Medical Instrument system, Regulations of Medical Devices |
| [2] | **Bioelectric signals and Electrodes:**<br>Origin of Bioelectric signals, Recording Electrodes, Electrodes for ECG, EEG, EMG, Electrical conductivity of electrodes jellies and creams, Micro-electrodes, Skin surface electrodes and needle electrodes |
| [3] | **Recording systems :**<br>Basic recording system, General considerations for signal conditioners, Preamplifiers, Sources of noise in low level measurement, Biomedical signal analysis techniques, Signal processing techniques, The main amplifier and driver stage, Different types of recorders, VCG, PCG, EEG, EMG, ECG |
| [4] | **Patient monitoring Systems:**<br>System concepts, Cardiac monitor, Bedside Patient Monitoring system, Central Monitors, Measurement of Heart Rate, Measurement of Blood Flow, Measurement of Pulse Rate, Blood Pressure Measurement, Measurement of Temperature, Measurement of Respiration rate, Catherization lab instrumentation |
| [5] | **Modern Imaging Systems:**<br>**X-Ray Machines and Digital Radiography:**<br>X-Rays, X-Rays Machine, X-Ray Computed Tomography, Nuclear Medical Imaging Systems, Emission Computed Tomography (ECT),Single Photon Emission Computed Tomography (SPECT),Positron Emission Tomography (PET), Magnetic Resonance Imaging (MRI) |
| [6] | **Ultrasonic Imaging Systems:**<br>Diagnostic Ultrasound, Physics of Ultrasonic waves, Medical Ultrasound, Basic Pulse echo apparatus, A- scan, Echocardiograph, Real time Ultrasonic Imaging Systems, Biological effects of ultrasound |

[7] **Cardiac Pacemakers:**
Need for Cardiac Pacemakers, External Pacemakers, Implantable Pacemakers, Recent Development in Pacemakers

[8] **Cardiac Difibrillators:**
Need for Cardiac defibrillator, DC Defibrillator, Implantable Defibrillator, Pacer-Cardioverter-Defibrillator

**Instruments for Surgery:**
Surgical Diathermy, Surgical Diathermy Machine, Safety aspects in Surgical Diathermy machine, Surgical Diathermy Analyzers

[9] **LASER Application in Biomedical Engineering:**
What is LASER?, Different types of LASER, Effects of Tissues and related issues, Selection of LASER for surgery, Application in different areas, Safety Aspects

[10] **Haemodialysis machine:**
Function of Kidneys, Artificial Kidneys, Dialyzer, Haemodialysis machine

**Electrical Safety of Medical Equipment:**
Physiological effect of electrical current, Shock hazard form electric equipment, Methods of accident prevention

**Latest Issues in BME:**
Biomaterials, Telemedicine, Artificial heart

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co
2. Ltd., 2003.
3. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.
4. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
5. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.


## E. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Understand the physiology of biomedical system by studying different bio electric signals of human body. |
| **CO2** | Understand | To measure biomedical and physiological information and study various electronic devices and Instruments. |
| **CO3** | Understand | Discuss the application of Electronics in diagnostics and therapeutic area and to study various imaging and body scan techniques. |

## F. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 2 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| **CO2** | 1 | 3 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| **CO3** | 3 | 3 | 2 | 2 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## G. CO AND PSO MATRIX

| PSO<br>CO | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 1 | 2 | 2 |
| **CO2** | 2 | 2 | 2 |
| **CO3** | 1 | 2 | 2 |

## H. LIST OF EXPERIMENTS

1. To perform the Blood Pressure Measurement Unit.
2. To perform the Blood Flow Measurement.
3. To perform the Respiration Rate Meter.
4. To perform the D.C. Defibrillator.
5. To perform the Heart Rate Indicator.
6. To perform the Single channel ECG Machine.
7. To perform the Medical Telemetry Machine.
8. To perform the Multi-parameter Monitor.
9. To perform the Tread Mill Tester.
10. To perform the External Pacemaker.
11. To perform the Phonocardiograph System.

**B. TECH. SEMESTER – VII (IC)**

**SUBJECT: (IC7XX) DIGITAL SIGNAL PROCESSING**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

PEC

**Program Elective-V**

## A. COURSE OVERVIEW

"Digital signal processing" is a core course in the field of data processing. Course starts from the basic concepts of discrete-time signals and proceed to learn how to analyze data via the Fourier transform, how to manipulate data via digital filters and how to convert analog signals into digital.

## B. DETAILED SYLLABUS

| NO. | TOPIC |
|---|---|
| [1] | **DISCRETE-TIME SIGNALS AND SYSTEMS**<br>Introduction, Representation of Discrete-Time Signals, Basic Operations on Sequences, Classification of Discrete-time Signals, Classification of Discrete-Time Systems |
| [2] | **DISCRETE CONVOLUTION AND CORRELATION**<br>Impulse Response and Convolution Sum, Analytical evaluation of Discrete Convolution, Convolution of finite sequences, Methods to compute the convolution sum of two sequences, Deconvolution using tabular method, Interconnection of LTI System, Discrete Correlation |
| [3] | **THE Z-TRANSFORMS**<br>Z-transforms by summation of left, right and two-sided sequences, Regions of convergence and z-transform properties, inverse z-transforms |
| [4] | **SYSTEM REALIZATION**<br>Introduction, Realization of discrete time systems, Structure for realization of IIR systems, Structures for Realization of FIR Systems |
| [5] | **DISCRETE –TIME FOURIER TRANSFORM**<br>Discrete – Time Fourier Transform(DTFT), Existence of DTFT, Relation between Z-Transform and Fourier Transform, Relation between Z- Transform and Fourier Transform, Inverse DTFT, Properties of DTFT |
| [6] | **DISCRETE FOURIER SERIES AND DISCRETE FOURIER TRANSFORM**<br>Discrete Fourier Series, Properties of DFS, Relation between DFT and Z transform, Comparison between DTFT and DFT, IDFT, Properties of DFT |
| [7] | **INTRODUCTION OF INFINITE DURATION IMPULSE RESPONSE (IIR) FILTERS AND FIR FILTERS**<br>Introduction, Requirements for Transformation, Design of IIR Filters, Specification of the Low-pass Filter, Design of digital low–pass butterworth and chebyshev filters, Characteristics of FIR filters |

## C. RECOMMENDED TEXT / REFERENCE BOOKS

1. Digital Signal Processing: A. Anand Kumar, PHI Publication

2. Discrete Time Control Systems: Katsuhiko Ogata, Pearson Edition,2nd Edition

3. Digital Signal Processing: A Computer-Based Approach, S. K. Mitra, McGraw-Hill, Third edition, 2006.

4. Analog and Digital Signal Processing by Ashok Ambardar, THOMSON Books/Ole

5. Discrete-Time Signal Processing by A. V. Oppenheim and R. W. Shafer, PHI,2/E, 2000

6. Digital Signal Processing: Principles, Algorithms and Applications, J. Proakis, D. Manolakis, Prentice-Hall, 2006 (4-th edition)

7. Digital Filters – Analysis, Design & Applications by Andreas Antoniou, Tata McGrow Hill, 2nd Edition

## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Classify discrete time signal systems based on their properties, to understand and use the implications of linearity, time-invariance, causality, memory, gain knowledge about Z transform tool for discrete system for analysis |
| **CO2** | Analyze | Describe Fourier transforms, convolution and correlation for continuous-time and discrete-time signals, apply system realization methods and z transformation tools for design and analysis of discrete time system for IIR and FIR filters, |
| **CO3** | Application | Describe DTFT and DFT for analysis of discrete time systems, understand and apply the design techniques for IIR and FIR filter using transformation technique |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 3 | 1 | 1 | 0 | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 3 | 1 | 1 | 3 | 2 | 1 | 0 | 1 | 2 | 1 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 0 | 2 | 2 | 1 | 1 |

| | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 2 | 1 | 2 |
| **CO2** | 1 | 1 | 1 |

| | | | |
|---|---|---|---|
| **CO2** | 2 | 2 | 1 |

**F. LIST OF TUTOTRIALS**

1. Introduction to signals and systems
2. Basic operations on Discrete time signals
3. Convolution and Correlation
4. Z-Transformation
5. Inverse Z- Transformation
6. Discrete System Realization
7. Discrete time Fourier Transform and Discrete Fourier Transform
8. Introduction to FDA Tool
9. IIR/ FIR Filter design (Butterworth filter)
10. IIR/ FIR Filter design (Chebyshev filter)

**B. TECH. SEMESTER – VII (IC)**

**SUBJECT: (IC7XX) INDUSTRIAL ELECTRONICS & DRIVES**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

PEC

**Program Elective-V**

## A. COURSE OVERVIEW

Electronics adapted to industrial plant, in terms of timings action switching or parameter control is called Industrial Electronics. The student should study this subject with a view to understand the use of electronics and drives to bring about faster and more accurate responses in industrial plants.

## B. DETAILED SYLLABUS

| NO. | TOPIC |
|---|---|
| [1] | **POLYPHASE RECTIFIERS:** Three phase controlled converters, Three pulse Converters(M3 Connection), Six Pulse Converters, Three Phase fully Controlled Bridge Converters, Three phase half Controlled Bridge Converter, Selection of Converter Circuits |
| [2] | **CONVERTERS & INVERTERS:** Chopper Classification & Operation, Chopper Control Strategies, Chopper Configuration, Thyristor based Chopper Circuits, AC Choppers, Classifications of Inverters, Single phase Voltage source inverters, Performance Parameters of Inverters, PWM Inverter, 3 Phase Inverter, Thyristor based Inverters, Series Inverter, Self Commutated Inverter, Parallel Inverter, Current Source Inverter |
| [3] | **AC & DC DRIVES:** Introduction, Speed Control of Induction Motors, Stator Voltage Control, Variable Frequency Control, Schemes for DC motor Speed Control, PLL Control of DC Drives, DC Chopper Drives |
| [4] | **INDUSTRIAL APPLICATIONS:** Introduction, Introduction Heating, Dielectric Heating, Welding, HVDC Transmission, Smart UPS, Hybrid and Elecrtical Vehicles |
| [5] | **CYCLOCONVERTER & DUAL CONVERTER:** Introduction, Basic Principle of Cycloconverters and Dual Converters, Single phase to single phase cycloconverter, Dual converter with and without circulating current Operation, Dual mode dual Converter |

## C. RECOMMENDED TEXT / REFERENCE BOOKS


1. A Text book on Power Electronics – Devices, Circuits, Systems and Applications, 2 nd Edition, by Dr. H. C. Rai
2. Industrial Electronics and Control, PHI Publication, Biswanath Paul
3. Power Electronics By: M.D. Singh, K.B. Khandchandani Tata Mcgrawhill, 2nd Edition Industrial Electronics, 11th Edition, by G. K. Mithal
4. Calculations in Industrial Electronics and Instrumentation, by V. K. M. John
5. Engineering Electronics, by John D. Ryder
6. Electric Motor Drives - Modeling, Analysis, And Control, by R. Krishnan

## D. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Understand the application of Induction heating & Dielectric Heating |
| **CO2** | Application | Develop designing skill of different types of choppers , inverters and polyphase rectifiers |
| **CO3** | Analysis | Analyse industrial applications of DC & AC Drives |

## E. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| **CO2** | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 0 | 1 | 1 | 0 | 2 |

| | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 2 |

## F. LIST OF EXPERIMENTS

1. operation of forced commutation Class A, Class- B and Class –C
2. Perform the operation of forced commutation Class D and Class -E
3. Perform the operation of DC motor Speed Control
4. Perform the operation of Jone's Chopper
5. Perform the operation of Morgan's Chopper
6. Single Phase full wave Controlled bridge Rectifier with R Load
7. single Phase full wave Controlled bridge Rectifier with RL Load
8. Perform the operation of Series Inverter
9. Perform the operation of Parallel Inverter
10. Perform the operation of Cycloconverter

**B. TECH. SEMESTER – VII (IC)**

**SUBJECT: (IC-7XX) ADVANCED CONTROL THEORY & DESIGN**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 0 | 3 | 3 | 60 | 00 | 00 | 00 | 60 |

**Reference Code PCC**

**TYPE OF COURSE:** Program Core
**PREREQUISITE:** Basic Engineering Mathematics, Basics of Control Theory

**A. COURSE OVERVIEW**

This course provides knowledge about selection and design of controllers. Using this learning, students can build and analyze stability of different models of control systems. Also the course provides knowledge of advanced process control methods/models for automation and control.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] System compensation**
Introduction to system compensation, Time domain compensation technique using root locus, Frequency domain compensation, Techniques using Bode Plots, Minor-loop Design of Control System

**[2] State variable analysis**
Introduction, State modes of linear continuous-time systems, Diagonalization, Solutions of state equations, Concept of controllability & Observability, Direct method of Liapunov's stability analysis.

**[3] Optimal control systems**
Introduction, Performance indices, Parameter optimization: Servomechanisms

**[4] Network synthesis**
Introduction, Positive Real Function, Synthesis of One Port LC, RC, RL and RLC passive networks

**[5] Advanced process control**
Introduction to Advance Control Systems – Adaptive Control, Model Reference Adaptive Control (MRAC), Internal Model control

**C. RECOMMENDED TEXT / REFERENCE BOOKS**

1. Control system engineering by I. J. Nagrath & M. Gopal
2. Modern Network Synthesis by Van Valkenburg
3. Control system principles and design by M. Gopal

**D. REFERENCE BOOKS AND NOTES**

1. State space analysis of control system by Ogata
2. Modern control theory by J. T. Tou
3. Modern control system theory by M. Gopal
4. Linear Control System (Analysis & Design conventional & Modern) by D'azzo & Houpis
5. Design of Feedback System by Thaler G. J. Digital control and state variable methods by M. Gopal

## E. COURSE OUTCOMES

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Application | To apply state variable analysis techniques with Parameter optimization control problems |
| **CO2** | Create | To design Network synthesis and compensator/controller using various approaches |
| **CO3** | Analysis | To understand and differentiate the Adaptive control strategy and conventional PID controller with their characteristics |

## F. COURSE MATRIX

| POs<br>COs | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 2 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| **CO2** | 2 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| **CO3** | 3 | 2 | 2 | 2 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## G. CO AND PSO MATRIX

| PSO<br>CO | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 3 | 2 | 2 |
| **CO2** | 2 | 2 | 1 |
| **CO3** | 1 | 2 | 2 |

## H. LIST OF TUTORIALS

1. Introduction to state space models of control systems
2. State model Controllability and Observability
3. State model analysis
4. Describing function method
5. Introduction to Optimal control systems
6. Introduction to compensation in control systems
7. Compensation in Time domain
8. Compensation in Frequency domain
9. Testing driving point functions
10. Passive network synthesis

**B. TECH. SEMESTER – VII (IC)**

**SUBJECT: (IC-7XX) PROCESS CONTROL**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

Reference Code PCC

**A. COURSE OVERVIEW**

For ensuring safety along with high quality production in huge quantities, efficient control of the manufacturing process and unit operation is mandatory. In context with basic control algorithm of PID, the course provides useful knowledge regarding control strategies and advanced control strategies for solving complex industrial process control problems. This course provides knowledge about conceptual and advanced level knowledge for development of industrial process control strategies. The course discusses in depth the nature and intricacies of different widely employed industrial equipments, their process details, relevant critical parameters and their interaction; and suggests efficient control schemes.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] Introduction to Process Control and Fundamental Concepts**
Introduction to process control, Evolution of process control, Laplace transforms in process control, open loop v/s closed loop systems, open loop response, feedback v/s feed forward control configuration

**[2] Study and Analysis of Open Loop Response**
Open loop response of simple systems, Effects of P, PI, PD & PID controllers on the transient response of control systems, Complex control systems

**[3] Study and Analysis of Transient Response and Control Dynamics**
Transient response of control systems, Level control.

**[4] Control of Key Critical Equipments**
Boiler controls, Distillation column controls, Steam turbine controls, Heat exchanger controls

**[5] Control Strategies**
Ratio control, Cascade control, Feed-forward control, Inverse-derivative control, Split range control, etc.

**[6] Advanced Control Strategies**
Advance Control Systems – Adaptive Control, Valve Position Control (VPC), etc.

**C. RECOMMENDED TEXT / REFERENCE BOOKS**


1. Process Control, by Peter Harriot
2. Applied Instrumentation in Process Industries, Vols. I, II & III, by Andrews & Williams
3. Process Control-Principles and Applications, by Surekha Bhanot
4. Instrument Engineer's Handbook (Process Control), by Bela G. Liptak (Vol. II)
5. Chemical Process Control, by Stephanopoulos
6. Process Modeling, Simulation & Control for Chemical Engineers, by W. Luyben
7. Chemical Process Control, by Coughnour & Copel
8. Chemical Process Control, by Shinskey
9. Principles of Process Control, by Patranabis
10. Automatic Control of Power & Process, by Manifold
11. Process Control, by Pollard

**D. COURSE OUTCOMES**

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To understand the fundamental concepts of process control, characteristics and behaviour of typical variable and loop, and complex process control |
| **CO2** | Application | To learn operation of most widely used industrial equipments and their suggested control schemes |
| **CO3** | Application | To develop awareness regarding limitations of basic PID control, and useful understanding of various control strategies and advance control strategies |

**E. COURSE MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| **CO2** | 3 | 0 | 3 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 1 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**F. CO-PSO MAPPING**

| | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 2 |

**G. LIST OF EXPERIMENTS**

1. Performance analysis of the response of a bare thermometer
2. Performance analysis of the response of thermometer with thermo-well
3. Simulation analysis of the open loop response of a first order system
4. Simulation analysis of the open loop response of a second order system
5. Simulation analysis of the response of Ratio Control Scheme
6. Simulation analysis of the response of Cascade Control Scheme
7. Simulation analysis of the response of Feed Forward Control Scheme
8. Simulation analysis of the response of a first order mixing process
9. Simulation analysis of the response of transportation lag
10. Simulation analysis of the responses of single tank and two tank systems

**B. TECH. SEMESTER – VII IC**

**SUBJECT: (IC-7XX) ROBOTICS ENGINEERING**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**PEC**

**Type of Course:** Program Elective -VI

**Prerequisite:** Mathematics, Electronic Measurement

**Rationale:** Nowadays, majority of the industries are transitioning towards automation. The industrial manipulators are controlled to perform the required task and operations. This course will equip students with the fundamental aspects of coordinate mapping, transforms, trajectory planning besides sensing and applications

**A. OBJECTIVES OF THE COURSE**

- To impart knowledge about basic concepts required to understand robot motion
- To familiarize students with approaches to robot modeling and trajectory planning
- To impart knowledge about hardware components, applications involved in robotics

**B. DETAILED SYLLABUS**

**[A] INTRODUCTION**

Evolution of Robot and Robotics, Laws of Robotics, Progressive advancement in Robot, Robot Anatomy, Human Arm characteristics.

**[B] CO ORDINATE FRAMES, MAPPING & TRANSFORMS**

Co ordinate frames, Description of objects in space, Transformation of vectors, Inverting of Homogeneous Transforms, Fundamental rotation Matrices.

**[C] MODELING OF ROBOT - DIRECT KINEMATIC MODEL**

Mechanical structure and notations, Description of links & joints, Kinematic modeling of the manipulator, Denavit- Hartenberg notation, Kinematic relationship between adjacent links

**[D] TRAJECTORY PLANNING**

Joint space techniques, Cartesian space techniques

**[E] ROBOTIC ACTUATORS, SENSOR & VISION**

Sensors in robots , Actuators, Kinds of sensors used in Robotics, Robotic vision

**[F] ROBOT SAFETY, ROBOT-ECONOMY & INSTALLATION**

Introduction, plant survey, potential safety hazards ,Safety planning checklist, Safety guidelines

## C. COURSE OUTCOMES

| CO NUMBER | SKILL | STATEMENT |
|---|---|---|
| **CO1** | Understand | To understand basic concepts associated with robots/robotics |
| **CO2** | Analysis | To analyze and evaluate various methods for robot description modeling and planning |
| **CO3** | Understand | To understand aspects of robot hardware, installation and operation |

## D. Mapping of CO's and PO's (number grading)

| POs<br>COs | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| i | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ii | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| iii | 3 | 1 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |

## E. Mapping of CO's and PSO's

| PSOs<br>COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| i | 2 | 2 | 3 |
| ii | 3 | 3 | 2 |
| iii | 2 | 2 | 2 |

## F. RECOMMENDED TEXTBOOKS

6. Robotics and Control by I.K.Mittal & I.J.Nagrath ,Second Reprint 2005, Tata McGrawHill
I. Introduction to robotics by Saeed B.Niku, First Indian reprint 2002, Pearson Education
J. Electronic Communication Systems, George Kennedy, Tata McGraw-Hill Education Pvt. Ltd.

## G. REFERENCE BOOKS AND NOTES

[24] Robotics by K. S. Fu , R. C. Gonzalez & C.S. G. Lee.
[25] Robotics principles & Practice by K.C.Jain & L.N.Aggarwal, Khanna publishers 2003 edition

## H. LIST OF EXPERIMENTS

1. Introduction to Robotics
2. Mapping and Transforms.
3. Kinematic Modelling - I
4. Kinematic Modelling - II
5. Trajectory Planning
6. Robot sensors
7. Robot Vision System
8. Robot Applications
9. FireBird V Robot Buzzer Beep Application
10. FireBird V Robot Line follower Application

## B. TECH. SEMESTER – VII IC

## SUBJECT: (IC-7XX) FUNDAMENTALS OF MACHINE LEARNING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext. | Sess | TW | Pract. | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

**PEC**

**Type of Course:** Program Elective -VI

**Prerequisite:** Mathematics

**Rationale:** Machine learning is the science of getting computers to act without being explicitly programmed. In the past decade, machine learning has given us self-driving cars, practical speech recognition, effective web search, and a vastly improved understanding of the human genome. Machine learning is so pervasive today in various fields and continues to find its way to newer domains. In this course, the students will learn about the most effective machine learning techniques, how to implement them and getting them to work. Additionally, the students will learn about the theoretical underpinnings of most frequently used ML algorithms.

### A. OBJECTIVES OF THE COURSE

- To impart knowledge about various algorithms in the domain of machine learning
- To conceptually understand mathematical relationships of various machine learning algorithms
- To familiarize with various aspects that need to be considered for applying ML to different problems

### B. DETAILED SYLLABUS

**[A] INTRODUCTION**

Introduction, Motivation and applications, Basics of supervised and unsupervised learning

**[B] REGRESSION TECHNIQUES**

Basic concepts and applications of Regression, Simple Linear & Multiple Regression, Gradient Descent, Hyper-parameters tuning, Evaluation Measures for Regression Techniques

**[C] CLASSIFICATION TECHNIQUES**

Naïve Bayes Classification, K-Nearest Neighbors, Classification Trees, Support Vector Machines, Evaluation Measures for Classification Techniques

**[D] ARTIFICIAL NEURAL NETWORKS**

Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, Multilayer Perceptron, Back-propagation Neural Networks

**[E] DIMENSIONALITY REDUCTION & CLUSTERING**

PCA, k-means clustering

### C. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | To comprehend, differentiate supervised and unsupervised machine learning problems and relevant algorithms |
| CO2 | Understand | To understand mathematical relationships within and across machine learning algorithms |
| CO3 | Analyze | To analyze fundamental issues and application aspects of ML algorithms to various problems |

**D. Mapping of CO's and PO's**

| POs<br>COs | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| i | 3 | 2 | 2 | 2 | | 2 | | | | | | |
| ii | 3 | 3 | 3 | 3 | | | | | | | | |
| iii | 3 | 3 | 3 | 3 | 3 | 3 | | | | | | |

**E. Mapping of CO's and PSO's**

| PSOs<br>COs | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| i | 2 | 2 | 2 |
| ii | 3 | 3 | 2 |
| iii | 3 | 2 | 2 |

**F. RECOMMENDED TEXTBOOKS**

A. Tom Mitchell, Machine Learning, TMH Publications.
B. C. Bishop, Pattern Recognition and Machine Learning, Springer Publications
C. Simon Rogers, Mark Girolami, First Course in Machine Learning, CRC Press

**G. REFERENCE BOOKS AND NOTES**

1. Kishan Mehrotra, Chilukuri Mohan and Sanjay Ranka, Elements of Artificial Neural Networks, Penram International Publishers.
2. Athem Ealpaydin, Introduction to Machine Learning, PHI Publications
3. Simon Haykin, Neural Networks and Learning Machines, Pearson

**H. LIST OF EXPERIMENTS**

Simple regression
Multiple regression
Bayes Classification
k nearest neighbours (kNN)
Support Vector Machines
Neural networks for Regression
Neural Networks for Classification
Managing data/accessing data
Dimensionality reduction techniques
Evaluation methods/parameters of ML algorithms

**B. TECH. SEMESTER – VII (IC)**

**SUBJECT: (IC-7XX) SMART INSTRUMENTATION**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 3 | 0 | 0 | 3 | 3 | 60 | 0 | 0 | 0 | 60 |

**OEC**

**A. OBJECTIVES OF THE COURSE**

Modern world manufacturing facilities are upgraded and leading towards smart factories. To equip the factories with state-of-the-art facilities meeting global standards, it is imperative to upgrade the existing instrumentation with smart instrumentation. This course provides knowledge regarding different types of smart sensors and their usage for transducer design. The course also discusses usage of microprocessors for development of smart instrumentation and networking. Relevant international standards are also included in the discussion employed in realization of smart sensor networking. The course intends to make students aware about classification, fabrication and recent trends in sensor technologies, sensor-networking techniques and relevant standards, protocols and technologies.

**B. DETAILED SYLLABUS**

**NO TOPIC**

**[1] Smart Sensors**

Sensors and their classification, Sensor fabrication techniques, Sensors fabrication process details and latest trends in sensor fabrication, some special types of sensors: Fiber optic sensors, Chemical sensors, Biosensors, Characterization of sensors

**[2] Sensor Networks:**

Basic concepts, Sensor networking, industrial networking, sensor networking solutions, ISO/OSI model of 7-layers, Smart Sensors, Smart Sensor manufacturing technologies, Smart transducers and smart valve actuators

**[3] LAN: Technologies, Protocols, and Topologies**

Wired and wireless networking, Various topologies, Wired network protocols, wireless network protocols

**[4] WSNs and their applications**

Basic concepts, purposes, usage, Factors and considerations for applications, Practical implementation issues, WSN standard IEEE 802.15.4, WSN applications in emerging areas

**[5] IEEE 1451 Family of Standards**

Brief discussions on IEEE 1451.0 standard, IEEE 1451.1 standard, IEEE 1451.2 standard, IEEE 1451.3 standard, IEEE 1451.4 standard, IEEE 1451.5 standard, IEEE 1451.6 standard and IEEE 1451.7 standard

**C. RECOMMENDED TEXT / REFERENCE BOOKS**


[1] Understanding Smart Sensors by R. Frank, Artech House

[2] Smart Material Systems and MEMS: Design and Development Methodologies: Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan , John Wiley & Sons Ltd.

[3] Data and computer communication by William Stallings, Pearson

[4] Wireless Sensor Networks – Architecture and Protocols, by Edger H. Callaway, CRC Press

[5] Measurement and Instrumentation: Theory and Application, by AS Morris, R Langari and Butterworth-Heinemannm, Elsevier

[6] Intelligent Instrumentation, by G. Barney, PHI

[7] Chemical Sensors and Bio-Sensors, by Brayan Eggins, John Wiley & Sons.

[8] Fiber Optic Sensors, by Eric Udd, Wiley

[9] Smart Sensors, by Chapman P., ISA Publications
[10] John G. Webster, Editor-in-chief, "Measurement, Instrumentation, and Sensors Handbook", CRC Press.

**D. COURSE OUTCOMES**

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | To develop awareness regarding sensor technologies, special types of sensors, and relevant terminologies |
| **CO2** | Understand | To familiarize regarding wired-wireless networking techniques along with relevant terminologies and technical specifications |
| **CO3** | Understand | To study IEEE 1451 family of standards with each sub-standard information and their application for smart transducers development |

**E. CO-PO MAPPING**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **CO2** | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**F. CO-PSO MAPPING**

| | PSO1 | PSO2 | PSO3 |
|---|---|---|---|
| **CO1** | 2 | 1 | 1 |
| **CO2** | 2 | 2 | 2 |
| **CO3** | 2 | 2 | 1 |

**B. TECH. SEMESTER – VII(IC)**

**SUBJECT: (IC7XX) INDUSTRIAL EXPOSURE & PRACTICE**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 0 | 1 | 2 | 3 | 2 | 0 | 0 | 25 | 25 | 50 |

**Reference Code PORJ**

**Type of Course:** Project

**.A. DETAILED SYLLABUS**

The students will undertake vocational training in industries after completion of 6th semester for the period of minimum 3 week and maximum 6 week. They should understand the instrumentation engineer's role in industries. They are supposed to prepared and submit a project report as a part of their term-work for the industrial training and give seminars on their training work.

**.B. COURSE OUTCOMES**

After completion of the course students should be able to:

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Ability to understand of roll of instrumentation engineer in various industries |
| **CO2** | Understand | An ability to share knowledge effectively in oral and written form and formulate documents adapt to real time industry exposure and experience |
| **CO3** | Understand | value the health, environment, safety and ethical practices during the internship |
| **CO4** | Understand | develop lifelong learning skills for productive career / entrepreneurship |
| **CO5** | Apply | Identify, formulate and solve a problem of Instrumentation and Control Engineering |

**C. Mapping of CO's and PO's (number grading)**

| POs COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 0 | 0 | 1 |
| **CO3** | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| **CO4** | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **CO5** | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**D. Mapping of CO's and PSO's (number grading)**

| PSOs<br>COs | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 3 | 2 | 2 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 2 |
| **CO4** | 3 | 2 | 2 |
| **CO5** | 3 | 2 | 1 |

**B. TECH. SEMESTER – VIII(IC)**

**SUBJECT: (IC8XX) INDUSTRIAL INTERNSHIP & PROJECT**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 0 | 0 | 24 | 24 | 12 | 0 | 0 | 0 | 350 | 350 |

**PROJ**

**Type of Course:** Program Core

## A. DETAILED SYLLABUS

The students will undertake project work for the period of one semester. They should design/develop & fabricate the project. They are supposed to prepared and submit a project report as a part of their term-work for the project and give seminars on their project work. The students may be sent to the industry for their project and they are to timely report to the department regarding monitoring and necessary guidance. They should arrange for demonstration of the project work at the time of examination They are to be examined based on viva and/or demonstration.

## B. COURSE OUTCOMES

After completion of the course students should be able to:

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Understand | Make use of acquired knowledge of instrumentation for the problem identification and definition related to current industrial trends |
| **CO2** | Analysis | Industrial aspects of the project in a systematic way |
| **CO3** | Understand | Selection of modern tools and techniques for problem solving |
| **CO4** | Create | Perceive the possibility of scalability and scope of intellectual property rights |
| **CO5** | Apply | Demonstrate and conclude the project with effective communication amongst peers and mentors |

## C. Mapping of CO's and PO's (number grading)

| POs<br>COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 0 | 0 | 1 | 2 | 0 | 1 | 1 | 1 | 2 |
| **CO2** | 2 | 3 | 3 | 1 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 2 |
| **CO3** | 3 | 2 | 2 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| **CO4** | 2 | 2 | 2 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| **CO5** | 2 | 2 | 2 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |

**D. Mapping of CO's and PSO's (number grading)**

| PSOs<br>COs | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 3 | 3 | 3 |
| **CO2** | 3 | 3 | 2 |
| **CO3** | 2 | 2 | 3 |
| **CO4** | 2 | 2 | 2 |
| **CO5** | 2 | 2 | 2 |

**B. TECH. SEMESTER – VIII(IC)**

**SUBJECT: (IC8XX) SEMINAR**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Pract. | Total | | Ext. | Sess. | TW | Pract. | Total |
| 0 | 0 | 12 | 12 | 6 | 0 | 0 | 150 | 0 | 150 |

**PROJ**

**Type of Course:** Program Core

## A. DETAILED SYLLABUS

The aim of this course is to use the industrial internship experience to enable students to develop their engineering skills and practice. The students will be placed in industry / Construction site / Consultancy/ research organization and assessed for academic credit. The internship will be aligned with the aims of the engineering program and its areas of specialization. Students are expected to experience a real-life engineering workplace and understand how their engineering and professional skills and knowledge can be utilized in industry. The internship focuses upon the demonstration of functioning engineering knowledge, both new and existing, and identification of areas of further development for future careers.

## B. COURSE OUTCOMES

After completion of the course students should be able to:

| CO NUMBER | Skill | Statement |
|---|---|---|
| **CO1** | Apply | An ability to share technical knowledge effectively in oral and written form and formulate project report and presentation |
| **CO2** | Understand | Develop work habits, technical skills and attitudes necessary for professional success |
| **CO3** | Understand | appraise the importance of an individual and team efforts for effective project execution |
| **CO4** | Understand | develop lifelong learning skills for productive career / entrepreneurship |

**C. Mapping of CO's and PO's (number grading)**

| POs<br>COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 |
| **CO2** | 2 | 3 | 2 | 1 | 0 | 1 | 2 | 0 | 1 | 1 | 1 | 0 |
| **CO3** | 2 | 2 | 3 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| **CO4** | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |

**D. Mapping of CO's and PSO's (number grading)**

| PSOs<br>COs | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|
| **CO1** | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 2 |
| **CO3** | 2 | 2 | 2 |
| **CO4** | 2 | 2 | 2 |

## MBA SEMESTER – III

## SUBJECT: ADVERTISING AND SALES PROMOTION

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- To acquaint the students with concepts and techniques in the application for developing and designing an effective advertising and sales promotion program.
- To sensitize students to the various facets of advertising, public relation and promotion management.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | An Introduction to Integrated Marketing Communications:<br>Marketing, IMC, Promotional Mix, Promotional Management, IMC Planning Process. | **2.5** | CO1 |
| [2] | The Role of IMC in the Marketing Process:<br>Marketing Strategy and Analysis, Target Marketing Process, Developing the Marketing Planning Program, The role of Advertising and Promotion. | **2.5** | CO1 |
| [3] | Organizing for Advertising and Promotion:<br>The role of Ad Agencies and Other Marketing Communication Organization: An Overview, organizing for Advertising and Promotion, Advertising Agencies, Agency Compensation, Evaluating Agencies, Specialized Services, Collateral Services. | **2.5** | CO1 |
| [4] | Perspective on Consumer Behaviour:<br>An Overview, The Consumer Decision Making Process, The Consumer Learning Process, Environmental Influences on Consumer Behaviour, Alternative Approaches to Consumer Behaviour. | **2.5** | CO1 |
| [5] | The Communication Process:<br>The Nature of Communication, A Basic Model of Communication, Analyzing the Receiver, the Response Process, Understanding Involvement, Cognitive Processing of Communications, Summarizing the Response Process. | **2.5** | CO1 |
| [6] | Source, Message, and Channel Factors:<br>Promotional Planning through the Persuasion Matrix, Source factors, Message factors, Channel factors. | **2.5** | CO1 |
| [7] | Establishing Objectives and Budgeting for the Promotional Program: | **2.5** | CO1 |

| | | | |
|---|---|---|---|
| | The Values of Objectives, Determining Promotional Objectives, Sales versus communication Objectives, DAGMAR, Problem in setting objectives, Establishing and allocating. | | |
| **[8]** | Creating Strategy:<br>Planning and Development: The importance of Creativity in Advertising, advertising Creativity, Planning Creative Strategy, The Creative Process, Creative Strategy development. | **2.5** | CO2 |
| **[9]** | Creating Strategy: Implementation and Evaluation:<br>Appeals and Execution Styles, Creative Tactics, Client Evaluation and Approval of creative work. | **2.5** | CO2 |
| **[10]** | Media Planning and Strategy:<br>An Overview, Developing the Media Plan, Market Analysis and Target, Establishing Media Objective, Developing and Implementing, Evaluation and Follow-Up, Computers in Media Planning, Characteristics of Media. | **2.5** | CO2 |
| **[11]** | Evaluation of Broadcast Media:<br>Television, Buying Television Time, Radio. | **2.5** | CO4 |
| **[12]** | Evaluation of Print Media:<br>Role of Magazines and Newspaper, Magazines, Newspaper. | **2.5** | CO4 |
| **[13]** | Support Media:<br>The Scope of the Support Media Industry, Out of Home media, Promotional Products Marketing, Other Media. | **2.5** | CO5 |
| **[14]** | Directing Marketing:<br>An Overview, Direct selling, Evaluating the effectiveness of Direct Marketing. | **2.5** | CO4 |
| **[15]** | The Internet and Interactive Media:<br>Defining the Internet, developing an Internet Program, the internet and integrated Marketing Communications, Measuring Effectiveness of the Internet, Advantages and Disadvantages of the Internet, Additional Interactive Media. | **2.5** | CO5 |
| **[16]** | Sales Promotion:<br>The scope and role of sales promotion, the growth of sales promotion, consumer-oriented sales promotion, and consumer oriented sales promotion techniques, Trade Oriented sales promotion, Coordinating sales promotion, Sales Promotion abuse. | **2.5** | CO4 |
| **[17]** | Public Relations, Publicity, and Corporate Advertising:<br>Public relations, The process of public relations, publicity, corporate advertising. | **2.5** | CO4 |
| **[18]** | Personal selling:<br>The scope of personal selling, the role of Personal selling, Advantage and Disadvantage, combining personal selling, Evaluating the personal selling effort. | **2.5** | CO4 |
| **[19]** | Measuring the Effectiveness of the Promotional Program:<br>Argument for and Against Measuring effectiveness, Conducting Research to Measure, The Testing Process, establishing a Program for Measuring, Measuring the effectiveness of other program elements. | **1.5** | CO3 |

| | | | |
|---|---|---|---|
| [20] | International Advertising and Promotion:<br>The importance of International Markets, The Role of international, The International Environment, Global versus localized Advertising, Decision Areas in International Advertising, The roles of other Promotional Mix Elements in International Marketing | **1.5** | CO1 |
| [21] | Regulation of Advertising and Promotion: Self-Regulation, Federal Regulation of Advertising, State Regulation, Regulation of Other Promotional Areas. | **1** | CO2 |
| [22] | Evaluating the social, Ethical, and Economic Aspects of Advertising and Promotion: Advertising and Promotional ethics, Social and Ethical Criticism of Advertising, Economics effects of Advertising. | **1** | CO3 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

Belch E G & Belch M A. Advertising and Promotion: An Integrated Marketing Communications Perspective, 7th ed., Tata McGraw-Hill. India, 2010.

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

- Clow K E. Integrated Advertising, Promotion, and Marketing Communications, 7th ed., Pearson, 2014.
- Kazmi S H H and Batra. S Advertising and Sales Promotion, 5th ed., Excel Books, 2014.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Describe the marketing communication mix, IMC, communication models, elucidate the role of advertising in marketing communication, design an advertising plan and an advertising program using the 5 Ms of advertising, describe the methods for setting the advertising budget, and describe the functions of |

| | | |
|---|---|---|
| | | advertising agencies. |
| **CO2** | Comprehension | Develop a creative strategy using the steps in creative strategy development, explain the various styles of advertising executions, creative tactics, appeals, layouts, describe the elements of a media strategy, explain the implementation of media strategy with IMC perspective, and enumerate emerging media options. |
| **CO3** | Application | Describe the methods for testing advertising effectiveness, explain the methods used in advertising research, explain the Social, Economic, Cultural and Ethical aspects of advertising, enumerate the functions of ASCI and types of advertising awards. |
| **CO4** | Synthesis | Define sales promotion and its purpose, explain the major decisions in sales promotions, differentiate between consumer and trade promotion tools, coordinate sales promotion with advertising. |
| **CO5** | Analysis | Define digital media and the digital consumer, explain the advantages, disadvantages and challenges of digital marketing, explain digital marketing methods, social media marketing and platforms, and enumerate methods for digital reputation management. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| **CO1** | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | |
| **CO3** | 3 | 1 | 3 | 2 | 1 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | |
| **CO4** | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | |
| **CO5** | 2 | 2 | 1 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | |
| **Avg** | 2.2 | 2.2 | 2.4 | 2.2 | 2.4 | 2.4 | 2.2 | 2.2 | 2.4 | 2.2 | 2.4 | 2.4 | 2.6 | 2.4 | 2.4 | 2.5 | 2.3438 |

## MBA SEMESTER – II
## SUBJECT: BUSINESS RESEARCH METHODOLOGY

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- To learn the basic skills to conduct research.
- To understand the quality of research studies and literature review.
- To design and produce a research proposal & research project.
- To analysis the research finding.
- To interpret the research result.
- To develop the research report.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Research in Business: Why study business research? How research industry works, what is good research? | 2.5 | CO1 |
| [2] | Thinking Like a Researcher: Research and scientific method, concepts, constructs, definitions, variables, propositions, hypothesis. | 2.5 | CO1 |
| [3] | Ethics in Business Research: What are research ethics? Ethical treatment of participants. | 2.5 | CO1 |
| [4] | Research Methodology: Details and applications. | 2.5 | CO4 |
| [5] | Defining the Research Problem: Types of research questions. | 2.5 | CO4 |
| [6] | Research Design: What is research design, exploratory studies, descriptive studies, causal studies. | 2.5 | CO4 |
| [7] | Secondary Data Searches: The exploratory phase search strategy, level of information, types of information sources, analysis. | 2.5 | CO2 |
| [8] | Qualitative Research: Definition, Qualitative versus quantitative research, qualitative research methodology. | 2.5 | CO2 |
| [9] | Observation Studies: Uses of observation, evaluation of observation method. | 2.5 | CO2 |
| [10] | Surveys: Self-administered surveys. | 2.5 | CO2 |
| [11] | Questionnaires and Instruments: Revisiting the research question hierarchy | 2.5 | CO2 |
| [12] | Samplings: Nature & types of sampling, steps in sampling design. | 2.5 | CO2 |

| | | | |
|---|---|---|---|
| [13] | Measurements / Measurements Scales: Nature of measurement, types of scales, selecting a measurement scales. | **2.5** | CO3 |
| [14] | Data Preparation and Description: Simple tabulation and cross-tabulation and Hypothesis Testing, Coding, Data entry, data analysis. | **2.5** | CO3 |
| [15] | Analysis of variance and the Design of Experiments: Usage of SPSS | **2.5** | CO3 |
| [16] | Correlation and Regression: Explaining Association and Causation Simple and multiple regression. | **2.5** | CO3 |
| [17] | Discriminant Analysis: classification and Prediction Applications & SPSS usage. | **2.5** | CO3 |
| [18] | Factor Analysis for Data Reduction: Applications and SPSS Usage | **2.5** | CO3 |
| [19] | Cluster Analysis for Market Segmentation: Applications and SPSS Usage | **2.5** | CO3 |
| [20] | Written and Oral Report: Short reports, long reports, Research report components, writing the report, presentation of statistics. | **2.5** | CO5 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

Cooper R D & Schindler S P. Business Research Method, 9th ed., Tata McGraw-Hill. India, 2006

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

- Malhotra N K. Marketing Research, 4th ed., Pearson Education. India, 2012.
- Kothari C. R. Research Methodology, 2nd ed., New Age Publishers. India, 2006.
- Nargundkar R. Marketing Research Text and Cases, 2nd ed., Tata MacGraw Hill, India, 2009.
- Sachdeva J K. Business Research Methodology, 2nd ed., Himalaya Publishing Ltd, 2015.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Define the basic concepts of research and research designs and in describing the various steps in the research process. |
| CO2 | Comprehension | Enumerate the various data collection methods and design questionnaires. Through the course students would be able to describe and differentiate between the various sampling and |

| | | |
|---|---|---|
| | | scaling techniques. |
| **CO3** | Application | Select and apply the relevant parametric and non-parametric tests to test a hypothesis. The tests will be useful in identifying relationships between variables, determining and rating the performance of brands and training methods or for comparing a before-after phenomenon. |
| **CO4** | Synthesis | Segment markets. The course shall help students in estimating the performance of the company's products in different market segments, and in evaluating trends in the demand patterns for a company's products. The course shall help students in discovering the cause-effect relationships related to product or market problems. The course shall help students analyses and draw conclusions about the impact of multiple variables on a dependent variable. |
| **CO5** | Analysis | Choose the right type of report required in different situations, enumerating the different steps in writing a research report and the mechanics of writing a good research report. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| **CO 1** | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | |
| **CO 2** | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | |
| **CO 3** | 3 | 1 | 3 | 2 | 1 | 3 | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | |
| **CO 4** | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | |
| **CO 5** | 2 | 2 | 1 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | |
| | | | | | | | | | 3 | | | | | | | | |
| **Avg** | 2.2 | 2.4 | 2.2 | 2.6 | 2.6 | 2.2 | 2.6 | 2.4 | 2.8 | 2.2 | 2 | 2.4 | 2.6 | 2.2 | 2.4 | 2.4 | 2.3875 |

## MBA SEMESTER – III
## SUBJECT : CONSUMER BEHAVIOUR

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- The basic objective of the course is to develop an understanding about Customers.
- To make students to understand decision-making process for buying goods and services.
- To understand customers as an individual in respect to their personality, perspective, attitude and learning.
- To apprehend students about communication process.
- To comprehend significances of family influences, reference group influences and social class influence while buying Products from the Market.
- To respect culture and sub culture of customers for buying influence of products.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Consumer Behavior: Its origin and strategic Application:<br>Development of the Marketing Concept, Customer value, satisfaction and retention, the impact of digital technologies on marketing strategies, consumer behavior and decision making are interdisciplinary. | 3 | CO1 |
| [2] | Consumer Research:<br>Consumer research paradigms, the consumer research process, ethics in consumer research. | 3 | CO2 |
| [3] | Market Segmentation:<br>Meaning, Bases for segmentation, criteria for effective targeting of market segments and implementation segmentation strategies. | 3 | CO2 |
| [4] | Consumer Motivation:<br>Motivation as a psychological force, the dynamics of motivation, types and systems of needs, the measurement of motives. | 3 | CO4 |
| [5] | Personality and consumer behavior:<br>Meaning, theories of personality, personality and understanding consumer diversity, brand personality and self and self-image. | 3 | CO3 |
| [6] | Consumer Perception:<br>Elements of perception, dynamics of perception, consumer | 3 | CO2 |

| | | | |
|---|---|---|---|
| | imagery, perceived risk. | | |
| [7] | Consumer learning:<br>Elements of consumer learning, behavioral learning theories, cognitive learning theory, measures of consumer learning. | **3** | CO3 |
| [8] | Consumer attitude formation and change:<br>Meaning, structural models of attitudes, attitude formation, strategies of attitude change. | **3** | CO2 |
| [9] | Communication and consumer behavior:<br>Components of communication, the communication process, designing persuasive communication, marketing communication and ethics. | **3** | CO5 |
| [10] | Reference groups and family influences:<br>Meaning, understanding the power of reference groups, selected consumer related reference group, celebrity and other reference group appeals, socialization of family members. | **3** | CO4 |
| [11] | Social Class and Consumer behavior:<br>Meaning, the measurement of social class, social class mobility, affluent consumer, the working class, techno class. | **3** | CO3 |
| [12] | The influence of culture on consumer behavior:<br>Meaning, culture is dynamic, measurement of culture, American core value, Indian core value. | **3** | CO2 |
| [13] | Subcultures and consumer behavior:<br>Meaning, nationality, religious, geographic, age, sex | **3** | CO4 |
| [14] | Cross cultural consumer behavior: An international perspective:<br>The imperative, cross cultural consumer analysis, alternative multinational strategies, global versus local, cross cultural psychographic segmentation. | **3** | CO3 |
| [15] | Consumer influences and the diffusion of innovation:<br>Meaning, opinion leadership, dynamics of the opinion leadership process, the measurement of opinion, the adoption process, a profile of the consumer innovator. | **3** | CO2 |
| [16] | Consumer decision making and Beyond:<br>Decision, level of consumer decision making, model of consumer decision making. Relationship Marketing | **3** | CO2 |
| [17] | Group Presentation | **2** | CO3 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

Schiffman L G , Kanuk L L and Kumar S R Kanuk. Consumer Behaviour, 12th ed., Pearson Education, New Delhi, 2011.

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

- Nair S. Consumer Behaviour in India Perspective, 2nd ed., Himalaya Publishing Ltd, New Delhi, 2015.

- Case Study, articles, journal papers, periodicals etc.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Identify Consumer Behaviour as the most important concept to learn in marketing. |
| CO2 | Comprehension | To Know about the principles in understanding consumer behaviour. |
| CO3 | Application | To know factors affecting Consumer Behaviour. |
| CO4 | Synthesis | To identify the steps in the consumer decision making process. |
| CO5 | Analysis | To explain various models of Consumer Behaviour. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO1 | 3 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | |
| CO2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | |
| CO3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | |
| CO4 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 2 | |
| CO5 | 1 | 2 | 1 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 2 | 1 | 2 | |
| Avg | 2.2 | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2.2 | 2.2 | 2.4 | 2.6 | 2.2 | 2.2 | 2.4 | 2.2 | 2.2 | 2.4 | 2.275 |

## MBA SEMESTER – IV
## SUBJECT: CONTEMPORARY ISSUES IN MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This course is designed to introduce and induct students into the latest developments in the field of Management through case studies and other contemporary pedagogies. Various latest areas like Behavioural Finance, Digital Marketing etc. have been covered in this subject.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Introduction to Behavioral Finance:<br>● Why Psychology Matters<br>● Forecasting Errors<br>● Overconfidence Bias<br>● Conservatism | 2 | CO1 |
| [2] | The Psychology of Personal Investment Decisions:<br>● Choice Under Constraint<br>● Objectives<br>● Types of Risks<br>● Characteristics of Investments<br>● Human Capital<br>● Risk Management<br>● The Psychology of Personal Finance<br>● Self Deception<br>● Heuristic Simplification<br>● The Catering Theory of Dividends<br>● The Social Dimension<br>● Influence of Emotion and Mood<br>● Prospect Theory<br>● The Disposition Effect<br>● Avoidance of Psychological Biases<br>● Saving and Self-Control<br>● Habitual Non-Savers<br>● Self Control, Personality Traits, and Social Mood<br>● Influences on Retirement and Saving Behaviour<br>● Classifying Investors | 2 | CO2 |
| [3] | Emotions, Neuroscience and Investing: Investors Dopamine Addict: | 2 | CO3 |

| | | | |
|---|---|---|---|
| | ● The Primacy of Emotion<br>● Emotions: Body or Brain<br>● Emotions: Good, Bad or Both?<br>● Self Control is like a Muscle<br>● Hard-Wired for the Short Term<br>● Hard-Wired to Herd<br>● Plasticity as Salvation | | |
| [4] | Surveillance in Stock Exchanges (Introduction) | **2** | CO1 |
| [5] | Rules and Regulations (Securities Contracts Regulation Act, 1956 and Rules, 1957) | **2** | CO2 |
| [6] | Securities and Exchange Board of India Act, 1992, | **2** | CO3 |
| [7] | SEBI (Stock brokers & Sub Brokers) Regulations 1992) | **2** | CO3 |
| [8] | SEBI (Prohibition of Insider Trading) Regulations, 1992, SEBI (Prohibition of Fraudulent and Unfair Trade Practices) Regulations 2000 | **2** | CO2 |
| [9] | Introduction to Banking, Banking and Economics | **2** | CO4 |
| [10] | Understanding a Bank's Financials (CAMELS framework) | **2** | CO4 |
| [11] | BASEL Framework (Bank for International Settlements (BIS)) (Basel Accords) | **2** | CO4 |
| [12] | Indian Commodity Futures Market<br>● Understanding Commodities<br>● Derivatives and Commodity Futures Trading<br>● Commodity Derivatives Exchange<br>● The Market Participants<br>● The Financialization of Commodities<br>● Commodity Futures Market in India<br>● The Regulatory Issues in India<br>● Policy issues and challenges<br>● Case Study:<br>  ● Silver Thursday and Hunt Brothers Scandal<br>  ● Crude Oil Price Fixing Scandal<br>  ● The Enron Scandal<br>  ● The Copper King Scandal<br>  ● The Guar Futures Trading Scandal<br>  ● The NSEL Payment Scam | **2** | CO3 |
| [13] | **Introduction to Retail:**<br>● Retail, Function of Retailer, The Marketing-Retail Equation, The Rise of Retailer, The Global Retail Market: Issue and Challenges, Retail of 21st Century, Retail as a Career. | **2** | CO4 |

| | | | |
|---|---|---|---|
| [14] | **Retail in India**:<br>● The Concept of Organized Retail, The Evolution of Retail in India, Drivers of Retail Change in India, The size of Retail in India, Key sector in Retails, Retail Retailers. | **2** | CO4 |
| [15] | **Understanding the Retail Consumer**:<br>● The Need for studying Consumer Behaviour, Factors influencing the Retail shopper, The Customer Decision Making Process, Market Research. | **2** | CO5 |
| [16] | **Retail Strategy**:<br>● Strategy, The Concept of the Business Model, Strategy, International Expansion- A Growth Strategy. | **2** | CO3 |
| [17] | **Retail Franchising**:<br>● The Concept of Franchising, Evolution of Franchising, Types of Franchising, Types of Franchising, Advantage of Franchising, Disadvantage of Franchising, Franchising in India and legal issues in Franchising in India. | **2** | CO4 |
| [18] | **Retail Marketing and Branding:**<br>● The role of Marketing in Retail, The Retail Marketing Mix, The STP Approach, The Retail Image, The Retail Communication Mix, The Concept of Branding**.** | **3** | CO5 |
| [19] | **Introduction to Digital Marketing:**<br>Digital Marketing, Internet Users, Digital Marketing Strategy, Digital Advertising Market in India, Skills required in Digital Marketing, Digital Marketing Plan. | **2** | CO3 |
| [20] | **Display Advertising:**<br>Introduction, Types of Ads, Types of Display Ads, Buying Models, Display Plan, Targeting, What makes a Good Ad, Programmatic Digital Advertising, Analytics Tools, Youtube Advertising. | **3** | CO1 |
| [21] | **Search Engine Advertising:** | **2** | CO2 |

| | | | |
|---|---|---|---|
| | Why pay for Search Advertising, Understanding Ad Placements, Understanding AdRanks, Creating the First Ad Campaign, Enhance Your Ad Campaign, Performance Reports. | | |
| [22] | **Social Media Marketing:**<br>Facebook Marketing, Linkedln Marketing, Twitter Marketing, Instagram and Snapchat, Mobile Marketing.<br><br>**Search Engine Optimisation and Web Analytics:**<br><br>Search Engine, Concept of Search Engine Optimisation, SEO Phases, On Page Optimisation, Off Page Optimisation, Social Media Reach, and Maintenance.<br><br>Data Collection, Key Metrics, Making Web Analytics Actionable, Multi Channel Attribution. | **2** | CO3 |
| [23] | **<u>Forensic Accounting</u>**<br>Understanding, Analyzing and Interpreting financial statements<br>How to unearth early warning signals by analyzing financial statements?<br>How to uncover mysteries and tactics of explaining how to analyze various detailed components of financial statements?<br>How to dissect financial statements with surgical precision?<br><br>How to read between the lines of financial statements beyond what is visible on surface? | **2** | CO3 |
| [24] | Network Design and operation in supply chain management<br>Supply chain integration and restructuring<br>Agile supply chains<br><br>Case studies:<br><br>1) Kurlon Limited<br><br>2)Vehicle routing at Baroda union<br><br>3) Supply chain management at Dalmia Cement Ltd<br><br>4) Power equipment (india) ltd | **2** | CO4 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

No book is recommended as textbook given the nature of the subject.

## D. REFERENCE BOOKS

1. Personal Finance and Investments – A Behavioural Finance Perspective By Keith Redhead, Pulbisher: Routledge
2. Behavioural Investing – A practitioner's guide to applying behavioural finance, James Montier, Wiley
3. NPTEL course by Prof Abhijit Chandra (IIT, Kharagpur) on Behavioural and Personal Finance, Module 1, Lecture 2
4. Pradhan, Swapna, Retailing Management, 3rd Edition, McGraw Hill.
5. A Beginner's Guide to Indian Commodity Futures Market by Neeraj Mahajan and Kavaljit Singh, Madhyam
6. Gupta, Seema, Digital Marketing, First edition, McGraw Hill.
7. Bhatia singh, Puneet, Fundamentals of Digital Marketing, Current Edition, Pearson.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Train the students about latest policy changes in India |
| CO2 | Comprehension | Train students about the latest developments in all areas like Marketing, Finance, HR etc. |
| CO3 | Application | Make students aware about changes in Business Environment |
| CO4 | Synthesis | Make students aware about changes in Technology that affect Businesses in India |
| CO5 | Analysis | Teach practical dimensions of latest management theories through latest practical case studies |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 |
| CO3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 |
| CO4 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| CO5 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 1 | 2 | 3 | 2 | 3 | 1 | 2 | 1 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Avg** | 2 | 2.4 | 2 | 2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2.2 | 2.4 | 2.2 | 2.4 | 2 | 2.2 | 2 | 2.175 |

## MBA. SEMESTER – II
## SUBJECT: COST AND MANAGEMENT ACCOUNTING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

- To make students aware of various techniques and methods ascertaining cost of various products and also to enable them to study & evaluate measures of controlling cost.
- To enable students to evaluate performance of various business concerns by use of technique of ratio analysis.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **Concept of cost from various angles:** Definition of Cost Accounting – Its Basic- Methods and Techniques of costing, Advantage and Limitation of Cost Accounting – Comparison with Financial Accounting – Analyses and Classification of cost | 4 | CO1 |
| [2] | **Elements of Cost** Procedures of linking cost to cost centers and cost units, Overheads: Nature and classification, Procedure of linking overheads to cost units, classification and collection of overheads, Allocation and apportionment of overheads – Examples, Overhead absorption and absorption rate. Actual and predetermined overheads | 4 | CO1 |
| [3] | **Valuations** Joint Product, By product and stock valuation. Job batch and contract costing – examples | 4 | CO3 |
| [4] | **Processing Costing** Process costing with examples, nature and problem in processes costing, normal and abnormal losses and their valuation – operation and services costing | 4 | CO3 |
| [5] | **Marginal Costing** Nature and problem of Marginal costing, Break even analysis, CVP relationship with examples | 4 | CO2 |
| [6] | **Budgetary and Budgetary control** Nature and problem, various types of budget, preparation of budget, examples and preparing of budget, responsibility accounting, learning curves, standard cost and standard costing, calculation and analysis of variances | 4 | CO4 |
| [7] | **Cost control Accounts** Types of Accounting records, Integral accounting & non-Integral Accounting and Reconciliation of cost and financial accounts | 4 | CO3 |
| [8] | **Activity based costing** | 4 | CO3 |

| | | | |
|---|---|---|---|
| | Implementation and continuation of costing system, cost reduction, value analysis, value addition and review | | |
| [9] | **Cash flow statement and Fund flow statement**<br>Preparation and analyses, examples | **4** | CO5 |
| [10] | **Ratio analysis**<br>Calculation of ratio and grouping of ratios, analysis of changes in ratios | **4** | CO5 |
| [11] | **Analysis of financial position and performance of business concern**<br>Possible reason for variance in performance/ financial position | **4** | CO5 |
| [12] | **Project Preparation** | **6** | CO5 |

## C. TEXT BOOKS

- Bhar, B. K. (n.d.). *Cost Accounting* (Latest Edition ed.). Academic Publisher.
- Tulsian, P.C. (n.d.). *Cost Accounting* (Latest Edition ed.). S.Chand Publication.

## D. REFERENCE BOOKS

- Charles, Srikant and George (n.d.). *Cost Accounting* (Latest Edition ed.). PHI Publication.
- Arora, M. N. (n.d.). *Cost and Management Accounting* (Latest Edition ed.). HPH Publication.
- Kishor, R. M. (n.d.). *Cost and Management Accounting* (Latest Edition ed.). Taxmann Publication.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Classify and identify the cost and its elements including Methods and techniques of cost ascertainment and control along with Allocation and apportionment of overheads. |
| CO2 | Synthesis | Analyse business decisions using cost-volume- profit analysis |
| CO3 | Application | To apply and analyse Methods and techniques of Costing along with various valuation techniques |
| CO4 | Comprehension | Develop and apply standards and budgets for planning and controlling purposes. |
| CO5 | Analysis | Analyse cash flow and fund flow, Variance analysis, Ratio analysis and Project planning to evaluation. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | |
| CO2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | |
| CO3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | |
| CO4 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **..** | | | | | | | | | | | | | | | | | |
| **Avg** | 2.8 | 2.8 | 2.6 | 2.2 | 2.2 | 2.2 | 2.8 | 2.2 | 2.2 | 2.8 | 2.2 | 2.2 | 2.8 | 2.2 | 2.8 | 2.2 | |

## MBA Semester IV

## SUBJECT: CORPORATE TAX PLANNING

| Teaching Scheme (Hours/Week) | | | | Credit | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | s | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | | 100% |

## A. COURSE OVERVIEW

To enable students to understand provision in Income Tax Act. To make them capable to file return of the income for the corporate etc. To enable students to plan regarding tax liability and also to plan to achieve minimum tax labiality by taking advantage of tax incentives, reliefs etc available in the Income Tax Act

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Residential status & Tax liability Terms used in Income tax Residential status of Tax payers, impact of tax for various type of assesses, calculation of taxable income from residence angle,, Income exempt from tax | 4 | CO3 |
| [2] | Income from salary:<br>Computation of income from salary, various allowance and their taxability, perquisites and their valuation | 5 | CO4 |
| [3] | Computation of Agriculture income:<br>Meaning, Methods, examples etc | 4 | CO2 |
| [4] | Computation of Capital gain:<br>Meaning, methods, income under capital gain, computation, tax on capital gain | 4 | CO3 |
| [5] | Income from House Property:<br>Meaning, methods, computation from income of house property | 4 | CO5 |
| [6] | Minimum Alternative Tax (MAT)<br>Meaning, methods, computation of MAT and tax credit | 4 | CO1 |
| [7] | Income from Business and Profession:<br>Nature and problem, practical application of vital sections , various allowance, relief , weighted deduction etc. | 5 | CO2 |
| [8] | Clubbing of income:<br>Computation on tax on clubbing of income, | 4 | CO5 |
| [9] | Set off carry forward of losses:<br>Computation of income after set of losses, deduction from income. | 4 | CO3 |
| [10] | Computation of Tax liability for companies:<br>Meaning, methods, examples | 4 | CO4 |

| | | | |
|---|---|---|---|
| [11] | Interest for late filling of return, and non-payment of advance tax, Advance Tax<br>Computation of tax liability , tax planning by tax avoidance | 4 | CO1 |
| [12] | Tax Planning:<br>Tax Planning from various angles, Project on Tax Planning | 4 | CO2 |
| | | | |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per ACS referencing format)

1. Student guideline to Income Tax by Vinod and Monica Singhania – Taxman
2. Corporate Tax Planning by Vinod and Monica Singhania - Taxman

## D. REFERENCE BOOKS

(The format should be as per ACS referencing format)

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | To understand various provision in Income Tax Act |
| CO2 | Comprehension | How to file return of the income for the different assesse. |
| CO3 | Application | To plan regarding tax liability and also to plan to achieve minimum tax liability by taking advantage of tax incentives, reliefs etc available in the Income Tax Act |
| CO4 | Synthesis | To explore how individual and salaried persons can take the exemption from income. |
| CO5 | Analysis | To understand the basics related to Goods and service tax. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO1 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| CO2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | |
| **CO4** | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 1 | |
| **CO5** | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **..** | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| **Avg** | 2.4 | 2.4 | 2.6 | 2.2 | 2.6 | 2 | 2.4 | 2.2 | 2.4 | 2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.31 |

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Ethics in Business: Business Ethics and Its issues, Moral Development and Moral Reasoning, Arguments for and against Business Ethics, Moral responsibility and Blame.<br>Cases: Business Ethics in Saudi Culture, WorldCom's Whistle-blower, Was National Semiconductor Morally Responsible? Gun Manufacturers and Responsibility.<br>Take Home Cases: Slavery in the Chocolate Industry, Enron's Fall | 4 | CO1 |
| [2] | Ethical Principles in Business: Utilitarianism: Weighing Social Costs and Benefits, Rights and Duties, Justice and Fairness, The Ethics of Care, Integrating Utility, Rights, Justice and Caring, An alternative to Moral Principles: Virtue Ethics, Morality in International Context.<br>Cases: Working for Eli Lilly & Company, Conflict Diamonds, Exxon Mobil, Amerada Hess, and Marathon Oil in Equatorial Guinea.<br>Take Home Cases: Publius, Unocal in Burma | 4 | CO1 |
| [3] | The Business System: Government, Markets, and International Trade: Free Markets and Rights: John Locke, Free Markets and Utility: Adam Smith, Free Trade and Utility: David Ricardo, Marx and Justice: Criticizing Markets and Free Trade, Conclusion: The Mixed Economy, the New Property, and the End of Marxism.<br>Cases: Napster's, Grokster's, and StreamCast's Rovolution, Brian's Franchis,<br>Take Home Cases: GlaxoSmithKline, Bristol-Myers Squibb, and AIDS in Africa, Accolade versus Sega | 4 | CO1 |
| [4] | Ethics in Marketplace: Introduction, Perfect Competition, Monopoly Competition, Oligopolistic Competition, Oligopolies and Public Policy, Cases: Drug Company Monopolies and Profits, Fixing the Computer Memory Market, Oracle and PeopleSoft, Take Home Cases: Playing Monopoly: Microsoft, Archer Daniels Midland and the Friendly Competitors | 4 | CO2 |
| [5] | Ethics and Environment: The dimensions of pollution and Resource Depletion, The Ethics of Pollution Control, The Ethics of Conserving Depletable Resources.<br>Cases: The Aroma of Tacoma, The Auto Companies in China, Exporting Poison Take Home Cases: The Ok Tedi Copper Mine, Gas or Grouse? | 4 | CO3 |
| [6] | The Ethics of Consumer Production and Marketing: Markets and Consumer Protection, The Contract View of Business Firm's Duties to Consumers, The Due Care Theory, The Social Costs View of the Manufacturer's Duties, Advertising Ethics, Consumer Privacy Cases: The Tobacco Companies and Product Safety, Advertising Death? New Balance and the "Made in USA" Label, Take Home Cases: Becton Dickinson and Needle Sticks, The Ford/Firestone Debacle | 4 | CO2 |
| [7] | The Ethics of Job Discrimination:<br>Job Discrimination and Its Nature, Discrimination: Its Extent, Discrimination: Utility, Rights, and Justice, Affirmative Action, Cases: Johnson Controls' Fatal Protection Policy, Wall Street: It's Man's World, | 4 | CO2 |

| | | | |
|---|---|---|---|
| | Peter Oiler and Winn-Dixie Stores, Take Home Cases: Shoulder Kroger Pay for What Ralphs' Employer Did Then? Wal-Mart's Women | | |
| **[8]** | The Individual in the Organization: The Rational Organization, The Employee's Obligations to the Firm, The Firm's Duties to the Employee, The Political Organization, Employee Rights, Organizational Politics, The Caring Organization, Cases: Delivering Pizza, Employment at Will at Howmet Corporation? Swingline Moves, Take Home Cases: Gap's Labor Problems, Who Should Pay? | **4** | CO2 |
| **[9]** | 1. What is Stress? Stress and Burnout, Stimulus-Oriented Approach, Response-Oriented Approach, The Psychodynamic Approach, Stress Tolerance Limit, Burnout, Ancient Indian Concepts, Positive Role of Stress, Stress Potential and the Creative Personality, Stress Potential of the Creative Process, Stress Potential for Creative Managers | **4** | CO4 |
| **[10]** | Organizational Role Stress: The Concept of Role-Stress, Role Space, Role Set, Measurement of Role Stress, Role Space Conflicts, Role Set Conflicts, Correlates of Role Stress, Personal Correlates of Role Stress, Role Stress and Background Factors, Stress and Productivity, Organizational Correlates of Role Stress | **4** | CO5<br>CO4 |
| **[11]** | Coping Styles or Strategies: Coping Strategies: Concept, Coping Management, Coping Profiles of Some Groups | **4** | CO5 |
| **[12]** | Moderators of Stress: Personality Variables, needs as Moderator, Locus of Control as Moderator, Type-A as Moderator, Mental Health as Moderator, Coping Strategies as Moderator and all other variables as moderators | **2** | CO5 |
| **[13]** | Countering Stress: What an Organization Can do, Theory of Job Characteristics Model, Managing Organizational Stress using the Job Characteristic Approach, Issues in Implementing the Job Characteristic Model, A New Strategy using the Job Characteristics Approach to Manage Organizational Stress, Concept of Role Efficacy as a Reducer of Stress, What Individuals can do, Stress: Its perception and consequences, Awareness of being in a stressful state, What happens during a stressful situation, Proneness to Experience stress and its identification, Coping Mechanisms in Indian Managers, Coping Strategies for Role Stresses, Ways to Manage Stress Effectively, Managing the stress through non drugs methods (all), The Spiritual Dimension of Stress | **4** | CO5 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)


1. Velasquez, M. G. (2006). *Business ethics: Concepts & cases*. Pearson Educación.
2. Pestonjee, D. M. (1992). *Stress and coping: The Indian experience*. Sage Publications Ltd.


## D. REFERENCE BOOKS

(The format should be as per APA referencing format)


1. S.K. Chakraborty, *Ethics in Management: Vedantic Perspectives* (New Delhi: Oxford University Press, 1995)

2. Drucker, P. (2012). *Managing in turbulent times*. Routledge.
3. Gandhi, M. (2021). *The story of my experiments with truth: An autobiography*. e-artnow.
4. The Bhagwad Geeta
5. The Holy Bible
6. The Koran

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Increase awareness about real life corporate scandals and ethical reasons behind that at individual, group and system level |
| CO2 | Comprehension | Identify the frameworks that can help deal with real life ethical dilemmas |
| CO3 | Application | Increase the awareness about human rights, environmental ethics, values, gender etc. discrimination |
| CO4 | Synthesis | Create a scientific foundation of stress management |
| CO5 | Analysis | Create awareness about how to deal with the stress experience, including the inputs from the Indian scriptures. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO1 | 2 | 2 | 3 | 1 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | |
| CO2 | 1 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | |
| CO3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | |
| CO4 | 3 | 1 | 1 | 3 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 3 | |
| CO5 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | |
| | | | | | | | | | | | | | | | | | |
| Avg | 2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2.4 | 2.225 |

**MBA SEMESTER – I**
**SUBJECT: FINANCIAL ACCOUNTING FOR MANAGERS**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

To enable students to understand, interpret & analyse Accounting System, Accounting books / records Financial Statements & also understand & decide relevance of accounting information to Managerial Decisions.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Introduction to Accounting, Concepts 'introduction: Fixed/ current Assets, investment, Current / long term liability, Income, Expenditure, Profit, loss, Etc | 4 | CO1 |
| [2] | Balance sheet & related concepts | 4 | CO1<br>CO2<br>CO3 |
| [3] | Profit & loss account & related concept | 4 | CO1<br>CO2<br>CO3 |
| [4] | Smokey Valley café case – Information from main financial statement – Interested parties – Their area of interest Various accounting books & entries made in them | | CO1<br>CO4 |
| [5] | Accounting Mechanics: - Passing of accounting entries | 4 | CO1<br>CO4 |
| [6] | Preparation of trial Balance, Adjustment & closing entries, Making of Manufacturing, Trading profit & loss account & Profit & loss appropriation account, Limitations of the financial statements.<br>Preparation of a limited company's balance sheet & profit & loss account | 4 | CO1<br>CO2<br>CO3<br>CO4 |
| [7] | Case studies for final accounts etc. of Proprietary, Partnership & limited company accounts from Text book & reference books | 4 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| [8] | Bank Reconciliation, Fixed assets, Depreciation methods, Disposing / revaluation of fixed assets, writing of Fixed assets, Deferred revenue expenditure, Capitalization of expenditure | 4 | CO5 |
| [9] | Accounting for transactions involving Foreign currency. Incorporating foreign br. Working results & balance sheet in head office final accounts | 4 | CO1<br>CO2<br>CO5 |
| [10] | Overview Business purchase & Merger Accounting | 4 | CO1<br>CO2 |
| [11] | Case study – Understanding , Analysing and interpreting financial statements | 5 | CO2<br>CO3 |
| [12] | Consolidated Financial Statement | 5 | CO1<br>CO3 |

## C. TEXT BOOKS

- Tulsian, D. P. (2021). *Financial Accounting* (Latest Edition ed.). S Chand.

## D. REFERENCE BOOKS

- Gupta, A. (n.d.). *Financial Accounting for Management* (Latest Edition ed.). Pearson.
- Lalitha, V. R. (n.d.). *Financial Accounting* (Latest Edition ed.). Pearson.
- Shah, P. (n.d.). *Financial Accounting for Management* (Latest Edition ed.). Oxford.
- Swami, R. N. (n.d.). *Financial Accounting- A Managerial Perspective* (Latest ed.). PHI.

## E. COURSE OUTCOMES

| CO No. | Skills | Statement |
|---|---|---|
| CO1 | Evaluate | Demonstrate accounting concepts and conventions and their implications on the accounting system. Create financial statements of sole proprietorship including Consolidated and standalone. |
| CO2 | Comprehension | Present financial statements according to the provisions of the Indian Companies Act. Analyse financial statements and apply comparative and common size techniques. |
| CO3 | Application | Analyse financial statements and apply various ratios to and interpret the company's financial performance. |
| CO4 | Synthesis | Demonstrate various accounting standards and Explain the concept of IFRS |
| CO5 | Analysis | Differentiate between funds flow statements and cash flow statements. Analyse funds flow statement and cash flow statement according to accounting standard 3 along with Bank Reconciliation, Fixed assets, Depreciation methods, Disposing / revaluation of fixed assets, writing of Fixed assets, Deferred revenue expenditure, Capitalization of expenditure |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 |
| CO 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 0 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 |
| CO 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| CO 4 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 0 |
| CO 5 | 2 | 2 | 3 | 2 | 3 | 0 | 0 | 3 | 2 | 3 | 2 | 2 | 0 | 3 | 3 | 3 |
| Avg | 2.4 | 2.4 | 2.8 | 2.2 | 2.2 | 2.4 | 2.2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.2 | 2.6 | 2.4 | 2.2 |

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Introduction to Financial Management: This chapter lays down the conceptual framework for financial decision making in a "for-profit" business setting. The goals of business organization, the decision areas in financial management, the issues of multiplicity of stakeholders and related conflicts of interest in a typical corporate set up, etc., issues will be discussed | 3 | CO2 |
| [2] | Time Value of Money: The application of time value of money is an invaluable tool in financial analysis. The applications range from personal finance areas to corporate finance such as capital budgeting, valuation and risk management' | 3 | CO1 |
| [3] | Valuation of Bonds and Stocks: It is divided in to five sections and deals with Bond Valuation and Bond Yields, Equity and Preference Share Valuation and E/P Ratio, Growth etc. | 3 | CO1 |
| [4] | Risk and Return: It is organized in to two sections discussing Risk and return of a single assets and portfolio, measurement of market risk and relationship between risk and return | 3 | CO5 |
| [5] | Risk and Return- Extension (portfolio management of two securities: Portfolio Risk and return, beta, alpha, diversification | 3 | CO2 |
| [6] | Cost of Capital: It focuses on cost of different sources of financing and eventually the overall cost of capital that acts as a hurdle rate or discount rate in the investment appraisal models. WACC, MACC | 3 | CO2 |
| [7] | Capital Budgeting: This Chapter deals with the conceptual framework and decisions criteria for the long-term investment decisions. The basic issues in capital budgeting like cash flow estimation and appraisal techniques for investment decisions will be discussed. NPV, IRR, PBP, BCR, MIRR, DPBP | 2 | CO1 |
| [8] | Leverage: This chapter is aimed at providing insights in to Operating leverage, financial leverage and combined leverage | 3 | CO5 |
| [9] | Capital Structure Theory: This chapter lays down the theoretical foundations of the capital structure that find their application in designing of capital structure. The crucial issue of determining the optimal capital structure will be addressed. NI, NOI, Traditional, M&M Approach | 2 | CO3 |
| [10] | Sources of Long term funds: It discusses the long term sources of finance like equity, bonds, debenture, preference share, internal accruals, term loans etc. | 2 | CO3 |
| [11] | Raising Long Term Funds: It is divided in to eight sections like venture capital, initial public offer, rights issues, private placements, preferential allotment, dilution etc. | 2 | CO2 |
| [12] | Dividend Policy and Dividend Decision: Gordon model, Walter Model, M&M Model | 3 | C05 |
| [13] | Introduction to Working Capital Management: This chapter introduces working capital management and concerns with decisions relating to | 3 | C04 |

| | | | |
|---|---|---|---|
| | current assets and current liabilities., Operating Cycle and cash cycle, Cash requirement for working capital | | |
| [14] | Working Capital Financing: It deals with the sources of finance that are used to support current assets like Accruals, Trade Credit, commercial papers etc., Tandon Committee, Chore Committee, MPBF | 3 | C04 |
| [15] | Cash Management: Cash Budgeting, Long term cash forecasting, optimal cash balance etc. Cash Budgeting, Optimal Cash Balance, Miller and Ore Model, Baumol Model, Cash Collection and Disbursement | 3 | C04 |
| [16] | Credit Management: Terms of Payment, Credit Policy Variables, Credit Evaluation, and Credit Granting decision. | 3 | CO3 |
| [17] | Inventory Management: Order Point, Need for inventories, EOQ model, criteria for judging inventory system, Safety Stock. Lead time | 3 | C04 |
| [18] | Cases (5 to 6) on time value of money, leverage, cash flow and others | 3 | CO2 |
| | | | |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per ACS referencing format)

1. Pandey I M, "*Financial Management*", 10th edition, Vikas Publication, New Delhi

## D. REFERENCE BOOKS

(The format should be as per ACS referencing format)

1. Van horne, *"Fundamentals of Financial Management",* Pearson Education, 11th ed.
2. Brigham, *"Financial Management"*, Cengage Publication
3. Kewown, J.Arthur, Martin, John, Petty, William, and Scott David, *"Financial Management: Principles and Applications"*,10th Ed. Pearson.
4. Chandra Prassanna, *"Financial Management"*, 10th Edition, TMH, New Delhi

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Demonstrate role of financial management in business corporations, Knowledge of the value of money overtime, its utility and trade off between risk and return. |
| CO2 | Comprehension | Construct and Compare the various capital budgeting techniques and risk in capital budgeting. |
| CO3 | Application | Distinguish between equity, debt and preference capital. |

| | | |
|---|---|---|
| | | Determine capital structure using EBIT –EPS analysis. Calculate specific cost of capital and weighted average cost of capital. |
| **CO4** | Synthesis | Demonstrate the concept of working capital and sources of working capital finance. Determine working capital estimation and EOQ levels, Plan cash management, inventory management. |
| **CO5** | Analysis | Differentiate between relevance and irrelevance theory of dividends. Calculate value of the firm using Walter's Model, Gordon's Model and MM Hypothesis |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 3 | 3 | |
| **CO2** | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | |
| **CO3** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 1 | |
| **CO4** | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | |
| **CO5** | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| **..** | | | | | | | | | | | | | | | | | |
| **Avg** | 2.4 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.4 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.2 | 2.4 | 2.4 | 2 | 2.3 |

## MBA SEMESTER – II
## SUBJECT: HUMAN RESOURCE MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

To acquaint students to the various facts of managing people and to create an understanding of the various practices and policies of Human Resource Management. The course also aims to help the students to understand and learn the concepts required for utilization and development of Human Resources.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **Introduction to HRM:** What is HRM and why is it important? The Trends Shaping Human Resource Management | 3 | CO1 |
| [2] | **Employment Law in India and United States:** Labor Legislations in India Equal Employment Opportunity in the United States 1964-1991 Equal Employment Opportunity 1990-91 Present Equal Employment Opportunity in the United States 1964-1991 Equal Employment Opportunity 1990-91-Present Defenses Against Discrimination Allegations Illustrative Discriminatory Employment Practices EEOC Enforcement Process Diversity Management and Affirmative Action Programmes | 3 | CO1<br>CO5 |
| [3] | **The Manager's Role in Strategic HRM:** Why Strategic Management Planning is Important to All Managers Fundamentals of Management Planning the Strategic Management Process Strategic Human Resource management HRD Scorecard Developed by TVRLS, India Building Your Own High Performance Work Systems | 2 | CO1 |
| [4] | **Job Analysis**: The Basics of Job Analysis Methods for Collecting Job Analysis Information Writing Job Descriptions Writing Job Specifications Job Analysis in a Worker-Empowered World | 3 | CO1 |
| [5] | **Human Resource Planning and Recruiting:** Planning and Forecasting the Need for Effective Recruiting a More Diverse Workforce Developing and Using Application Forms | 3 | CO2 |
| [6] | **Employee Testing and Selection:** Basic Testing Concepts Types of Tests Work Samples and Simulations Background Investigations and Other Selection Methods | 3 | CO2 |

| | | | |
|---|---|---|---|
| [7] | **Interviewing Candidates:** Basic Types of Interviews,What errors can undermine an interview's usefulness, How to design and conduct interviews | **3** | CO2 |
| [8] | **Training and Developing Employees:** Introduction to Orientation and Training Programmes Analyzing Training Needs and Designing the Programmes Implementing the Training Programme Implementing Management Development Programmes Managing the Organizational 3Change Programme Evaluating the Training Report | **3** | CO4 |
| [9] | **Performance Management and Appraisal:** Basic Concepts in Performance Management and Appraisal Dealing with Performance Appraisal Problems the Appraisal Interview Performance Management | **3** | CO2 |
| [10] | **Coaching, Careers, and Talent Management:** Improving your Coaching Skills Career Management Basics Career Management Methods Employee Life-Cycle Career Management Talent Management | **3** | CO4 |
| [11] | **Establishing Strategic Pay Plans:** Basic Factors in Determining Pay Rates Establishing Pay Rates Pricing Managerial and Professional Jobs Competency-Based Pay Special Topics in Compensation. | **3** | CO4 |
| [12] | **Pay Performance and Financial Incentives:** Money and Motivation Individual Employee Incentive and Recognition Programs Incentives for Sales People Incentives for Managers and Executives Team and Organization Wide Incentive Plans Designing the Effective Incentive Programs | **3** | CO4 |
| [13] | **Benefits and Services:** The Benefits Picture Today Pay for Time Not Worked Insurance Benefits Retirement Benefits Personal Services and Family-Friendly Benefits Flexible Benefits Programmes. | **3** | CO4 |
| [14] | **Ethics, Justice, and Fair Treatment in HR Management:** Ethics and Fair Treatment at Work What Determines Ethical Behaviour at Work? How Managers Use Personnel Methods to Promote Ethics and Fair Treatment Managing Employee Discipline and Privacy Managing Dismissals | **3** | CO5 |
| [15] | **Labor Relations and Collective Bargaining**: The Labor Movement Unions and The Law, The Collective Bargaining Process Grievances, The Union Movement Today and Tomorrow | **3** | CO2 |
| [16] | **Managing Global Human Resources:** HR and The Internationalization of Business Staffing the Global Organizations Training and Maintenance Expatriate Employees How to Implement Global HR Systems | **3** | CO2, CO3 |
| [17] | **Managing Human Resource in Entrepreneurial Firm:** The Small Business: Using Internet and Government Tools to Support the HR Effort Leveraging Small Size: Familiarity, Flexibility, Informality and HRM Using Professional Employee Organizations Managing HR Systems, Procedures and Paperwork | **3** | CO1 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

1. Garry Dessler, "Fundamentals of Human Resources Management", (Edinburgh: Pearson, 3rd Edition, 2014)

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

1. Sinha, P. R. N., Sinha, I. B., & Shekhar, S. P. (2017). *Industrial Relations, Trade Unions and Labour Legislation*. Pearson Education India.
2. Srivastava, S. C. (2012). *Industrial Relations and Labour Laws*. Vikas Publishing House.
**3.** Armstrong, M. (2003). A Handbook of Human Resource Management Practices, Kogan Page Limited.
4. Mello, J. A. (2014). *Strategic human resource management*. Cengage Learning.
**5.** Bailey, C., Mankin, D., Kelliher, C., & Garavan, T. (2018). *Strategic human resource management*. Oxford University Press.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Explain various concepts, theories and issues needing attention in Human Resources Management. |
| CO2 | Comprehension | Demonstrate, interpret, predict and organise the process of procurement of Human Resources. |
| CO3 | Application | Define, outline, and determine key elements of Human Resource Development and Assessment. |
| CO4 | Synthesis | To distinguish methods for designing relative worth of jobs through better reward management. |
| CO5 | Analysis | To display the importance of Ethics in Business and how HRM plays a critical role in it. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO1 | 1 | 2 | 2 | 1 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 2 | 2 | |
| CO2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | |
| CO3 | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 3 | 3 | 2 | 2 | 2 | 3 | |
| CO4 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO5** | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | |
| | | | | | | | | | | | | | | | | | |
| **Avg** | 2.2 | 2 | 2.2 | 2.2 | 2.4 | 2.2 | 2 | 2 | 2 | 2.2 | 2.4 | 2.2 | 2.2 | 2.4 | 2.2 | 2.2 | 2.1875 |

## MBA SEMESTER – II
## SUBJECT: INDIAN BUSINESS ENVIRONMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This course intends to create an understanding of the Political, Economical, Social, Technological, Cultural, Legal, Governmental, Global environments and their implications on the businesses at Macro as well at Micro Levels. After studying this course, the students will be able to develop a strategic thinking and how these forces affect the strategy making into the business in real life.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **An over view of Business Environment:** Types of environment; Internal environment, External environment; Micro environment; Macro environment; Competitive structure of industries; Competitor analysis; Environmental analysis and strategic management | 2 | CO2<br>CO3<br>CO5 |
| [2] | **Environmental Analysis and Forecasting:** Techniques for environmental analysis; Steps in environmental analysis; Types of environmental forecasting; Techniques for environmental forecasting; Benefits / importance of environmental analysis; Limitations of environmental Forecasting | 2 | CO2<br>CO3<br>CO5 |
| [3] | **Economic Environment Nature of the economy:** Structure of the economy; Economic policies; Economic conditions | 2 | CO4 |
| [4] | **Political and Government Environment:** Functions of State; Economic roles of government; Government and legal environment; Economic Roles of Government in India; The Constitutional Environment | 2 | CO4 |
| [5] | **Natural and Technological Environment**: Natural environment; Tech environment; Innovation; Technological leadership and follower ship; Technology and competitive advantage; Sources of Technological Dynamics; Time lags in technology. Introduction/Absorption; Appropriate Tech and Tech Adaptation; impact of tech on globalization; IT and Marketing; Transfer of Technology | 2 | CO4 |
| [6] | **Demographic Environment:** Population size; Falling birth rate and changing age structure; Migration and ethnic aspects | 2 | CO4 |
| [7] | **Societal Environment**: Business and society; Objectives and importance of business; Professionalization; Business ethics; Business and Culture; Religion; Language; Culture and OB; Other Social / cultural factors; Technological development and social change | 2 | CO4 |
| [8] | **Social Responsibility of Business Classical and contemporary views:** Social orientation of business; Factors affecting social orientation; Responsibilities to different sections; The Indian situation; Arguments for and against social involvement; Social audit. | 2 | CO4 |

| | | | |
|---|---|---|---|
| [9] | **Industrial Policy:** Industrial policy up to 1991; The new industrial policy; An evaluation of the new policy | **2** | CO4 |
| [10] | **IDRA and Industrial Licensing Industries (Development and Regulation) Act:** Industrial licensing; The new policy | **2** | CO1 |
| [11] | **Public, Private, Joint and Co-operative Sectors Public sector:** Growth and performance of public sector; The new public sector policy; Organization of public enterprises | **2** | CO1 |
| [12] | **Government Environment Government and parliamentary control over public enterprises:** Pricing policy in public enterprises; Department of Public Enterprises; Nationalization; Private sector; Joint sector; The concept of national sector; Cooperative sector | **2** | CO4 |
| [13] | **Privatization and Disinvestments:** Expansion of public sector and its defects; Privatization reaction; Ways of privatization; Obstacles; Conditions for success of privatization; Benefits of Privatization; Arguments against privatization; sins and pitfalls of privatization; Rangarajan Committee and Disinvestments; Privatization in India | **2** | CO1 |
| [14] | **Village and Small Industries**: The VSI sector; Definitions; SMEs in other countries; Importance; Development of VSI under the Plans; Promotional measures; Institutional support structure; State industrial policies; Khadi and village industries; Ancillary industries; Drawbacks and problems | **2** | CO4 |
| [15] | **Industrial Sickness Definition:** Magnitude; Causes of sickness; Preventive and curative measures; Sick Industrial Companies Act | **1** | CO4 |
| [16] | **Price and Distribution Controls:** Objectives of price and distribution controls; Price policy in India; Price controls; Indirect controls; Direct controls; Administered prices; Dual pricing; Subsidization; (The gist of) Essential Commodities Act; Other laws to control production, distribution and prices (list only); The public distribution system | **2** | CO2 |
| [17] | **Competition Policy and Law Competition policy and law:** Nature and Scope; Government policies and distortions to competition; Interface of FDI and competition law; Pre-requisites for a competition policy; Contours of competition law; Annexure to chapter on MRTP Act | **2** | CO2 |
| [18] | **Stock Exchange and its Regulations Meaning:** Importance and functions; Dealings on stock exchange; Speculation on stock exchange; Organization of stock exchanges in India; OTCEI; National Stock Exchange of India; Stock Holding Corporation of India; Regulation of stock exchanges – Securities Contracts (Regulation) Act; SEBI; Capital market reforms and developments | **2** | CO1 |
| [19] | **Industrial Finance Short-term finance:** Medium term finance; Long term finance; Ownership securities; Creditorship securities; New issues – marketing of securities; Underwriting of securities; Internal financing (ploughing back of profits); Public deposits; Commercial banks | **2** | CO1 |
| [20] | **Industrial Financial Institutions:** Types of institutions; Types of assistance; IDBI; IFCI; ICICI; Industrial Investment Bank of India; Discount and Finance House of India; State Financial Corporations; State Industrial Development / Investment Corporations; Investment Institutions; Institutions for small industry; Commercial banks | **2** | CO1 |

| | | | |
|---|---|---|---|
| [21] | **Planning in India**: The Planning Commission; The NDC; State plans; Formulation of the Plan; Performance Industrial Development Strategy Salient features of industrial planning and development; Capital goods vs. consumer goods; Roles of public and private sectors; Village and small industries; Comparative cost dynamics; Import substitution and export contribution; Capacity utilization; Regional disparities; An evaluation Planning and Development of Agriculture Phases of development; Expansion and development of inputs and services; Agricultural marketing; Agricultural price policy; Commodity exchange | **2** | CO1 |
| [22] | **GATT/WTO and Global Liberalization** Objectives; An evaluation of GATT; The Uruguay Round Agreement; GATT and WTO; Functions of WTO; Salient features of UR agreement; GATS; TRIMS; TRIPS; Evaluation of the Uruguay Round; UR agreement and developing countries; Implementation issues; UR agreement and India; Annexure to the chapter on the Doha Declaration | **2** | CO4 |
| [23] | **International Investments Significance of foreign investment:** Trade and investment; Types of foreign investment; Factors affecting international investment; Growth of foreign investment; Dispersion of FDI; Portfolio investments; Cross-border M&As; Foreign investment in India; Foreign investment by Indian companies | **2** | CO1 |
| [24] | **Multinational Corporations:** Definition and meaning; Organizational models; Dominance of MNCs; MNCs and international trade; Merits of MNCs; Demerits; Perspectives; Codes of conduct; Multinationals in India | **2** | CO4 |
| [25] | **Globalization:** Globalization of world economy; Globalization of business; Meaning and dimensions; Features of current globalization; Globalization stages; Essential conditions for globalization; Foreign market entry strategies; Pros and cons of globalization; Policy options; Globalization of Indian business | **1** | CO4 |
| [26] | **Development and Regulation of Foreign Trade:** Regulation of foreign trade; Foreign Trade (Development and Regulation) Act; Export Import policy; Export promotion; Organizational setup; Production assistance; Marketing assistance; EPZs, EOUs, TPs and SEZs; Export houses and trading houses; An evaluation | **2** | CO1 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)


1. Cherunilam, F. (2022). *Business environment: Text and cases*. Himalaya Publishing House.


## D. REFERENCE BOOKS

(The format should be as per APA referencing format)


1. Paul, J. (2010). *Buss. Environment*. Tata McGraw-Hill Education.
2. Fernando, A. C. (2011). *Business environment*. Pearson Education India.
3. Worthington, I., & Britton, C. (2009). *The business environment*. Pearson education.

4. Ahmed, F., & Alam, M. A. (2021). *Business Environment: Indian and Global Perspective*. PHI Learning Pvt. Ltd..

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Make them aware of basics of the financial system of India |
| CO2 | Comprehension | To make the students aware about fundamentals of Business Environment |
| CO3 | Application | Teach them the ways of planning the scenarios |
| CO4 | Synthesis | Help them understand effects of constitutional environment, technological environment, cultural environment, economic environment on business |
| CO5 | Analysis | Help them comprehend the effects of SWOT on organization's strategy |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO1 | 2 | 2 | 2 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | |
| CO2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 1 | |
| CO3 | 3 | 2 | 1 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 2 | 2 | 3 | |
| CO4 | 2 | 2 | 3 | 2 | 3 | 1 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 1 | 3 | 2 | |
| CO5 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | |
| | | | | | | | | | | | | | | | | | |
| Avg | 2.2 | 2.4 | 2.2 | 2.2 | 2.4 | 2 | 2 | 2.2 | 2.4 | 2.4 | 2 | 2.4 | 2.2 | 2.2 | 2.4 | 2 | 2.225 |

## MBA. SEMESTER – IV

## SUBJECT: INTERNATIONAL FINANCIAL MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

The course acquaints students with notions of foreign exchange market, exchange rate determination and hedging techniques. It leads them in to discussion of management of foreign exchange risk and exposure by applying different tools of derivatives.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Foundation for International Financial Management: Globalization and Multinational Firm- Dimensions of International finance, Trends in globalization of the world economy; International Monetary System - - Evolution of the International Monetary System, Current exchange rate arrangements, Fixed vs. Flexible Exchange rate regimes; Balance of Payments- Balance of Payments Accounts and Identity | 3 | CO1 |
| [2] | The Foreign Exchange Market, Exchange Rate Determination and Currency Derivatives: The Market for Foreign Exchange – Function and structure of FX Market, FX Market participants, The Spot Market- spot rate quotations, Bid- Ask spread, Cross rate quotations, Triangular Arbitrage, The Forward Market – Forward Rate quotations, Forward cross exchange rates, Forward Premium/Discount | 3 | CO2 |
| [3] | International Parity Relationships and Forecasting Foreign Exchange Rates – Interest rate Parity, Purchasing Power Parity, Fisher Effects | 3 | CO2 |
| [4] | Futures and Options on Foreign Exchange- Futures Contracts & Currency Futures Market, Options Contracts & Currency Options Markets | 3 | CO3 |
| [5] | World Financial Markets: International Banking and Money Market – International Banking services, Reasons for International Banking, Types of International Banking offices, Capital Adequacy Standards, International Money market | 2 | CO1 CO4 |
| [6] | International Bond Market – The world's bond markets, Foreign bonds and Eurobonds, Types of instruments, International Bond market credit ratings | 2 | CO1 CO4 |
| [7] | International Equity Markets- Market Structure and Trading practices, International Equity Market Benchmarks, Trading in international | 2 | CO1 CO4 |

| | | | |
|---|---|---|---|
| | equities- Cross listing of shares, Yankee stock offerings, The European stock market, ADR, GDR | | |
| [8] | Interest rate and Currency Swaps- Types of swaps, Swap market quotations, Interest and Currency swaps, Risk of Interest rate and currency swaps | 3 | CO3 |
| [9] | Foreign Exchange Exposure and Management: Management of Transaction Exposure – Types of exposure, Hedging Foreign Currency Receivables and Payables by Forward market hedge, Money Market hedge and Options market hedge | 4 | CO3 |
| [10] | Management of Economic Exposure- Measuring Economic Exposure, operating exposure- Meaning and Determinants, Managing operating exposure | 3 | CO3 |
| [11] | Management of Translation Exposure- Translation Methods, FASB 52, Management of translation exposure | 2 | CO3 |
| [12] | Financial Management of Multinational Firm: Foreign Direct Investment and Cross-Border Acquisitions- Global trends in FDI, Reasons to invest overseas, Cross border mergers and acquisitions, Political risk and FDI; Multinational Cash Management- The management of international cash balances, Netting systems, Centralized vs. decentralized cash management | 3 | CO1<br>CO2 |
| [13] | Foreign Trade Contracts and Procedures: Incoterms | 3 | CO5 |
| [14] | Letter of Credit – Meaning, Mechanism and Advantages, Types of Letter of Credit; Operation of a Letter of Credit- Salient Features, Responsibilities and Liabilities of parties | 3 | CO5 |
| [15] | Finance of Foreign Trade: Financing Exports- Packing Credit Advance, Pre-shipment Credit in Foreign Currency, Advances against duty drawback, Other services to Exporters | 3 | CO5 |
| [16] | Project Exports and Investments Abroad- Financing of Project Exports, Export of Services, Export Guarantees, Indian Investments Abroad | 3 | CO5 |
| [17] | Export Import Bank of India – Lending to Indian Exporters, Lending to Foreign Government, Companies, Loans to Commercial Banks in India, Non-Lending Services | 3 | CO5 |
| [18] | Financing Imports- Trade regulations, Exchange control regulations, opening a Letter of credit, Payment of Import bills, Import Trust Receipt | 2 | CO5 |

## C. TEXT BOOKS

1. Eun & Resnick, "*International Financial Management*", Tata McGraw Hill, Latest edition

## D. REFERENCE BOOKS

1. C. Jeevanandam, "*Foreign Exchange & Risk Management*", Sultan Chand, Latest edition
2. Shapiro, "*Multinational Financial Management*", Tata McGraw Hill, Latest edition
3. P.G. Apte, "*International Financial Management*", Tata McGraw Hill, Latest edition

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Describe the integration of international financial markets and analyse implications for financial managers |
| CO2 | Synthesis | Forecast exchange rates by evaluating operations of foreign exchange rate markets and international parity relationships. |
| CO3 | Application | Identify and hedge the risks and exposures by applying different tools of derivatives in the international financial markets. |
| CO4 | Comprehension | Describe and analyse differences across international equity and debt markets |
| CO5 | Analysis | Identify the documentation, processes and instruments used in the financing of international trade. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | |
| CO2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | |
| CO3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | |
| CO4 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | |
| CO5 | 2 | 1 | 2 | 1 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 2 | 1 | |
| .. | | | | | | | | | | | | | | | | | |
| Avg | 2.4 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.4 | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2.4 | 2.2 | |

## MBA Semester III

## SUBJECT: INDIAN FINANCIAL SYSTEMS

| Teaching Scheme (Hours/Week) | | | | Credit | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | s | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

### A. COURSE OVERVIEW

To enable the students to understand the working of Indian Financial System as a whole. To provide an insight into the quality and range of the package of the financial services largely provided by the non-banking financial companies.

### B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Introduction of Financial System | 3 | CO2 |
| [2] | Non-Banking Financial Companies | 3 | CO1 |
| [3] | Factoring and Forfeiting | 2 | CO3 |
| [4] | Hire Purchase Finance and Consumer | 2 | CO5 |
| [5] | Theoretical and Regulatory Framework of Leasing | 2 | CO5 |
| [6] | Accounting/Reporting Framework and Taxation of Leasing | 2 | CO2 |
| [7] | Housing Finance | 2 | CO4 |
| [8] | Bills Discounting | 3 | CO3 |
| [9] | Venture Capital Financing | 3 | CO4 |
| [10] | Issue Management: Intermediaries | 3 | CO1 |
| [11] | Issue Management: Pre-Issue and Post Issue Obligations and Other Requirements | 3 | CO1 |
| [12] | Capital Market | 2 | CO3 |
| [13] | The Primary Market | 2 | CO3 |
| [14] | The Secondary Market | 2 | CO3 |
| [15] | Depositories and Custodians | 2 | CO4 |

| | | | |
|---|---|---|---|
| [16] | The Debt Market | 3 | CO2 |
| [17] | Stock Broking | 3 | CO1 |
| [18] | Money Market | 2 | CO3 |
| [19] | Credit Rating | 2 | CO5 |
| [20] | Insurance Services | 2 | CO4 |
| [21] | Mutual Funds | 2 | CO4 |
| | | | |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per ACS referencing format)

1. Financial Services, 4th edition, M Y Khan, Tata McGraw Hill
2. Indian Financial System, 2nd (Second) edition, Bharti V Pathak, Pearson Education
3. Indian Financial System, 4th (Fourth) edition, M Y Khan, Tata McGraw Hill

## D. REFERENCE BOOKS

(The format should be as per ACS referencing format)

1. Indian Financial System, 4th (Fourth) edition, M Y Khan, Tata McGraw Hill
2. Indian Financial System, 2nd (Second) edition, H R Machiraju, Vikas Publishing House
3. Financial Institutions and Markets, Meir Khon, Tata McGraw Hill
4. Financial services and System, Dr. S Gurusamy, Vijay Nicole Pvt. Ltd.
5. Business Standard, Economic Times, Business India, Economic Survey Report, RBI Bulletin, other finance related magazines

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Determine Indian Financial System and its Components. |
| CO2 | Comprehension | classify financial services offered in India |
| CO3 | Application | Assess primary and secondary markets in India |
| CO4 | Synthesis | Identify services and role of Merchant Bankers in India. |
| CO5 | Analysis | Infer credit rating agencies in India and express factoring in India. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| CO2 | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | |
| CO4 | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | |
| CO5 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| .. | | | | | | | | | | | | | | | | | |
| Avg | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2.4 | 2.2 | 2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.4 | 2.26 |

## MBA SEMESTER – IV
## SUBJECT: INTERNATIONAL MARKETING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- To make the students understanding the Marketing knowledge at Global Level.
- To make the students to learn International Marketing concepts.
- To make students ready to serve in the International Market.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Nature of International Marketing: Challenges and Opportunities<br>Marketing Illustration, Process of International Marketing, International Dimension of Marketing, Domestic Marketing versus International Marketing, The applicability of Marketing. | 2.5 | CO1 |
| [2] | Trade Theories and Economic Development:<br>Basis for International trade, Exchange ratio, trade, and gain, Systematic Planning to Determine export Opportunities. | 2.5 | CO1 |
| [3] | Trade Distortion and Marketing Barriers<br>Protection of Local Industries, Marketing Barriers, WTO. | 2.5 | CO1 |
| [4] | Political Environment:<br>Multiplicity of Political Environment, Measure to Minimize Political Risk. | 2.5 | CO1 |
| [5] | Legal Environment:<br>Legal system, Intellectual Property and Gray Market. | 2.5 | CO1 |
| [6] | Culture:<br>Culture, Influence of Culture, Different countries culture. | 2.5 | CO1 |
| [7] | Consumer Behavior in the International Context: Psychological and Social Dimension, Perspective on consumer behavior, Diffusion Process of Innovations. | 2.5 | CO2 |
| [8] | Marketing Research and Information System:<br>Nature of Marketing Research, MIS, Basic method of Data Collection, Measurement scale. | 2.5 | CO2 |

| | | | |
|---|---|---|---|
| [9] | Market Analysis and Foreign Market Entry Strategies :<br>Market Analysis, Strategic Alliances, free trade zones. | **2.5** | CO3 |
| [10] | Product Strategies: Basic Decision and Product Planning<br>Product, Theory of International Product Life cycle, A move toward world Product | **2.5** | CO3 |
| [11] | Product Strategies Branding and Packaging Decision<br>Branding Decision, Branding levels and Alternatives, Brand Consolidation, Brand Origin and Selection, Brand Characteristics, Brand Protection, Packaging: Functions and Criteria. | **2.5** | CO4 |
| [12] | Distribution Strategies: Channel of distribution<br>Direct and Indirect selling channels, types of intermediaries: Direct channel, Determinants of channel types. | **2.5** | CO5 |
| [13] | Distribution Strategies: Physical Distribution and Documentation<br>Modes of Transportation, Documentation. | **2.5** | CO5 |
| [14] | Promotion strategies: Personal Selling, Publicity, and Sales Promotion<br>Promotion and Communication Sales Promotion. | **2.5** | CO4 |
| [15] | Promotion strategies: Advertising<br>Role of advertising, Standardized International Advertising | **2.5** | CO3 |
| [16] | Pricing Strategic: Basic Decision<br>The Role of Price, Dumping, Transfer Pricing | **2.5** | CO4 |
| [17] | Pricing Strategic: Terms of sale and Payment<br>The Role of Price, Dumping, Transfer Pricing | **2.5** | CO5 |
| [18] | Sources of Financing and International Money Markets<br>Nonfinancial Institution, Financial centers | **2.5** | CO4 |
| [19] | Currencies and Foreign Exchange<br>Money, Foreign exchange, Exchange rate systems, Evaluation of floating rates, financial Implication and strategies | **2.5** | CO3 |
| [20] | Group Presentation | **2.5** | CO2 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

Onkvisit S and Shaw J. International Marketing: Analysis and Strategy, 3rd ed., Pearson India, 2006.

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)


- Keegan W J and Bhargava N K. Global Marketing Management, 8th ed., Pearson India, 2017
- Lee K and Carter S. Global Marketing Management, 3rd ed., Oxford, 2012.


## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | To distinguish related concept, perspectives, drivers and environment of International business |
| CO2 | Comprehension | To identify, distinguish and interpret global business integration ant national and global level |
| CO3 | Application | To define, outline and analyse global entry strategies |
| CO4 | Synthesis | To identify e-enablers of business |
| CO5 | Analysis | To identify functional resources useful for international business |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO1 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | |
| CO2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | |
| CO3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | |
| CO4 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 3 | 1 | 2 | 1 | 1 | 3 | 3 | |
| CO5 | 2 | 2 | 3 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 1 | 3 | 2 | 2 | 2 | |
| | | | | | | | | | | | | | | | | | |
| Avg | 2.4 | 2.4 | 2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.2 | 2 | 2.4 | 2.4 | 2.6 | 2.6 | 2.3 |

**MBA SEMESTER – III**

**SUBJECT : INDUSTRIAL AND SERVICE MARKETING**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- To develop insights into latest inclination in the service sector and to understand the significance of marketing and management of services, and to face highest challenges in any service related organization.
- To develop insights into emerging trends in the Industrial marketing and tackle issues in the marketing of Industrial goods.

| S.No | Course Contents | L+T (hrs) | COs |
|---|---|---|---|
| 1 | Define Business Marketing in the new era<br>Business Marketing Environment<br>Text, Chapter 1 for concepts of interest, *read* Chapter 2 thoroughly<br>Case: Cumberland Metals, Engineered Products Division, 1980 Case | 2.5 | CO4 |
| 2 | The Organization as a customer<br>Organizational buying behavior<br>Text Chapter 3<br>Case - e-Procurement at Cathay Pacific Airways: e-Business Valuation Case | 2.5 | CO 4 |
| 3 | Scanning the Business Environment and Gathering Information<br>Business Market Segmentation, Targeting and Positioning<br>Text Chapter 4<br>Case -The Peppers and Rogers Group Case | 2.5 | CO 4 |
| 4 | Product Strategy<br>Text Chapter 5<br>Case: Signode Industries, Inc. (A) Case | 2.5 | CO 4 |
| 5 | Innovation and New Product Development<br>Developing Pricing Strategies<br>Text Chapter 6<br>Case: Millipore Corporate Strategy Case | 2.5 | CO 4 |
| 6 | Business Marketing Channel and Logistic<br>Text Chapter 7 | 2.5 | CO 5 |

| | | | |
|---|---|---|---|
| | Case: WESCO Distribution Case | | |
| 7 | Integrated Marketing Communication<br>Text Chapter 8<br>Case: KONE: The MonoSpace Launch in Germany Case | 2.5 | CO5 |
| 8 | Brand Building in Business Market<br>Text Chapter 9<br>Case: Zucamore, S.A.—Global Competition in Argentina Case | 2.5 | CO5 |
| 9 | Managing the Sales Force<br>Text Chapter 10<br>Case: CMR Enterprises, Inc. Case | 2.5 | CO5 |

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Introduction to services marketing:<br>Service Dominate the modern economy, Services pose distinctive Marketing Challenges, Important Differences exist among services, Marketing must be integrated with other functions, services success requires a focus on both customer and competitive markets and conclusion. | **1.5** | CO1 |
| [2] | Consumer behaviour in service encounters:<br>Customer interact with service operations, the purchase process for services involves multiple steps, customers have needs and expectations, customers may find it difficult to evaluate services, a services business is a system and conclusion. | **1.5** | CO1 |
| [3] | Positioning Services in Competitive Markets:<br>Focus underlies the search for competitive advantage, Market Segmentation forms the basis for focused strategies, Positioning distinguishes a brand from its competitors, Conduct internal, market and competitors analyses, Use positioning maps to plot competitive strategy, Competitive positioning can be changed and conclusion. | **1.5** | CO1 |
| [4] | Creating the services product:<br>Planning and creating services, Identifying and Classifying Supplementary services, Planning and Branding services Products, New services development and Conclusion. | **1.5** | CO1 |
| [5] | Designing the communication mix for services:<br>Communication plays a key role in marketing, Communicating services presents both challenges and opportunities, Set Clear Objectives for Marketing communication, The Marketing Communication Mix, Branding and Communications, Marketing Communication and the Internet and conclusion. | **1.5** | CO1 |
| [6] | Pricing and Revenue Management:<br>Effective Pricing is central to financial success, Objectives and foundation for setting prices, cost based pricing , value based pricing, competitions based pricing, Revenue management, Ethical concern and perceived | **1.5** | CO2 |

| | | | |
|---|---|---|---|
| | fairness of pricing policies, Putting services Pricing into practice and conclusion. | | |
| [7] | Distributing services:<br>Distribution in a services context, the type of contact: options for services delivery, Decision about place and time, Services delivery in cyberspace, the role of intermediaries, Internationally Distributed services and Conclusion. | **1.5** | CO2 |
| [8] | Designing and Managing Services Processes:<br>Blueprinting Services to create valued experiences and productive operations, Service Process redesign, The customer as Coproduce, The problem of Customer Misbehavior and conclusion. | **1.5** | CO2 |
| [9] | Balancing demand and capacity:<br>Fluctuations in Demand Threaten Service Productivity, Many Service Organization are capacity constrained, Patterns and determinants of demand, Demand levels can be managed, Inventory demand through waiting lines and reservation, Minimizing perceptions of waiting time, Creating an effective reservation system, and conclusion. | **1.5** | CO2 |
| [10] | Planning the Service Environment:<br>The purpose of service environments, Consumer response to service environments, Dimensions of the services environment, Putting it all together and conclusion. | **1.5** | CO2 |
| [11] | Managing People for Service Advantage:<br>Service Staff are crucially important, Frontline Work is difficult and stressful, Cycles of failure, mediocrity and success, Human Resources Management: How to get it right, Service Leadership and culture and conclusion. | **1.5** | CO3 |
| [12] | Managing Relationship and Building Loyalty:<br>The search for customer Loyalty, Understanding the customer/firm relationship, Targeting the right customers, Analyzing and Managing the Customer Base, Building Customer loyalty, Customer Relationship Management System and conclusion. | **1.5** | CO3 |
| [13] | Customer Feedback and Service recovery:<br>Customer Complaining behaviour, Customer Response to effective service recovery, principles of effective service recovery systems, Services Guarantees, Discouraging abuse and opportunistic behaviour, Learning from Customer Feedback and conclusion. | **1.5** | CO3 |
| [14] | Improving service quality and productivity:<br>Integrating services quality and productivity strategies, what is service quality?, the gap model: A conceptual tool to identify and correct services, Quality problem, Measuring and Improving Service Quality, Defining and Measuring productivity, Improving services Productivity and conclusion. | **1.5** | CO3 |
| [15] | Organizing for service leadership:<br>The search for synergy in service Management, creating a leading service Organization, In search of leadership and conclusion. | **1.5** | CO3 |
| [16] | Group Presentation | **2.5** | |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

- Lovelock C and Wirtz J. Service Marketing, 6th ed., Pearson India, 2005.
- Anderson J C, Narus J A, Narayandas D, and Seshadri P V R. Business Market Management, 3rd ed., Pearson India, 2010.

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

- Zeithaml V and Bitner M. Services Marketing-integrating customer focus across the firm, 3rd ed., Tata Mc Graw- Hill, India, 2008.
- Hutt M D and Speh W T. Business Marketing Management: B2B, 10th ed., Cengage Learning Pvt Ltd, 2017.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Define the service concept and the goods-services continuum, elaborate on the 4Is of services and the associated challenges, explain the segmentation, target marketing and positioning of services. |
| CO2 | Comprehension | Describe the tools of the services marketing mix, elaborate on the measurement of service quality through the service gaps model, explain the strategies for dealing with the 4I's of services. |
| CO3 | Application | Explain the service marketing triangle, explain how customer relationships can be built using segmentation and retention strategies, define CRM, elucidate the factors responsible for CRM growth, describe the types and framework of CRM. |
| CO4 | Synthesis | Explain the characteristics of retail marketing, Describe the type of retailers, role and trends in retailing, level of FDI in retailing, describe the current scenario and problems in Indian retailing, and enumerate retail pricing strategies. |
| CO5 | Analysis | Describe the responsibilities of a store manager, explain the |

| | | |
|---|---|---|
| | | types of store layouts and visual merchandizing techniques, describe the process of planning merchandise assortments, explain buying systems and the retail communication mix. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | |
| CO2 | 2 | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | |
| CO3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | |
| CO4 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | |
| Avg | 2.8 | 2.4 | 2 | 2.6 | 2.6 | 2.4 | 2.6 | 2.6 | 2.4 | 2.4 | 2.2 | 2.6 | 2.6 | 2.2 | 2.4 | 2.4 | 2.45 |

## MBA Semester I

## SUBJECT: INTRODUCTION TO MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | | 100% |

## A. COURSE OVERVIEW

To make students aware of the fundamentals concepts of management, evolution of management and contemporary management theories and practices globally as well as in the Indian context.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Management and Manager: organization and the need for management, the management process, types of managers, management levels and skills, the challenges of management | 3 | CO1 |
| [2] | The Evolution of Management Theory: why study management theory? the scientific management school, classical organization theory school, behavioural school, the system approach, contingency approach | 3 | CO5 |
| [3] | Organizational and Natural Environment: organizational environment, direct-action environment, indirect-action environment, natural environment | 2 | CO1 |
| [4] | Social Responsibility and Ethic: the changing concepts of social responsibility, the shift to ethics, the tools of ethics | 2 | CO3 |
| [5] | Globalization and Management: globalization and competitiveness, the changing international scene, global business practice | 2 | CO4 |
| [6] | Inventing and Reinventing Organization: the meaning of entrepreneurship, the importance of entrepreneurship, reinventing organization | 2 | CO2 |
| [7] | Culture and Multiculturalism: defining culture and performance, corporate culture and performance, multiculturalism and organizational success | 2 | CO4 |
| [8] | Quality: Deming's fourteen points, TQM-the main ideas, history quality, defining quality | 3 | CO5 |

| | | | |
|---|---|---|---|
| [9] | Decision Making: time and human relationship in decision making, the nature of managerial decision making, the rational model of decision making, the rational model in perspective | 3 | CO5 |
| [10] | Planning and Strategic Management: the importance of planning at organization, the evolution of the concept of strategy, the content of a corporate strategy. | 3 | CO3 |
| [11] | Strategy Implementation: matching structure and strategy, institutional strategy, operational strategy | 3 | CO1 |
| [12] | Organizational Design and Organizational Structure: four building blocks, organizational design, downsizing, functional organization | 2 | CO2 |
| [13] | Power and The Distribution of Authority: power, culture aspects of power, authority, line and staff authority, delegation. | 2 | CO5 |
| [14] | Human Resource Management: human resources planning, recruitment, selection, training and development, promotion transfer demotion and separation | 2 | CO1 |
| [15] | Managing Organizational Change and Innovation: modal of change process, types of planned change, organizational development. | 2 | CO3 |
| [16] | Motivation: the challenge of motivation, theories of motivation, contemporary views of motivation | 3 | CO1 |
| [17] | Leadership: the trait approach to leadership, the behavioural approach, contingency approach | 3 | CO2 |
| [18] | Teams and Teamwork: types of team, characters of team, making team effective | 2 | CO2 |
| [19] | Communication and Negotiation: the importance of effective communication, communication process, communication in organization, stability of negotiation outcomes. | 1 | CO2 |
| [20] | Effective Control: meaning of control, designing control system, financial controls, types of budgets, auditing | 2 | CO3 |
| [21] | Operation Management: the operational system, designing operation systems, operational planning and control decisions | 2 | CO1 |
| [22] | Information System: information and control, management information systems, implementation and security, end-user computing | 1 | CO3 |
| | | | |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per ACS referencing format)

1. Stoner James A F, Freeman R Edward & Gilbert Jr Daniel R "Management" New Delhi Prentice-Hall of India

## D. REFERENCE BOOKS

(The format should be as per ACS referencing format)


1. Koontz Harold & Weihrich Heinz "Essential of Management" New Delhi Tata McGraw Hill
2. Burton Gene & Manab Thakur "Management Today" New Delhi Tata McGraw Hill
3. Robbins Stephen P & Coulter Mary "Management "New Delhi Prentice-Hall of India


## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Explain the various concepts and theories of management |
| CO2 | Comprehension | Demonstrate different leadership styles and skills required for working in groups and teams |
| CO3 | Application | Teach the basic functions of management like planning, organizing, leading and controlling |
| CO4 | Synthesis | Explain the various culture and quality aspects related to business. |
| CO5 | Analysis | Evaluating the practical approach for the real business situation. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 1 | 1 | 3 | 2 | 1 | 3 | 2 | |
| CO2 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | |
| CO3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | 2 | 3 | 2 | |
| CO4 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | |
| CO5 | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | |
| .. | | | | | | | | | | | | | | | | | |
| Avg | 2.4 | 2.2 | 2 | 2.6 | 2.2 | 2.4 | 2.2 | 2.2 | 2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2 | 2.2 | 2.2 |

## MBA. SEMESTER – III
## SUBJECT: LEGAL ASPECTS OF BUSINESS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 1 | 50% | 20% | 30% | - | 100% |

### A. COURSE OVERVIEW

- Linkage of the acts done for business for various rights and liabilities arising there from. To make them able to independently interpret the corporate and allied laws.
- To make students understand the legal implications of Business Communication made / received, agreements made, modified, cancelled
- To make the students aware of various commercial laws.
- To make the students understand the legal implications of Business Communication made / received, agreements made, modified, cancelled

### B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **Introduction to Law** | 5 | CO1 |
| [2] | **Indian Contract Act:**<br>Nature of Contract, Offer and Acceptance, Consideration, Capacity of Contract, Free Consent, Legality of Object, Void Agreements, Contingent Contacts, Performance of Contract, Discharge of Contract, Remedies of Breach of Contract, Quasi-Contracts | 5 | CO1 |
| [3] | **Special Contracts:**<br>Indemnity and Guarantee, Bailment and Pledge, Contract of Agency, Sales of Goods, Conditions and Warranties, Transfer of Property, Performance Contract, Rights of an Unpaid Seller, Partnership, Relations of Partners, Dissolution of Firm, Laws of Insurance, Life Insurance, Fire Insurance, Marine Insurance | 5 | CO1<br>CO2 |
| [4] | **Important Provisions of Negotiable Instrument Act** | 5 | CO1<br>CO2 |
| [5] | **Company Law:**<br>Nature of Company, Kinds of Companies, Formation of Company, Memorandum of Association, Articles of Association, Prospectus, Membership in a Company, Share Capital | 5 | CO3 |
| [6] | **Intellectual Property Rights: Patents, Copyright Act, Trademark Act**<br>Patents: What Can be Patented? WTO and Patents, Compulsory Licensing Copyright Protection: Scope, Rights of Copyright Owner, Registration of Copyright, Exemptions | 5 | CO5 |

| | | | |
|---|---|---|---|
| | from Copyright Violations, Copyright Infringement Trademark Protection: Trademark and Common Law, Class of Goods in The Trade and Merchandise Marks Act, Registration in the Trade and Merchandise Marks Act, Developments in the field of passing off, The Trade Mark Act | | |
| [7] | **Important Provisions of Information Technology Act:** Introduction, Scope of the Act, Definitions, Electronic Governance, Digital Signature and Digital Signature Certificates, Electronic Records, Certifying Authorities, Duties of Subscribers, Network Services Providers, Miscellaneous, Cyber Regulation and Appellate Tribunal. | **5** | CO5 |
| [8] | **Right to Information Act:** Citizen, Information and Public Authority, Enforcement and Penalty, Public Authority, Refusal to Information, Rights of Third Party | **5** | CO5 |
| [9] | **MRTP/Competition Act:** Unfair Trade Practices, Restrictive Trade Practices, Unfair Trade Practices, MRTP Commission, CCI, Why India adopted a new competition law, Historical Developments Leading to Enactment of MRTP, Enforcement of MRTP, Economic Reforms and Impact of MRTP, Experience with MRTP, Metamorphosis of MRTP Act to Competition Bill, New Wine in the Old Bottle, Conclusion | **5** | CO4 |
| [10] | **FERA and FEMA:** Scope, Definitions, Authorized Person, Regulation and Management of Foreign Exchange, Contravention and Penalties, Adjudication and Appeals, Directorate of Enforcement, Miscellaneous, Difference Between FERA and FEMA | **5** | CO4 |

## C. TEXT BOOKS


- Pathak, A. (n.d.). Legal Aspects of Business (Latest ed.). Tata McGraw Hill.
- Kapoo, N. (n.d.). Mercantile Law (Latest ed.). New Delhi: Sultan Chand & Co


## D. REFERENCE BOOKS


- Abbi, N. K. (n.d.). General Laws and Procedures (Latest ed.). Sultan Chand & Sons.
- Gulshan, S. S. (n.d.). Business Law (Latest ed.). Excel.
- Varadarajan, S. S. (n.d.). SEBI – Law, Practice & Procedure (Latest ed.). Delhi: Commercial Law Publishers (India).


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Understand and Evaluate the different laws used in making a contract. |
| CO2 | Synthesis | Define the laws relating to special contracts along with Negotiable Instrument Act. |
| CO3 | Application | Summarize the law relating to the formation of companies along with the highlights of Companies Act 2013. |
| CO4 | Comprehension | Comprehend the Competition law, FEMA & FERA in India. |
| CO5 | Analysis | Analyse and Outline the concepts of Company Act,2013, SEBI, IPR, IT Act and RTI ACT 2005. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | |
| CO2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | |
| CO3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | |
| CO4 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | |
| CO5 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | |
| .. | | | | | | | | | | | | | | | | | |
| Avg | 2.8 | 2.8 | 2.6 | 2.2 | 2.2 | 2.2 | 2.8 | 2.2 | 2.2 | 2.8 | 2.2 | 2.2 | 2.8 | 2.2 | 2.8 | 2.2 | |

## MBA SEMESTER – II
## SUBJECT: MARKETING MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 0 | 4 | 4 | 50% | 20% | 30% | - | 100% |

### A. COURSE OVERVIEW

The course focuses on formulating and implementing marketing management strategies and policies, a task undertaken in most companies at the strategic business unit level. The marketing management process is important at all levels of the organization, regardless of the title applied to the activity. Typically, it is called corporate marketing, strategic marketing, or marketing management. For our purposes they all involve essentially the same process, even though the actors and activities may differ. The course will provide you with a systematic framework for understanding marketing management and strategy.

### B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| 1 | ● Defining Marketing for the New Realities<br>● Developing Marketing Strategies and Plans<br>Case:1 | 3 | CO1<br>CO2 |
| 2 | ● Creating Long-term Loyalty Relationships<br>● Collecting Information and Forecasting Demand | 3 | CO1 |
| 3 | ● Conducting Marketing Research<br>Case:2 | 2 | CO3<br>CO5 |
| 4 | ● Analyzing Consumer Markets<br>● Analyzing Business Markets<br>Case: 3 | 4 | CO5 |
| 5 | ● Tapping into Global Markets<br>● Identifying Market Segments and Targets | 3 | CO1<br>CO3 |
| 6 | ● Crafting the Brand Positioning<br>● Creating Brand Equity | 2 | CO2 |
| 7 | ● Addressing Competition and Driving Growth<br>● Setting Product Strategy<br>● Designing and Managing Services<br>Case: 4 | 4 | CO2<br>CO5 |
| 8 | ● Introducing New Market Offerings<br>● Developing Pricing Strategies and Programs | 3 | CO1<br>CO3 |
| 9 | ● Designing and Managing Integrated Marketing Communications | 3 | CO1<br>CO5 |

| | | | |
|---|---|---|---|
| | ● Managing Mass Communications: Advertising, Sales Promotions, Events and Experiences, and Public Relations<br>Case: 5 | | |
| 10 | ● Managing Digital Communications: Online, Social Media and Mobile Marketing<br>● Managing Personal Communications: Direct Marketing, Word of Mouth, and Personal Selling<br>Case6 | 4 | CO1<br>CO3<br>CO5 |
| 11 | ● Designing and Managing Integrated Marketing Channels<br>● Managing Retailing, Wholesaling, and Logistics<br>Case: 7 | 3 | CO3<br>CO4 |
| 12 | ● Managing a Holistic Marketing Organization for the Long Run | 1 | CO1<br>CO3<br>CO4 |
| 13 | ● Contemporary issues and presentation | 1 | CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

1. 'Marketing Management', Philip Kotler, Kelvin Keller, 15th Edition, Perspective, Pearson Education, New Delhi.

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

2. Marketing Management – Planning, Implementation and context, - Ramaswamy and Namakunsari, 3rd Edn, Macmillan India Ltd., New Delhi.
3. 'Marketing' – Michael J. Etzel, Bruce J. Walker William J. Stanton, Tata McGraw-Hill, 13th Edition, Delhi.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Develop an understanding of marketing as a function and capable to observe the factors effecting marketing of organization's products or services. |
| CO2 | Comprehension | Identify the criteria to segment, target and positioning of products or services of organizations and to be able to estimate the. |
| CO3 | Application | Design and develop marketing programmes and strategies for organizations. |

| | | |
|---|---|---|
| **CO4** | Synthesis | Summarize the efficiency of marketing function by applying the marketing audit and control procedures |
| **CO5** | Analysis | Analyse the behaviour of target market and relate them to organizational marketing strategies. |

**MBA. SEMESTER – III**

**SUBJECT: MERGERS AND ACQUISITIONS AND RISK MANAGEMENT**

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

The course acquaints students about fundamentals, trading and structure of derivatives and leads them to the valuation of derivatives. It develops an understanding of M&A as significant economic activity taking place in today's economy. It familiarizes students with various techniques of corporate restructuring, and valuation methods used by corporate in real life.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **INTRODUCTION:**<br>● Mergers, Acquisition and Restructuring<br>● The Takeover process | 3 | CO1 |
| [2] | **M & A THEORIES:**<br>● Theories of Mergers and Tender Offers,<br>● International Takeovers and restructuring<br>● SEBI Guidelines | 3 | CO1 |
| [3] | **VALUATION - I:**<br>● Accounting for M & A –AS-14,<br>● Companies Act – Section 230-240, Terms of M & A | 4 | CO1<br>CO2<br>CO3 |
| [4] | **VALUATION – II & III:**<br>● Alternative Approaches to Valuation<br>● Increasing the Value of the Organization | 4 | CO1<br>CO2<br>CO3 |
| [5] | **RESTRUCTURING:**<br>● Corporate Restructuring and Divestiture<br>● Financial Restructuring | 4 | CO1<br>CO3 |
| [6] | **M & A STRATEGIES:**<br>● Alliances and Joint Ventures,<br>● Employee Stock Ownership,<br>● Going Private and Leveraged Buyouts. | 4 | CO2 |
| [7] | **STRATEGIES FOR CREATING VALUE:**<br>● Share Repurchases,<br>● Share Buyback Guidelines for Indian companies<br>● Takeover Defenses | 3 | CO2 |
| [8] | **Introduction to Risk Management**<br>● Overview of the Indian Derivatives Markets, Forward, Futures, Options<br>● Types of Traders, Exchange traded market, Over the counter market<br>● Hedgers, Speculators, and Arbitragers | 2 | CO4 |

| | | | |
|---|---|---|---|
| [9] | **Interest Rates**<br>● Types of rates, Measuring interest rates, Zero rates, Bond Pricing.<br>● Duration, Convexity, Theories of term structure of Interest rates | 2 | CO4 |
| [10] | **Futures**<br>● Basics of Futures, Mechanics of Futures Markets, Convergence of Futures Price to Spot Price, Daily Settlement and Margins, Forward Vs Futures market, Types of Traders and types of orders.<br>● Hedging Strategies using futures: Cross Hedging, Stock Index Futures, Rolling the Hedge forward<br>● Interest Rates Futures: - Day Count and Quotation Conventions, Eurodollar futures, Duration based hedging strategies. | 3 | CO4 |
| [11] | **Determination of Forward and Futures Prices**<br>● Investment assets Vs Consumption assets, Known Income and Yields.<br>● Forward and Future contracts on currencies, Futures on Commodities, The cost of Carry, Forward and expected future spot rates | 3 | CO4 |
| [12] | **Options**<br>● Types of Options, Option Position, Underlying assets, Factors affecting option prices, Specification of stock options, Trading, Commission, Margin, Warrants, Convertibles etc., Upper and Lower Bounds for option prices.<br>● Put-call Parity, Options on Stock Indices, Valuation of European Stock Index Option, Valuation of Stocks paying known dividend Yields | 2 | CO4 |
| [13] | **Swaps**<br>● Basics of Swaps, Interest Rate Swaps, Day Count Issues.<br>● Valuation of Interest Rate Swaps, Confirmations | 2 | CO4 |
| [14] | **Binomial Tree**<br>● A one-step binomial model and no arbitrage argument, Risk neutral valuation, Two Step Binomial Trees, American Options, Delta, Matching Volatility with u and d<br>● Valuation of Futures Prices using binomial trees | 2 | CO5 |
| [15] | **The Black Scholes Merton Model**<br>● Risk Neutral Valuation, Black Scholes Pricing Formulas, Cumulative normal Distribution function, Implied volatiles, effects of dividends on price.,<br>● Black's model for valuing futures options | 3 | CO5 |
| [16] | **The Greek Letters**<br>● Naked and Covered Position, A stop loss Strategy, Delta Hedging, Theta, Gamma, Vega, Rho, Scenario Analysis, Portfolio Insurance. | 2 | CO5 |

| | | | |
|---|---|---|---|
| | • Brief about Volatility Smiles | | |
| [17] | **Value at Risk**<br>• The VAR Measure, Model Building Approach, Linear Model, Quadratic Model.<br>• Monte Carlo Simulation, Stress Testing | 2 | CO5 |
| [18] | **Strategies**<br>• Bull Spread, Bear Spread, Straddle, Strangle, Strip, Strap, Butterfly Spread.<br>• Collar, Calendar Spread, Box Spread, Diagonal Spread | 2 | CO5 |

## C. TEXT BOOKS

- Godbole, P. D. (n.d.). *Mergers, Acquisition and Corporate Restructuring* (Latest Edition ed.). Vikas Publishing House.
- Hull, J. C. (n.d.). *Options, Futures and Other derivatives* (Latest Edition ed.). New Delhi: Pearson Education

## D. REFERENCE BOOKS

- Gupta, S. P. (n.d.). *Derivatives* (Latest Edition ed.). New Delhi: PHI.
- Bhargava, P. (n.d.). *Derivatives* (Latest Edition ed.). Mumbai: Jaico Publication
- James J.Fred Weston, M. L. (n.d.). *Takeovers, Restructuirng and Corporate Governance* (Latest Edition ed.). Pearson.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Discuss the various forms of corporate restructuring namely Mergers, Acquisitions, Joint ventures, Spinoff, Split-ups, Equity carve out, Divestiture, Corporate Control etc. |
| CO2 | Synthesis | Compute and Evaluate company's valuation by applying asset based, income based, DCF based and market based models. |
| CO3 | Application | Analyse and explore the accounting, legal and taxation framework of various forms of corporate restructuring including M&A and takeover strategies which creates shareholders value. |
| CO4 | Comprehension | Understand the risk management concepts, valuation and trading strategies using derivatives instruments such as futures, forwards, options and swaps. |
| CO5 | Analysis | Identify how derivatives can be used for hedging the adverse price risk movements.. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | |
| CO2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | |
| **CO4** | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | |
| **CO5** | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | |
| **..** | | | | | | | | | | | | | | | | | |
| **Avg** | 2.8 | 2.8 | 2.6 | 2.2 | 2.2 | 2.2 | 2.8 | 2.2 | 2.2 | 2.8 | 2.2 | 2.2 | 2.8 | 2.2 | 2.8 | 2.2 | |

## MBA SEMESTER – I
## SUBJECT : MANAGERIAL COMMUNICATION

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- To introduce the students with the communication process and its importance.
- To help students to understand difference between Verbal and Non Verbal Communication.
- To help students with Oral and Written Communication.
- To introduce the students with case pedagogy of Management with real life Situations.
- It is quite relevant to industry and corporates.
- It even helps to build one's career in international countries also.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **The Innards of Communication:**<br>The Innards of Communication asks how we communicate. It presents a novel explanation on why we misunderstand one another and what role verbal and non-verbal symbols play in communication. | 3 | CO1 |
| [2] | **Seven Communication Roadblocks**:<br>Seven Communication Roadblocks describes seven barriers that communication less effective than it could be. It also gives a few general tips on bringing them down and improving our communication skills. | 3 | CO2 |
| [3] | **Communicating across cultures:**<br>Communication across cultures deals with cultural values that quietly shape our communication. It alerts us to certain basic that we need to keep in mind if we want to communicate well with people of other culture. | 3 | CO2 |
| [4] | **Listening: The Mother of all Speaking:**<br>The mother of all speaking deals with the mother of all speaking - listening. Our listening is mostly partial and passive. In order to make our communication effective both as communicators and as communicates we need to make our listening active. The chapter describes the anatomy of poor listening and of poor speaking and goes on the features of a good listener. | 3 | CO1 |

| | | | |
|---|---|---|---|
| [5] | **Telephoning and Teleconferencing:** Telephoning and Teleconferencing focuses on spoken communication over the phone. The server reduction in the number and quality of non-verbal symbols when one uses this channel of communication poses challengers to whoever uses it. The chapter shows how to cope with this challenges and what etiquette to follow. | **3** | CO1 |
| [6] | **Effective Business Presentation:** Effective Business Presentation is on making oral presentations. It offers suggestions on how to plan presentation systematically, how to deliver them forcefully, how to develop and display visual aids, and how to handle questions from the audience. There are also some tips on how to cope with nervousness which nearly all speakers feel when they stand up to make presentation. | **3** | CO3 |
| [7] | **Meeting without Yawns:** Meeting without Yawns is devoted to meeting. Meetings are a fact of corporate life. No one can do without them. They are also a major source of terrible waste of time and resources. This chapter analyses the reasons for wastefulness and suggests ways of making meeting work | **3** | CO2 |
| [8] | **The Body Language of Business Letters:** The Body Language of Business letters deals with the body language of business writing, especially letters, and the impression in creates on the reader. | **3** | CO4 |
| [9] | **Business Letters – The Winning Tone:** Business letters – The wining tone discuss the tone of writing, an aspect of written communication that is underestimated by many managers. | **3** | CO4 |
| [10] | **Smart E-mail:** Smart E-mail takes a close look at e-mail – the modern miracle. It shows how to make your mail smart so that it stands out from the crowd and gets read. | **3** | CO4 |
| [11] | **Reports that command respect:** Reports that command respect focuses on reports. It shows how to write brief reports that command the reader's and get their acceptance. | **3** | CO5 |
| [12] | **Persuasive Proposals:** Persuasive Proposals is devoted to proposals. Executive have to make them persuasive for them to be read an accepted. This chapter shows how. | **3** | CO5 |
| [13] | ***Written Analysis of Cases*** | **9** | CO1, CO2, CO3, CO4, CO5 |

| | | | |
|---|---|---|---|
| [14] | **Oral Presentation** | **5** | CO3 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

Monippally M M. Business Communication Strategies, 1st ed.; Tata McGraw-Hill. India, 2009.

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

Kaul A. Effective Business Communication, 2nd ed.; Prentice Hall of India. India, 2015.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Determine the appropriate communication and listening skills. |
| CO2 | Comprehension | Demonstrate the non-verbal and negotiation skills in various business situations. |
| CO3 | Application | Demonstrative effective presentation skills in various occasions. |
| CO4 | Synthesis | Formulate effective business reports and letters in different scenarios. |
| CO5 | Analysis | Develop relations with media, investors, government and effective communication in crisis situations. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 1 | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 1 | |
| CO2 | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 3 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | |
| CO3 | 3 | 2 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 1 | |
| CO4 | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 1 | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 1 | |
| CO5 | 2 | 2 | 3 | - | - | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 2 | 1 | |
| Avg | 2.4 | 2.2 | 2.6 | 2.4 | 2.4 | 2.8 | 2.4 | 2.4 | 2.2 | 2.2 | 2.2 | 2 | 2.2 | 2.4 | 2.2 | 2.2 | 2.3 |

## MBA Semester IV

## SUBJECT: MANAGEMENT CONTROL SYSTEM

| Teaching Scheme (Hours/Week) | | | | Credit | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | s | Ext | Sess. | TW | Prac | Total |
| 4.5 | | | | 4 | 50% | 20% | 30% | | 100% |

## A. COURSE OVERVIEW

To provide knowledge, insight, and analytical skills related to how a corporation's senior executive design and implement the ongoing management systems that are used to plan and control the firm's performance. To introduce the various control measures of the systems to the students.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **The Nature Of Management Control System**<br>Basic concepts,<br>Boundaries of management control,<br>Impact of internet on management control. | 3 | CO5 |
| [2] | **Understanding Strategies:**<br>Goals,<br>The concept of strategy,<br>Corporate-level strategy,<br>Business unit strategy. | 3 | CO2 |
| [3] | **Behavior in Organization:**<br>Goal congruence,<br>Informal factors that influence goal congruence,<br>The formal control system,<br>Types of organizations,<br>Functions of the controller. | 3 | CO2 |
| [4] | **Responsibility Centers: Revenue And Expense Center:**<br>Responsibility center,<br>Revenue center,<br>Expense center,<br>Administrative and support centers,<br>Research and development centers,<br>Marketing centers. | 3 | CO1 |
| [5] | **Profit Center:**<br>General consideration,<br>Business unit as profit centers,<br>Other profit centers, | 3 | CO1 |

| | | | |
|---|---|---|---|
| | Measuring profitability. | | |
| [6] | **Transfer Pricing:**<br>Objectives of transfer pricing,<br>Transfer pricing methods,<br>Pricing corporate services,<br>Administrative of transfer prices. | 3 | CO3 |
| [7] | **Measuring And Controlling Assets Employed:**<br>Structure of the analysis,<br>Measuring asset employed,<br>EVA versus ROI.<br>Additional consideration in evaluating managers,<br>Evaluating the economic performance of the entity. | 3 | CO3 |
| [8] | **Strategic Planning:**<br>Nature of strategic planning,<br>Analyzing proposed new programs,<br>Analyzing ongoing programs,<br>Strategic planning process. | 3 | CO4 |
| [9] | **Budget Preparation:**<br>Nature of budget,<br>Other budgets,<br>Budget preparation process,<br>Behavioral aspects,<br>Quantitative techniques. | 4 | CO3 |
| [10] | **Analyzing Financial Performance Reports:**<br>Calculating variance,<br>Variation in practice,<br>Limitation of variance analysis. | 3 | CO3 |
| [11] | **Performance Measurement:**<br>Performance measurement systems,<br>Interactive control. | 3 | CO4 |
| [12] | **Management Compensation:**<br>Research findings on organizational incentives,<br>Characteristics of incentives compensation plans,<br>Incentives for corporate officers,<br>Incentives for business unit managers,<br>Agency theory. | 3 | CO2 |
| [13] | **Controls For Differentiated Strategies:**<br>Corporate strategy,<br>Business unit strategy,<br>Top management style. | 3 | CO4 |
| [14] | **Service Organization:**<br>Service organization in general,<br>Professional service organizations,<br>Financial service organization,<br>Health care organization, | 3 | CO1 |

| | | | |
|---|---|---|---|
| | Nonprofit organization. | | |
| [15] | **Multinational Organization**:<br>Cultural differences,<br>Transfer pricing,<br>Exchange rates. | 3 | CO2 |
| [16] | **Management Control Of Projects**:<br>Nature of projects,<br>The control environment,<br>Project planning,<br>Project evaluation,<br>Project execution . | 4 | CO5 |
| | | | |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per ACS referencing format)

1. Robert N Anthony & Vijay Govindrajan, "Management Control System" Tata McGraw Hill, 12th Edition.

## D. REFERENCE BOOKS

(The format should be as per ACS referencing format)

2. Joseph A. Maciarielle, "Management Control System" - Prentice Hall of India (EEE).

3. Subhash Sharma, "Managerial Control System" Tata Mc Graw Hill Publishing Pvt. Ltd

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | To measure the various responsibility centres of the business organization. |
| CO2 | Comprehension | To learn the organizational structure of different industries |
| CO3 | Application | To explore the transfer pricing issue with different business units. |
| CO4 | Synthesis | To provide knowledge, insight, and analytical skills related to how a corporation's senior executive design and implement the ongoing management systems that are used to plan and control the firm's performance. |

| | | |
|---|---|---|
| **CO5** | Analysis | To introduce the various control measures of the systems. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | |
| **CO2** | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 2 | 3 | 2 | 2 | |
| **CO3** | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | |
| **CO4** | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 1 | |
| **CO5** | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | |
| **..** | | | | | | | | | | | | | | | | | |
| **Avg** | 2.4 | 2.4 | 2.6 | 2.2 | 2.6 | 2 | 2.4 | 2.2 | 2.4 | 2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.31 |

## MBA SEMESTER – I

## SUBJECT: MANAGERIAL ECONOMICS

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

The course helps the students to apply economic concepts, principles and ideas to decision making in business organizations. It provides basic theories and tools of analysis and develop an understanding of the behaviour of various economic agents to help decision-making.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Introduction: Ten Principles of Economics, The Economist as Scientist and as Policy Adviser , Economic Models – The Circular Flow Diagram, The Production Possibilities Frontier | 3 | CO1 |
| [2] | The Market forces of demand and Supply: Demand, Shift in demand curve, Supply, Shift in supply curve, Equilibrium, Analysing changes in Equilibrium | 2 | CO2 |
| [3] | Elasticity and Its Application :The Price Elasticity of Demand and its determinants, Income and Cross Price Elasticity of Demand, The Price Elasticity of Supply and its determinants, Applications of Supply, Demand and Elasticity | 2 | CO2 |
| [4] | Consumers, Producers and the Efficiency of Markets: Consumer surplus; Producer surplus; Market efficiency – the benevolent social planner, evaluating the market equilibrium | 2 | CO2<br>CO3 |
| [5] | The Cost of Production :_Costs – total revenue, total cost and profit, cost of capital as an opportunity cost, Cost in the short run, Cost in the Long Run, economic profit versus accounting profit; Production and costs – the production function, from production function to the total cost curve; The various measures of cost – FC, VC, AC, MC, cost curves and their shapes (rising MC, U-shaped ATC, the relation between MC and ATC), typical cost curves; Costs in the short run and long run – relationship between SR and LR, ATC, economies and diseconomies of scale | 3 | CO3<br>CO4 |
| [6] | Firms in Competitive Markets : Perfect Competition – Revenue, Profit Maximization, The Firm's Short run decision to Shut down and Long run decision to exit or enter the market, The Short run and Long run Market Supply | 3 | CO2<br>CO4 |
| [7] | Monopoly:_Concepts of Monopoly, Sources of Monopoly Power, Production, Pricing and Profit Maximization Decisions of Monopolies, The Welfare Costs of Monopoly, Public Policy towards Monopolies | 2 | CO4<br>CO4 |
| [8] | Oligopoly: Competition, Monopolies and Cartels, The Equilibrium for an oligopoly, Game theory – Prisoners' Dilemma and oligopoly, Public policies toward oligopolies | 2 | CO2<br>CO4 |

| | | | |
|---|---|---|---|
| [9] | Monopolistic Competition : The Monopolistically Competitive firm in the short run and long run, monopolistic vs perfect competition, Monopolistic competition and the welfare of society, The debate over advertising | 3 | CO2<br>CO4 |
| [10] | The Data of Macroeconomics : Measuring the cost of living: The consumer price index; Correcting economic variables for the effects of inflation, Production and growth: Economic growth around the world; The role and determinants of productivity; Economic growth and public policy; The importance of long-run growth | 3 | CO1<br>CO5 |
| [11] | The Real Economy in the Long Run: Saving, investment and the financial system ; Financial institutions in the US economy; Saving and investment in the National Income Accounts; The market for loan able funds | 3 | CO5 |
| [12] | The monetary system; The meaning of money; The Federal Reserve System; Banks and the money supply ; Money growth and inflation ; The classical theory of inflation; Money and Prices in the Long Run : The costs of inflation | 3 | CO1<br>CO5 |
| [13] | Open-economy macroeconomics – Basic concepts ; The international flow of goods and capital – the flow of goods (exports, imports, net exports), the flow of capital (net foreign investment), the equality of net exports and net foreign investment; savings, investment and their relationship to the international flows; The prices for international transactions (real and nominal exchange rates); A first theory of exchange-rate determination (purchasing power parity) | 4 | CO5 |
| [14] | Aggregate demand and aggregate supply ; Three key facts about economic fluctuations; Explaining short-run economic fluctuations; The aggregate demand curve; The aggregate supply curve; Two causes of economic fluctuations (the effects of shifts in aggregate demand and supply) | 3 | CO5 |
| [15] | The Macroeconomics of Open Economies: The influence of monetary and fiscal policy on aggregate demand; How monetary policy influences aggregate demand – the theory of liquidity preference, the downward slope of the aggregate demand curve, changes in the money supply, the role of interest-rate targets in Fed policy; How fiscal policy influences aggregate demand – changes in government purchases, the multiplier effect, a formula for the spending multiplier, other applications of the multiplier effect, the crowding-out effect, changes in taxes; Using policy to stabilize the economy – the cases for and against active stabilization policy | 4 | CO5 |
| [16] | Short-run Economic Fluctuations : The short-run tradeoff between inflation and unemployment; The Phillips Curve – origins, aggregate demand, aggregate supply and the Phillips Curve; Shifts in the Phillips Curve – the role of expectations; Shifts in the Phillips Curve – the role of supply shocks; The cost of reducing inflation – the sacrifice ration, rational expectations and the possibility of costless disinflation, the Volcker disinflation, the Greenspan era ; | 4 | CO5 |
| [17] | Five debates about macroeconomic policy (pros and cons): Should monetary and fiscal policymakers try to stabilize the economy; Should monetary policy be made by rule rather than by discretion; Should the Central Bank aim for zero inflation; Should fiscal policymakers reduce the | 4 | CO4<br>CO5 |

| | | | |
|---|---|---|---|
| | government debt; Should the tax laws be reformed to encourage saving | | |

## C. TEXT BOOKS

1. Gregory, Mankiw; "Economics: Principles and Application" India Edition, Cengage Publication, Latest edition

## D. REFERENCE BOOKS

1. Managerial Economics in a Global Economy, D Salvatore (Thomson SouthWestern)
2. Managerial Economics – 4th ed., 1999, H Craig Petersen and W Cris Lewis; Pearson / PHI
3. Economics, Samuelson and Nordhaus (McGraw Hill)
4. Managerial Economics, Atmanand (Excel Books)
5. Essentials of Managerial Economics, I C Dhingra (SCS)

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Comprehension | Define the basic concepts of Managerial Economics. This course will enable students to describe the situations of certainty, uncertainty and risk and the constraints therein in corporate situations. |
| CO2 | Application | Discover the reasons for success or failure of a product in the market by studying the various factors affecting demand for the product. Students will also be able to illustrate when an individual consumer or market attains a state of equilibrium. Students will be able to forecast demand using different methods. The course shall help students illustrate the concept of elasticity for pricing products, and for setting the budget for product promotions. |
| CO3 | Analysis | Identify the least cost-output relationship and determine the relationship between the output and the cost in the short run and the long run period of operation. Students will be able to determine the level of output beyond which profits will be generated. |
| CO4 | Synthesis | Estimate and optimizing the performance of the company in different market structures in terms of profits using the concepts of marginal revenue and marginal cost, and equilibrium price and output. The course shall help students in formulating pricing and non- pricing strategies to deter competition. |
| CO5 | Evaluation | Describe the methods for measurement of national income and inflation and to enumerate the policies to counter trade cycles. Students will be able to inspect the causes of a trade cycle and suggest remedies. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2** | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | |
| **CO3** | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | |
| **CO4** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | |
| **CO5** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 3 | 3 | 2 | |
| | | | | | | | | | | | | | | | | | |
| **Avg** | 2.6 | 2.6 | 2.4 | 2.2 | 2.2 | 2.2 | 2.2 | 2.4 | 2.2 | 2.2 | 2.2 | 2.2 | 2.6 | 2.6 | 2.6 | 2.2 | |

# Dharmsinh Desai University

## Centre for Management Studies

## General Guidelines for Management Research Project

### Prescribed format and specification

**1. General**

The guideline is intended to provide broad guidelines to the MBA students in the preparation of Management Research Project (MRP). The Management Research Project should report in an organized and scholarly fashion, an original work of a student along with research methodology, data analysis, interpretation and summary of findings.

**Steps to follow for a Management Research Project (MRP)**

1. Research Project must be started at the onset of 3rd Semester.
2. The topic of Project preferably should be related to the area of specialization from the broader field of management and the topic must be finalized in consultation with guide/project supervisor. However, it is not compulsory to select the topic only from specialization field. Students can select the topic on any contemporary issue also.
3. Each student is required to prepare a research proposal of 5 to 10 pages on the topic chosen by him/her in consultation with his/her guide and submit the same to the Head of the Department for approval. The copy of the Title page of approved proposal duly signed bythe evaluator must be added with it. The contents of research proposal should be:
    a. Title of the Project
    b. Review of literature and problem Statement (At least 5 Literature review for Indian and Global Perspective each)
    c. Rationale and Objectives of the proposed study
    d. Research Methodology (Sources of data, Sampling, Tools of analysis)
    e. Scope/Relevance of Proposed Study
    f. Proposed Questionnaire (if any)
    g. References (APA Style only)
4. Select the area, which you are interested in or the area which, you can handle it and competent. Begin the task of encapsulating your topic in one simple question. Your task of encapsulating your topic in one simple question. Your task in the project will be to answer to that question fully.
5. Check with your supervisors that the area you have chosen is suitable. Negotiate what is required for acceptance of the finished report. That is, what are the normal expectations

about the research activity, which will answer the question, you are asking yourself. What is the appropriate length for the kind of assignment you have set yourself? What are the constraints applying to the project (e.g. time, scope of what do you want to do, costs, etc). Do bear in mind that you must be able to complete the project with the time available.

6. Narrow your area of interest to a specific topic. Finalize the specific research question you intend to answer. There should be inherently one major question in each research project. Projects lacking this one question often from problems of definition and focus. (However, finalizing this specific question does not prevent you from later changing the direction of your project as you progress with it, in response to new or unforeseen developments).
7. Write an initial research plan of the approach you will follow in answering your question. Get your supervisor to comment on this.
8. Survey the literature relevant to your topic. Remember it is a rare piece of research which has no antecedents or which takes place in isolation. You should try to see your project in relationship to what are the probably numerous other similar studies that have been carried out before. Find information that helps you to understand how your study fits into the literature of the area. If you are through in your research you will almost certainly find that there is more than one literature of relevance to what you want to do. However, for the purposes of this paper you need show familiarity with only one.
9. Now that you have some idea of other, similar projects, re-think your approach in the light of what you have learned. If necessary, rewrite your research plan and show it to your supervisors. Think again about the validity (and practicalities) of what you have planned. Can your questions in fact be answered by a research project of this nature? Are your really able to do it with the time available?
10. If your answer to these questions is yes, now is the time to rewrite your research plan in more detail and send it to your supervisor for comment.
11. Once your plan is approved, start to work on the project itself. Often it is helpful to create schedule of the activities you have to complete and the time you available. Estimate how long each activity will take, add another 50% as a safety margin, and allocate time to each item accordingly.
12. Prepare a draft outline of the sections of the report. As you do the research, try to write parts of each these sections as you go. This helps you to keep an overview of the entire project and avoid getting to wrap up in any one aspect to the detriment of whole.
13. As soon as it is clear how the final report is going to look, send a draft copy of it to your supervisors for comments. Make corrections and changes as required. Complete the report and send it in, in final typed form.
14. **One Spiral bound hard copy** of Project Report should be submitted along with **soft copy of the report** at the end of the course.

Students can refer the following link for the resources for topics on any area of management.

1. http://www.jstor.org
2. http://onlinelibrary.wiley.com
3. www.springerlink.com.

4. http://www.oxfordjournals.org/
5. A brief user guide for access to the journals is available at http://www.inflibnet.ac.in/econ/pdf/OUP.pdf.
6. http://scholar.google.co.in/schhp?hl=en&tab=ws

**2. Arrangement of the content of the project report**

The sequence in which the material should be arranged and bound should be as follows:

a. Cover page and title page
b. Certificate
c. Executive Summary
d. Declaration
e. Acknowledgement
f. Table of Content
g. List of Table
h. List of Figure
i. List of Symbols, abbreviations and nomenclature
j. Chapters
k. References
l. Annexures

The table and figure should be introduced at the appropriate places.

## Checklist for research report Writing

1. Are the problem statement and objectives clearly and concisely written?
2. Have the objectives, hypotheses, and research questions been adequately addressed?
3. Are the findings, conclusions, and recommendations clearly stated and do they match the objectives, hypotheses, and research questions?
4. Where necessary, are significant or potentially controversial statements supported by the literature?
5. Are there weaknesses in logic or mistakes in spelling or grammar?
6. Are concepts and technical terms adequately explained?
7. Could a major point be better presented by a table or graph?
8. Does the title adequately describe the contents?
9. Is the use of headings and subheadings consistent throughout the paper?
10. Is each paragraph essential? Does one paragraph flow naturally into the next?
11. Are pages, tables, and charts numbered correctly?
12. Are all the references necessary?
13. Are quotations correct?
14. Have you included a table of contents?
15. If needed, have you included an abstract or summary of the report?

**3. Page Dimensions and Margins**

The dimensions of the final bound copies of the report must be as follows:

a. Standard A4 size (297 mm×210 mm) must be used for preparing and binding the report.

b. Following should be the page margins for the final copy.

- ❖ Top Edge: 1.38" to 1.8"
- ❖ Bottom Edge:1.0 to 1.2"
- ❖ Left Side: 1.35 to 1.57"
- ❖ Right Side: 0.80 to 0.90"

Tables and figures should confirm to the margin specifications. Large size figure should be photographically or otherwise reduced to be appropriate size before insertion.

**4. Manuscript Preparation**

a. Cover Page/title page

A specimen copy of the cover page/title page is given in this brochure (page 9).

b. Certificate

The bonafied certificate shall be in the double line spacing using font style time's new roman font size 12. The certificate should carry signature and date of the student and guide. The bonafied certificate should also carry external examiner's signature at the time of viva-voce.

c. Executive summary

It is in a simple way narration of the project report, outlining problem, methodology, tools used and summary of findings. It shall be in double line spacing using font style times new roman font size 12.

d. Declaration

The Declaration should be types in double spacing using font style times new roman font size 12. It consists of candidate's signature, date and place. The candidate's signature should be made at the bottom end above his/her name typed in capital.

e. Acknowledgement

The acknowledge should be brief and should not exceed one page. It should be types in double spacing using font style times new roman font size 12. The candidate's signature should be made at the bottom end above his/her name typed in capital.

f. List of Tables and figures

The list should use exactly the same captions as they appear above the tables in the text. Spacing should be one and half for typing the matter under this head.

g. List of Symbols, Abbreviations and Nomenclature

Spacing should be one and half for typing the matter under this head. Standard symbols, abbreviations etc should be used.

h. Chapters

The main text should be divided to several chapters and each chapter may be further divided several divisions and sub-divisions. Each chapter should be given appropriate title. Tables and figures in a

chapter should be placed in the immediate vicinity of the reference where they are cited. Footnotes should be used sparingly rather than end notes. They should be typed single space and placed directly underneath in the very same page, which refer to the material they annotate.

The format for typing chapter headings, division headings and sub-division headings should be incorporated through the following illustrative examples.

Chapter Heading: Chapter 1: FII in India

Division Heading: 1.1. Introduction

Sub-division Heading: 1.1.1 FII Flow in India (1993-2003)

The size of the titles should be 14 and bold caps lock.

The size of the sub titles should be 12 and bold sentence case.

Use 1.5 spacing except for long quotations, footnotes and endnotes which are single spaced.

i. Header and Footer

The size of text in header and footer should be 11.

Header: ID no. & Year on left hand side alignment and Title of elective from right hand side alignment.

Footer: Centre for Management Studies, DDU on center alignment and page no. on right hand side alignment.

j. Numbering of chapters, division and sub-division

The numbering of chapters, divisions and sub-divisions should be done using Arabic numbers only and further decimal notation should be used for numbering the division and sub-divisions within a chapter. For example, subdivision 1 of division 1 belonging to chapter 1 should be numbered as 1.1.1.

In a similar way, sub-division 2 of division 3 of chapter 4 can be numbered as 4.3.2.

Every chapter beginning with the first chapter should be serially numbered using Arabic numerals. Appendices included should be also numbered in an identical manner starting with appendix 1.

k. Annexures

Appendices provide supplementary information; but when they are included in the main text, it acts as a distraction and often cloud the central theme under discussion. Appendices should be numbered using Arabic numbers e.g. Appendix 1, Appendix 2 etc.

l. Pagination

Page numbers are to be placed at least 15 mm from the edge of the page at the bottom center of the page.

Every page except the title must be numbered. Title page is "I" but is not numbered. Preliminary

pages are to be numbered in lower case Roman numerals (ii, iii, iv etc); the text page ate to be numbered in Arabic numerals and all pages must be numbered consecutively and continuously, irrespective of volumes.

m. Overall Text

Text should be typed, one and a half-spaced, on one side of the paper only. All information excluding page numbers must be within the text area. All typing, print, illustrations, etc should be on one side of the paper only. Abstract and bibliography should be typed, one and a half-spaced, and be double-space between entries.

n. References

Any work of the other researcher if either used directly or indirectly; the origin of the material thus referred to as appropriate places should be indicated. Below shows the example of how to cite references at the end of the report as per APA referencing style 5th edition.

The entries would be listed in alphabetical order on an actual reference page.

**For books:**

Surname, Initials (year), Tit le of Book, Publisher, Place of publication.
E.g. Harrow, R. (2005), No Place to Hid e, Simon & Schuster, New York, NY.

**For book chapters:**

Surname, Initials (year), "Chapter title", Editor's Surname, Initials, Title of Book, Publisher, Place of publication, pages.
e.g. Calabrese, F.A.(2005), "The early pathways: theory to practice – a continuum", in Stankosky, M.(Ed.), Creating the Discipline of Knowledge Management, Elsevier, New York, NY, pp. 15-20.

**For journals:**

Surname, Initials (year), "Title of article", Journal Name, volume, number, pages.
E.g. Capizzi, M .T. and Ferguson, R. (2005), "Loyalty trends for the twenty-first century", Journal of Consumer Marketing, Vol. 22 No. 2, pp. 72-80.

**For published conference proceedings:**

Surname, Initials (year of publication),"Title of paper", in Surname, Initials (Ed.), Title of published proceeding which may include place and date(s) held, Publisher, Place of publication, Page numbers.

e.g. Jakkilinki, R., Georgievski, M. and Sharda, N. (2007), "Connecting destinations with an ontology-based e-tourism planner", in Information and communication technologies in tourism

2007 proceedings of the international conference in Ljubljana, Slovenia, 2007, Springer-Verlag, Vienna, pp. 12-32.

**For unpublished conference proceedings:**

Surname, Initials (year), "Title of paper", paper presented at Name of Conference, date of conference, place of conference, available at: URL if freely available on the internet (accessed date).

E.g. Aumueller, D. (2005), "Semantic authoring and retrieval within a wiki", paper presented at the European Semantic Web Conference (ESWC), 29 May-1 June, Heraklion, Crete, available at: http://dbs.unileipzig.de/file/aumueller05wiksar.pdf (accessed 20 February 2007).

**For working papers:**

Surname, Initials (year), "Title of article", working paper [number if available], Institution or organization, Place of organization, date.

E.g. Moizer, P. (2003), "How published academic research can inform policy decisions: the case of mandatory rotation of audit appointments", working paper, Leeds University Business School, University of Leeds, Leeds, 28 March

**For encyclopedia entries (with no author or editor):**

Title of Encyclopedia (year) "Title of entry", volume, edition, Title of Encyclopedia, Publisher, Place of publication, pages.

E.g. Encyclopaedia Britannica (1926) "Psychology of culture contact", Vol. 1, 13th ed., Encyclopaedia Britannica, London and New York, NY, pp. 765-71.

**For newspaper articles (authored):**

Surname, Initials (year), "Article title", Newspaper, date, pages. E.g. Smith, A. (2008), "Money for old rope", Daily News, 21 January, pp. 1, 3-4.

**For newspaper articles (non-authored):**

Newspaper (year), "Article title", date, pages. E.g. Daily News (2008), "Small change", 2 February, p. 7.

**For electronic source s:**

if available online the full U RL should be supplied at the end of the reference, as well as a date that the resource was accessed.

E.g. Castle, B. (2005), "Introduction to web services for remote portlets", available at: http://www-128.ibm.com/developerworks/library/ws-wsrp/ (accessed 12 November 2007).

In case of more than one publication by the same author, list them in chronological order, with the older item appearing first. For more than one publication in one year by the same author, use small (lower case) letters to distinguish them (e.g. 1980a, 1980b), do not Number the references.

Below is the format for MRP common pages.

**A STUDY OF CAPITAL STRUCTURE IN INDIA AND ITS IMPACT ON CORPORATE PERFORMANCE**

**A**

**MANAGEMENT RESEARCH PROJECT**

**SUBMITTED TO**
**DHARMSINH DESAI UNIVERSITY**
**FOR THE PARTIAL FULFILLMENT OF**

# FOR THE DEGREE OF

# MASTER OF BUSINESS ADMINISTRATION (MBA)

SUBMITTED BY

**[Name of Student]**
**[Roll no.]**

UNDER THE GUIDANCE OF

**[Name of Faculty Guide]**

**CENTRE FOR MANAGEMENT STUDIES**
**DHARMSINH DESAI UNIVERSITY**
**NADIAD**
**2024**

## Certificate

This is to certify that Ms/Mr._____is a bonafide student of MBA Semester IV, Centre for Management Studies, Nadiad. He/She has successfully completed the project work as prescribed by the Dharmsinh Desai University in the partial fulfillment of the requirement of Master of Business Administration(MBA) Program for the academic year 2022-2024.

The Project Work titled as "[Project Title]".

Faculty guide

Dean

Faculty of Management and Information Sciences

## Declaration

I, the undersigned, hereby declare that the project report entitled, [project title] submitted by me to the University of ....., in partial fulfillment of the requirement for the award of degree of Master of Business Administration under the guidance of Prof. [Faculty guide name], is my original work and the conclusions drawn therein are based on the material collected by myself.

The Report submitted is my own work and has not been duplicated from any other source. I shall be responsible for any unpleased moment/situation.

Place:

Date:

[Student Signature]

[Student Name]

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| Executive Summary | II |
| Declaration | III |
| Acknowledgement | IV |
| List of tables | V |
| List of graphs/charts | VII |


Note:- for all these initial pages, give page numbers in roman figure.


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| 3.13 | hypothesis | |
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| 4.1 | Analysis and Interpretation | |
| | And others whatever comes in chapter 4 | |

| | | |
|---|---|---|
| | **Chapter 5 Conclusions** | |
| 5.1 | Summary of Findings | |
| 5.2 | Suggestions and Recommendations | |
| 5.3 | Conclusions | |
| 5.4 | Directions for Future Research | |
| | In a similar way for other chapters if it is there in the report | |
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**Sample literature review for chapter 2.**

**Global Context:-**

Wong (1987) has surveyed five SEZs of China. He has noted that Shenzen SEZ alone accounted for over half of the foreign investment in China. (50.6% in Shenzen, 2.9% in Zuhai, 3.7% in Shantou, 2.6% in Xiamen). Like T.Crane, Wong has noted that the main negative comment is the amount of **domestic capital invested** in the zones (particularly in infrastructure provision and in domestically linked enterprises) has so far outweighed the amount of foreign investment being attracted. He further remarks that the performance of SEZs in terms of foreign exchange earnings is less impressive. One of the main objectives of SEZs is technology transfer. However, in the Shenzen SEZs, more than 93% value of the industrial production came from labor-intensive industries. Until this date the problem of transportation, linkage to the area, water and electricity are unsolved. Another problem is the absence of well-trained professional staff and application

of outdated management method instead of modern management technique. Again the phenomenon rise in the price of land and rent and commodities is a serious problem.

T.D rane (1988) in his study has noted the following observations about SEZs performance in china. Cranes had tried to draw a comparison between domestic infrastructural spending and actual foreign investment in Shenzen as an important measure of SEZ‟s economic performance. He has recorded that the only year in which foreign investment has exceeded domestically financed construction of zones is year 1986. In 1987 all SEZs have recorded foreign trade deficits. Technology transfer was also very limited, with majority of foreign investment driving from Hongkong.

**Indian Context:-**

Roy (2002) is arguing that the postponement of reforms in state owned enterprises and banking system has now created a situation, which would make the sustenance of present economic growth quite difficult. Because of various tax exemptions, the government tax/GDP ratio is falling (31.2% in 1978 to 11.6% in 1997) and government has consequently relied upon state owned banks to channel the rapidly rising saving of the household sector to unreformed loss making state owned enterprises. The level of NPL (Non-performing Loans) has reached to such an extent that the entire financial system has become highly vulnerable. The researcher is also pointing out that there are some physical constraints on the further growth of Chinese economy such as environmental degradation, infrastructural bottlenecks and difficulty of increasing agricultural production (mainly due to shortage of arable land irrigation) to keep pace with population growth.

When IFC Team conducted a survey at Nepal SEZs (2008) following results came. Tax Incentives was the sole reason to operate in SEZs and the firms revealed that they cannot operate without them. Tax Incentives were listed as a one of the firms‟ top five investment site selection. Majority of the firms described the very beneficial impacts of tax incentives on their operations, while few of them indicated it as an important „sign‟ from government indicating that government values investment. When respondents were asked to evaluate and rank between tax incentives on one hand and other benefits like infrastructure, training and reforms on the other hand; most of the firm valued second option compared to tax incentives. As per the survey, one fear is that through tax incentives uncompetitive companies with bad management could derive short term benefits from tax breaks, but ultimately fail in their business venture. Some respondents said it would be better to reform the overall business environment and provide a level playing field. In alternatives of tax incentives, firms valued subsidized electricity, upgrade to infrastructure, no import tax on capital investment and accelerated capital depreciation on capital equipment.

## MBA SEMESTER – III
## SUBJECT : NEW ENTERPRISE MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credit | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | s | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- This course will take a participant through the nitty-gritty of taking decisions on capital allocation framework, generation and screening of project ideas, selecting a project, market & demand analysis, technical analysis, financial estimates & projections, risk analysis of investments, project financing, and finally implementation of a project successfully
.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Importance of this course & how learning it can help us? An overview:Capital investments: Importance & difficulties. Types of capital investments, Phases of capital budgeting, levels of decision making, facets of project analysis, feasibility study: A Schematic diagram, objectives of capital budgeting, common weakness in capital budgeting, Structures and frameworks | 2 | CO1 |
| [2] | Capital allocation framework:Key criteria, elementary investment options, portfolio planning models, strategic position and action evaluation (space), diversification debate, Investment in capabilities, strategic planning and capital budgeting | 2 | CO2 |
| [3] | Generation and screening of project ideas:Generation of ideas, monitoring the environment, Corporate appraisal, profit potential of industries: porter model, scouting for project ideas, project rating index, sources of positive net present value | 2 | CO2 |
| [4] | Market and demand analysis:<br>Situational Analysis & Specification of objectives, collection of secondary information, conduct of market survey, characterization of the market, demand forecasting, market planning | 2 | CO3 |
| [5] | Technical Analysis:<br>Manufacturing process/technology, technical arrangements, material inputs and utilities, product mix, plant capacity, location and site, machineries and equipment, structures and civil works, environmental aspects, project charts and layouts, schedule of project implementation | 2 | CO3 |
| [6] | Financial estimates and projections: | 2 | CO3 |

| | | | |
|---|---|---|---|
| | Cost of project, means of finance, estimates of sales and production, cost of production, working capital requirement and its financing, Profitability projections, Projected Cash flow statement, Projected Balance sheet, Multi-Year Projections | | |
| [7] | The Time Value of Money:<br>Time Lines and notation, future value of a single amount, present value of a single amount, future value of an annuity, present value of an annuity, Intra-ear compounding and discounting | **2** | CO3 |
| [8] | Investment Criteria:<br>Net present value, benefit cost ratio, Internal rate of return, Urgency, Payback period, Accounting rate of return, Assessment of various methods, Investment Appraisal: Indian Practice, Investment Appraisal: International Practice | **2** | CO3 |
| [9] | Project Cash Flows:<br>Elements of the cash flow stream, Basic principles of cash flow estimation, cash flow illustrations, cash flows for a replacement project, viewing a project from other perspectives, How financial institutions and the planning commission define cash flows, biases in cash flow estimation | **3** | CO3 |
| [10] | The cost of capital:<br>Some preliminaries, cost of debt and preference, cost of equity, determining the proportions, weighted average cost of capital, weighted marginal cost of capital schedule, floatation costs and the cost of capital, cost of capital in practice, How financial institutions calculate cost of capital | **3** | CO3 |
| [11] | Risk Analysis of single investments:<br>Sources, measures, and perspectives on risk, sensitivity analysis, scenario analysis, break-even analysis, Hillier model, simulation analysis, managing risk, project selection under risk, risk analysis in practice, how financial institutions analysis risk | **3** | CO3 |
| [12] | Social cost benefit analysis:<br>Rationale for SCBA, UNIDO approach, Net benefit in terms of economic (efficiency) prices, Income distribution impact, adjustment for merit and demerit goods, Shadow prices, SCBA by financial institutions | **3** | CO5 |
| [13] | Financing of projects:<br>Capital structure, menu of financing, equity capital, preference capital, internal accruals, term loans, debentures, working capital advance, miscellaneous sources, raising venture capital, raising capital in international markets | **3** | CO5 |
| [14] | Venture capital:<br>VC Investors, what is a VC investment, What makes a VC Investment different, The VC investment appraisal process and management, the Indian VC industry, Regulation of VC Industry in India, Current concerns of the Indian VC Industry, How to approach a VC fund | **3** | CO4 |
| [15] | Project definition | **2** | CO4 |

| | | | |
|---|---|---|---|
| | Time planning<br>Reference book: chapter 5 | | |
| [16] | Project management:<br>Forms of project organization, project planning, project control, human aspects of project management, Pre-Requisites for successful project implementation | **3** | CO4 |
| [17] | Network techniques for project management:<br>Development of project network, time estimation, determination of the critical path, scheduling when resources are limited, PERT model, CPM model, Network cost system | **3** | CO4 |
| [18] | Project review and administrative aspects:<br>Control of In-Progress projects, Post-Completion audits, Abandonment analysis, Administrative aspects of capital budgeting, Agency problem, Evaluating the capital budgeting system of an organization | **2** | CO5 |
| [19] | Text book: chapter 23<br>Critical chain project management<br>Reference book: chapter 6 | **2** | CO5 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

- Chandra Prasanna, 'Projects – Planning, Analysis, Financing, Implementation and Review', Fifth Edition, Tata McGraw Hill

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

- Harvey Maylor, Project Management', Third Edition, Pearson Education
- Goldratt Eliyanhu M, 'Critical Chain', Indian Productivity Council, Chennai

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Help students to analyze their entrepreneurial potential and To develop the confidence into a challenging career of entrepreneurship. |
| CO2 | Comprehension | To help them understand the challenges and evaluation of starting and managing new ventures |
| CO3 | Application | Explaining to prepare a bankable business plan which can be considered prerequisite for starting and obtaining finance |

| | | |
|---|---|---|
| **CO4** | Synthesis | To learn various tools/Techniques to manage the project |
| **CO5** | Analysis | To encourage them to become entrepreneurial manager should they decide to take up job as a manager in an organization |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| **CO1** | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | |
| **CO3** | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | |
| **CO4** | 2 | 1 | 2 | 3 | 1 | 2 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 2 | |
| **CO5** | 1 | 2 | 1 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 2 | 1 | 2 | |
| Avg | 2.2 | 2.2 | 2.2 | 2.4 | 2 | 2.4 | 2 | 2 | 2.4 | 2.6 | 2.2 | 2.2 | 2.4 | 2.2 | 2.2 | 2.4 | 2.25 |

## MBA SEMESTER – I
## SUBJECT: ORGANIZATIONAL BEHAVIOUR

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This course aims to make students aware of the concepts of behavioural sciences and their applications in the field of management. It encompasses skills on leadership, emotional intelligence, communication, negotiations, perceptions, diversity, stress management etc. which are required to be a successful professional in any field (and not only management).

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **What is Organizational Behavior?** What Managers Do, Enter Organizational Behavior, Disciplines That Contribute to the OB Field, There are Few Absolutes in OB, Challenges and Opportunities for OB, Coming Attractions: Developing an OB Model, Global Implications | 3 | CO1 |
| [2] | **Diversity in Organizations:** Diversity, Biographical Characteristics, Ability, Implementing Diversity Management Strategies, Global Implications, Summary and Implications for Managers. | 3 | CO1, CO3 |
| [3] | **Attitude and Job Satisfaction:** Attitudes, Job Satisfaction, Global Implications, Summary and Implications for Managers | 3 | CO1, CO3 |
| [4] | **Emotions and Moods:** What are Emotions and Moods?, Emotional Labor, Emotional Intelligence, OB Applications of Emotions and Moods, Global Implications, Summary and Implications for Managers | 3 | CO1, CO5 |
| [5] | **Personality and Values:** Personality, Values, Linking an individual's personality to workplace, Global Implications, Summary and Implications for Managers | 3 | CO2 |
| [6] | **Perception and Individual Decision Making:** What is Perception?, Perception: Making Judgments about others, The Link between perception and individual decision making, Decision Making in organizations, Influences on decision making: individual differences and organizational constraints, Global Implications, Summary and Implications for Managers | 3 | CO5 |
| [7] | **Motivation Concepts:** Defining Motivation, Early Theories, Contemporary Theories, Integrating Contemporary Theories of Motivation, Global Implications, Summary and Implications for Managers | 3 | CO1 |
| [8] | **Motivation:** From Concepts to Applications: Motivating by Job Design: The Job Characteristics Model, Employee Involvement, Using Rewards to motivate employees, Global Implications, Summary and Implications for Managers | 3 | CO2 |

| | | | |
|---|---|---|---|
| [9] | **Foundations of Group Behaviour:** Defining and Classifying Groups, Stages of Group Development, Group Properties: Roles, Norms, Status, Size and Cohesiveness, Group Decision Making, Global Implications, Summary and Implications for Managers | **3** | CO3, CO4 |
| [10] | **Understanding Work Teams:** Why Have Teams Become so popular?, Differences Between Groups and Teams, Types of Teams, Creating Effective Teams, Turning Individuals into Team Players, Beware! Teams Aren't Always the Answer, Global Implications, Summary and Implications for Managers | **3** | CO3, CO4 |
| [11] | **Communication:** Functions of Communication, The Communication Process, Direction of Communication, Interpersonal Communication, Organizational Communication, Choice of Communication Channel, Barriers to Effective Communication, Global Implications, Summary and Implications for Managers | **3** | CO1, CO4 |
| [12] | **Leadership:** What is Leadership? Trait Theories, Behavioral Theories, Contingency Theories, LMX, Charismatic Leadership and Transformational Leadership, Authentic Leadership, Mentoring, Challenges to the leadership construct, Finding and creating effective leaders, Global Implications, Summary and Implications for Managers | **3** | CO4 |
| [13] | **Power and Politics:** A Definition of Power, Contrasting Leadership and Power, Bases of Power, Dependency, Power Tactics, Sexual Harassment, Politics, Causes and Consequences of Political Behavior, The Ethics of Behaving politically, Global Implications, Summary and Implications for Managers | **3** | CO1 |
| [14] | **Conflict and Negotiation:** A Definition of conflict, Transitions in conflict thought, The conflict process, negotiations, Global Implications, Summary and Implications for Managers | **3** | CO5 |
| [15] | **Foundations of Organization Structure:** What is Organizational Structure? Common Organizational Design, New Design Options, Why Do Structures Differ?, Organizational Designs and Employee Behavior, Global Implications, Summary and Implications for Managers | **3** | CO4 |
| [16] | **Organizational Culture:** Why is Organizational Culture?, What Do Cultures Do?, Creating and sustaining culture, How Employees Learn Culture, Creating an Ethical Organizational Culture, Creating a Positive Organizational Culture, Spirituality and Organizational Culture, Global Implications, Summary and Implications for Managers | **3** | CO5 |
| [17] | **Organizational Change and Stress Management:** Forces of Change, Planned Change, Resistance to Change, Approaches to Managing Organizational Change, Creating a Culture of Change, Work Stress and Its Management, Global Implications, Summary and Implications for Managers | **2** | CO5 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The

format should be as per APA referencing format)

1. Robbins, S. P., Judge, T. A., & Vohra, N. *Organizational behaviour by Pearson 18e*. Pearson Education India.

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

1. Luthans, F. (1981). *Organizational behavior*. McGraw-Hill Book Company.
2. Newstrom John W, & Keith, D. (1998). Organizational Behavior: human behavior at work.
3. Pareek, U. (2012). Udai Pareek's Understanding organizational Behaviour, 3e. *OUP Catalogue*.
4. Rao, P. S. (2010). *Organisational behaviour*. Himalaya Publishing House.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Categorise the various levels of OB like individual, team and system. |
| CO2 | Comprehension | Explain the various concepts and theories of behavioural sciences. |
| CO3 | Application | Demonstrate different leadership styles and skills required for working in groups and teams |
| CO4 | Synthesis | Demonstrate the concepts of organisational behaviour and personality types. |
| CO5 | Analysis | Develop ability to solve the problems creatively and innovatively in the various managerial capabilities or roles. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO1 | 2 | 1 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 2 | 3 | 2 | 3 | 1 | |
| CO2 | 3 | 3 | 2 | 1 | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | |
| CO3 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | |
| CO4 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | |
| CO5 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | |
| | | | | | | | | | | | | | | | | | |
| Avg | 2.4 | 2 | 2.2 | 2 | 2.4 | 2.4 | 2 | 2 | 2.2 | 2.2 | 2 | 2.2 | 2.2 | 2 | 2 | 2 | |

## MBA SEMESTER – II
## SUBJECT: PRODUCTION AND OPERATIONS MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- To develop an understanding of the strategic importance of operations and how they provide a competitive advantage in the marketplace
- To understand the relationship between operations and other business functions, such as Marketing, Finance, Accounting, and Human Resources.
- To develop knowledge of the issues related to designing and managing operations and the techniques to do so.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Introduction to the Field:<br>The field of operations management, Operation as service, Historical development of OM, Review and discussion | 2 | CO1 |
| [2] | Operations Strategy and Competitiveness:<br>What is operations strategy? Operations priorities, The notion of Trade-offs, Order winners and Qualifiers, Operation strategy in services, meeting the competitive challenge | 2 | CO1 |
| [3] | Linear Programming using the Excel Solver: | 2 | CO2 |
| [4] | Project Management:<br>Definition of Project management, project control, organization structure, Critical path scheduling, time-oriented techniques, time-cost models, managing resources, PERT | 2 | CO5 |
| [5] | Product Design:<br>Product design process, design for the customer, quality function development, Value analysis, Value engineering | 2 | CO3 |
| [6] | Learning Curves:<br>Applications & Case, Organizational learning | 2 | CO3 |
| [7] | Process Analysis:<br>Types of process, Product-Process matrix | 2 | CO3 |

| | | | |
|---|---|---|---|
| [8] | Job Design and Work Measurement:<br>Job design decisions, behavioral considerations in job design, work methods, work measurements and standard | **2** | CO3 |
| [9] | Manufacturing Process Selection and Design: | **2** | CO3 |
| [10] | Facility Layout:<br>Basic production Layout formats, Process layout, product layout, Group technology layout, fixed-position layout, Retail service layout | **2** | CO2 |
| [11] | Service Process Selection and Design:<br>Nature of services, operational classification of services, designing service organization | **2** | CO3 |
| [12] | Waiting Line Management:<br>The queuing system, customers arrivals, waiting line models | **2** | CO5 |
| [13] | Quality Management: Focus on Six Sigma:<br>Quality management and the Malcolm baldrige national quality awards, cost of quality, The singho system, fail safe design | **2** | CO5 |
| [14] | Process Capability and Statistical Quality Control:<br>Acceptance sampling, process control procedures, P Charts, X bar and R chart, Capability index | **2** | CO4 |
| [15] | Operations Consulting and Reengineering | **2** | CO4 |
| [16] | Supply Chain Strategy:<br>Supply chain management: Make or buy, outsourcing, Value density ,Electronic information flow | **2** | CO4 |
| [17] | Strategic Capacity Management: | **2** | CO4 |
| [18] | Facility Location:<br>Issues in facility location, plant location methods, center of gravity method, Ardlan Huristic method | **2** | CO2 |
| [19] | Lean Production:<br>Concept and application in lean production | **2** | CO5 |
| [20] | Forecasting:<br>Demand management, types of forecasting, qualitative techniques in forecasting, time series analysis: simple moving average, weighted moving average, exponential smoothing method | **2** | CO3 |
| [21] | Aggregate sales and Operations Planning:<br>Overview of operations planning activities, Hierarchical production planning, Aggregate production planning | **2** | CO2 |
| [22] | Inventory Control:<br>Definition of Inventory, Purpose of inventory, fixed-order quantity model, fixed-time period model, three simple inventory systems, ABC inventory planning | **2** | CO4 |
| [23] | Material Resource Planning: | **2** | CO4 |

| | | | |
|---|---|---|---|
| | MRP, MRP II, JIT in MRP, Lot sizing in MRP systems: Lot-for-Lot, Economic Order Quantity, Least total cost, least unit cost, lot size choice | | |
| [24] | Operation Scheduling:<br>The nature and importance of work centers, priority rules and techniques | **2** | CO4 |
| [25] | Simulation: | **2** | CO4 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

- Richard B Chase, F Robert Jacobs, Nicholas J Aquilano, Nitin K Agarw al, Operations Management for Competitive Advantage, Eleventh Edition,McGraw-Hill Education (India) Ltd, ISBN 0-07-060448-7

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

- Roberta S Russell and Bernard W Taylor III, Operations Management, Fourth (or later) Edition, Pearson Education, ISBN 81-297-0006-9
- B Mahadevan, Operations Management – Theory and Practice, Pearson Education, ISBN 81-7758-564-9
- Kachru Upendra, Production and Operations Management, Excel Books, Latest Edition

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | To understand the basic concepts and strategies in operations and production activities. |
| CO2 | Comprehension | To identify factors influencing plant location and plant layout |
| CO3 | Application | To understand production process & services and execute the customer order timely |
| CO4 | Synthesis | To know how to manage the materials, manpower efficiently and effectively by using appropriate inventory management methods, scheduling and material requirement planning |
| CO5 | Analysis | Summarize different queuing situations, Project and quality management tools & techniques |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO1 | 3 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | |
| CO2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | |
| CO3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | |
| CO4 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 2 | |
| CO5 | 1 | 2 | 1 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 2 | 1 | 2 | |
| Avg | 2.2 | 2 | 2.2 | 2.4 | 2 | 2.4 | 2.2 | 2.2 | 2.4 | 2.6 | 2.2 | 2.2 | 2.4 | 2.2 | 2.2 | 2.4 | 2.2625 |

## MBA SEMESTER – I

## SUBJECT: QUANTITATIVE TECHNIQUES

| Teaching Scheme (Hours/Week) | | | | Credit | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | s | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- To make students knowledgeable about business statistics, that is, understanding how the methods of statistics can be applied successfully to decision-making processes

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Organizing and Summarizing data: Statistics in business, Why and who uses statistics, How to arrange data, Raw data, Data array, the frequency distribution, constructing a frequency distribution, Charts & Graphs Descriptive statistics, Inferential statistics | 3 | CO1 |
| [2] | Measure of Central tendency, Measure of dispersion:Discrete & Continuous distribution, Arithmetic mean, Weighted mean, Geometric mean, median, mode, Dispersion, ranges, average deviation measures, relative dispersion, EDA | 3 | CO1 |
| [3] | Basic Probability: The study of odds and ends, basic terminology in probability, three types of probability, Probabilities under conditions of statistical independence, probabilities under conditions of statistical dependence, revising prior estimates of probabilities: Bayes' theorem | 3 | CO2 |
| [4] | Probability distributions, Random variable Expected Values Binomial Distribution, Poisson distribution, Normal distribution, Exponential distribution, uniform distribution, Hyper-geometric distribution | 3 | CO2 |
| [5] | Sampling and Sampling distribution: Introduction to sampling, random sampling, design of experiments, introduction to sampling distribution, sampling distributions in more detail, an operation consideration in sampling: the relationship between sample size and standard error | 3 | CO3 |
| [6] | Confidence Interval Estimation: Point estimates, Interval estimates and confidence intervals, calculating interval estimates of the mean from large samples, calculating interval estimates of the proportion from large samples, interval estimates using the t distribution, determining the sample size in estimation. | 3 | CO3 |
| [7] | Analysis of Variance (ANOVA) | 3 | CO4 |
| [8] | Testing of Hypothesis, One sample Test:Concepts basic to the hypothesis-Testing procedure, Hypothesis testing of means when the population standard deviation is known, Hypothesis testing of proportions: large samples | 3.5 | CO4 |

| | | | |
|---|---|---|---|
| [9] | Testing of Hypothesis, Two sample Test:Hypothesis testing for differences between means and proportions, Tests for differences between means: large sample sizes, small sample sizes, with dependent sample | **3.5** | CO4 |
| [10] | Chi-Square Test: Introduction, Chi-Square as a test of independence, Chi-Square as a Test of Goodness of Fit: Testing the appropriateness of a distribution | **3.5** | CO4 |
| [11] | Regression analysis: Estimation Using the Regression Line, Correlation Analysis, Making Inferences about population parameters, Using regression and correlation analysis, multiple regression analysis, Cases | **3.5** | CO5 |
| [12] | Non parametric Methods: Sign Test for paired data, Rank sum test: The Mann-Whitney U test and the Kruskal-Wallis Test, Run Test, Rank Correlation, The Kolmogorov-Smirnov Test | **3** | CO5 |
| [13] | LP Model formulation | **3** | CO5 |
| [14] | LP: Graphical Solution Method | **3** | CO5 |
| [15] | LP: Sensitivity Analysis | **3** | CO5 |
| [16] | Transportation Problem, Assignment Problem | **3** | CO5 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

- Levin Richard, Rubin David S., Statistics for Management, Seventh Edition, Pearson Education
- Sharma J.K., Quantitative Techniques for Managerial Decision, Macmillan

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

- Black Ken, Business Statistics for Contemporary Decision Making, Wiley StudentEdition, Sixth or later edition
- Huda R.P., Statistics for Business Economics, Third Edition, Macmillan

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Interpret appropriate numerical data used in everyday life in numerical, use measures of location, measures of dispersion for grouped and ungrouped data. |
| CO2 | Comprehension | Determining probabilities for various events. |
| CO3 | Application | Summarize discrete and continuous probability distributions to various business problems. |
| CO4 | Synthesis | Learn about a variety of sampling methods including random |

| | | |
|---|---|---|
| | | and non-random sampling. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. |
| **CO5** | Analysis | Compute and interpret the results of Regression and Correlation Analysis, transportation and assignment problems, linear programming problems |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| **CO1** | 3 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | |
| **CO3** | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | |
| **CO4** | 3 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 2 | 2 | 3 | |
| **CO5** | 1 | 3 | 2 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 2 | 1 | 2 | |
| Avg | 2.4 | 2.4 | 2.4 | 2.2 | 2 | 2.4 | 2 | 2 | 2.4 | 2.6 | 2.2 | 2.2 | 2.4 | 2.4 | 2.2 | 2.6 | 2.3 |

## MBA. SEMESTER – III

## SUBJECT: SECURITY ANALYSIS & PORTFOLIO MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

The course acquaints students with notions of Investments and Securities Market Structure. It leads them in to discussion of Modern Investment and Portfolio Theories and equips them with ability to carry out Security Valuations, and Creations and Monitoring of Investment Portfolios.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Introduction to Investment and Securities: Investment, Gambling, Speculation, Investment Objectives, Sweat Equity, Warrants, non-voting shares, Hedging | 3 | CO1 |
| [2] | Investment Alternatives: Negotiable and Non-negotiable instruments, Other types of investments | 2 | CO1 |
| [3] | Stock Market Indices: Computation of Index, The BSE Sensitive Index, NSE-50 index (Nifty), CNX Nifty Junior, S&P CNX 500, Selection Criteria | 2 | CO5 |
| [4] | The Securities and Exchange Board of India: Powers and Functions of SEBI, Legislation governing SEBI functions, Primary and Secondary Market Regulations, Critical Review of SEBI | 2 | CO1 |
| [5] | Risk and Return: Types of Risks, Minimizing Risk Exposure, Risk Measurement: The anticipated Return, Present Value of Return, Multiple Year Holding Period | 3 | CO1<br>CO3 |
| [6] | Debt Instruments and their Valuations: Players in the Debt Market, Valuation of Debt Instruments, Running Yield, Yield to Maturity, Redemption Yield, Holding Period Yield, yields to Call/Put, Yields on Index Linked Bonds, Yield Curves, Risk Management in Bonds, Bond Duration, Convexity, Dispersion | 3 | CO2 |
| [7] | Term Structure of Interest Rates and Bond Portfolio Management: Yield to Maturity, Time Maturity, Interest Rate Theory and Bond Portfolio | 3 | CO2 |
| [8] | Fundamental Analysis: Economic Analysis, Industry Analysis, Company Analysis, Earnings of the Company, Financial Statement Analysis | 3 | CO2<br>CO3 |

| | | | |
|---|---|---|---|
| [9] | Equity Instruments and Their Valuation: Share Valuation, Earnings Valuation, Revenues Valuation, Cash Flow Valuation, Asset Valuation, Yield Valuation, Valuation of Private Companies | 3 | CO1<br>CO3 |
| [10] | Technical Analysis: Line Charts, Line and Volume Charts, Reversal Patterns, Continuation Patterns, Bar Charts, Candle Stick Charts, Point and Figure Chart, Dow Theory, Elliott Wave Theory, Flow of Funds, Market Structure, Market Indicators | 3 | CO4 |
| [11] | Efficient Market Theory: Basic Concepts, Random Walk Theory, Weak Form of EMH, Predictability of Stock Returns, Semi Strong Form, Strong Form, The Essence of the Theory, Market Inefficiencies | 3 | CO1<br>CO4 |
| [12] | Portfolio Construction: Approaches in portfolio construction, Determination of Objectives, Selection of the Portfolio | 3 | CO5 |
| [13] | Portfolio Markowitz Model: Simple Diversification, The Markowitz Model, Risk and Return with different correlation, Markowitz Efficient Frontier | 3 | CO5 |
| [14] | The Sharpe Index Model: Single Index Model, Corner Portfolio, Sharpe's Optimal Portfolio, Optimum Portfolio with Short Sales | 3 | CO5 |
| [15] | Capital Asset Pricing Theory and Arbitrage Pricing Theory: The CAPM, Assumptions, Arbitrage Pricing Theory | 3 | CO4 |
| [16] | Portfolio Evaluation: Mutual Funds, Sharpe's Performance Index, Treynor's Performance Index, Jenson's Performance Index | 3 | CO5 |
| [17] | Portfolio Revision: Passive and Active Management, The Formula Plan, Variable Ratio Plan, Revision and the Cost | 3 | CO5 |
| [18] | Contemporary Issues: International Diversification, Basics of Derivatives Trading and Hedging | 2 | CO1<br>CO4 |

## C. TEXT BOOKS

1. Chandra, Prasanna, *"Security Analysis and Portfolio Management"*, Tata McGraw Hill

## D. REFERENCE BOOKS


1. Bodie, Kane, Marcus and Mohanty, *"Investment* "Eighth Edition, McGraw Hill, Indian Edition, New Delhi
2. Fischer, Jordan, *"Security Analysis and Portfolio Management",* Pearson Education, New Delhi
3. Bhalla, V K, *"Investment Management"*, 10th Edi, S Chand, Publication
4. Madhumati, Rangnathan, *"Investment Analysis and Portfolio Management"*, Pearson Education, New Delhi
5. Pandya, Falguni, "Security Analysis and Port Folio Management", Jaico Publication, New Delhi, First Edition

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | To present approaches of investment analysis and measure risk and return of a single security |
| CO2 | Comprehension | To explain type of debentures and validate the value of a bond using Bond Yield measures. |
| CO3 | Application | To assess the value of an equity share using DDM and P/E approach. |
| CO4 | Synthesis | To estimate risk, return of a portfolio, minimum risk of a portfolio and Detect overpricing and under-pricing of a stock using CAPM model. |
| CO5 | Analysis | To measure Portfolio using portfolio performance measures. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | |
| CO2 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | |
| CO3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | |
| CO4 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | |
| CO5 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | |
| .. | | | | | | | | | | | | | | | | | |
| Avg | 2.8 | 2.6 | 2.6 | 2.2 | 2.4 | 2.2 | 2.6 | 2.2 | 2.4 | 2.8 | 2.4 | 2.2 | 2.6 | 2.2 | 2.8 | 2.2 | |

## MBA SEMESTER – III
## SUBJECT: STRATEGIC BRAND MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 0 | 4 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

- To develop an understanding of basic branding principles and their exposure to classic and contemporary branding applications
- To make the students aware about the role of brands, the concept of brand equity, and the advantages of creating strong brands.
- To increase understanding of the important issues in planning, implementing, and evaluating brand strategies.
- To acquaint the students with the appropriate concepts, theories, models and other tools to make better brand decisions.
- To understand the latest developments and cultivate an understanding of the adjustments to be made in branding strategies over time and geographic boundaries to maximize brand equity.

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| 1. | • Introduction to Strategy (Reading material)*<br>• Formulating marketing strategies (Reading Material)*<br>• Brands and Brand Management (Ch.1)<br>Case:1Mountain man brewing company: bringing the brand light (Reading Material)* | 5 | CO1<br>CO2<br>CO3 |
| 2. | • Brand Positioning and Values (Ch.3)<br>• What are brands good for? (Reading Material)*<br>Case:2 Intel Corporation: Branding an Ingredient | 2 | CO1<br>CO2 |
| 3. | • Customer Based Brand Equity (Ch.2)<br>• Viewing brands in multiple dimensions (Reading material)*<br>Case: 3 Pepsi Cola Pakistan* | 3 | CO2<br>CO3 |
| 4. | • Choosing Brand Elements to Build Brand Equity (Ch 4)<br>• Are the Strategic stars aligned for your corporate brand? (Reading material)* | 2 | CO4<br>CO5 |

| | | | |
|---|---|---|---|
| 5. | • Designing Marketing Programs to Build Brand Equity (Ch 5)<br>Case:4 MTV: Building Brand Resonance | 2 | CO1<br>CO2 |
| 6. | • Integrating Marketing Communications to Build Brand Equity (Ch.6)<br>• Integrated marketing as management of holistic consumer experience (Reading material)*<br>Case-5 DuPont: Managing a Corporate Brand | 4 | CO2<br>CO5 |
| ***7.*** | • Leveraging Secondary Brand Knowledge to Build Brand Equity (Ch 7)<br>Case:6 Starbucks: Managing a High Growth Brand | 3 | CO2<br>CO5 |
| 8. | • Developing a Brand Equity Measurement & Management System (Ch 8)<br>• Case: 7 Red Bull: Building Brand Equity in New Ways | 3 | CO1<br>CO3 |
| ***9.*** | • Measuring Sources of Brand Equity: Capturing Customer Mindset (Ch 9)<br>• Prioritize Brands in the Portfolio (Reading Material)*<br>Case -8 Nivea: Managing a Brand Portfolio. | 3 | CO1<br>CO3 |
| ***10.*** | • Measuring Outcomes of Brand Equity: Capturing Market Performance (Ch 10)<br>• Don't let your brand falter during a Downturn (Reading Material)*<br>• Case: 9 California Milk Processor Board: Branding a Commodity. | 3 | CO1<br>CO2<br>CO4 |
| 11. | • Designing and implementing Brand Strategies (Ch 11)<br>Case: 10 Snapple: Revitalizing a Brand | 3 | CO2<br>CO3 |
| 12. | • Introducing and naming New Products & Brand Extensions (Ch 12)<br>• Case: 11 Accenture: Rebranding and Repositioning a Global Power Brand | 3 | CO1<br>CO2 |
| 13. | • Managing Brands over Geographic Boundaries & Market segments (Ch 14)<br>Case: 12 Yahoo!: Managing an Internet Brand | 4 | CO2<br>CO3 |
| 14. | • Managing Brands over time (Ch 13)<br>• Case: 13 Levi's Dockers: Building a Sub-brand | 4 | CO1<br>CO2 |
| 15. | • Closing Observations (Ch 15)<br>• Case: 14 Nike: Building a Global Brand | 3 | CO1<br>CO4<br>CO5 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

1. Strategic Brand Management, Kevin Lane Keller, Ambi M.G. Parmeswaran and Issac Jacob, 4th Edition, Pearson Education.

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

2. Strategic Brand Management, Creating & Sustaining Brand Equity Long term, Jean Noel Kapferer, 2nd Edition, Kogan Page
3. Building Strong Brands, David A. Aaker, Free Press

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Develop an understanding about Product and brand as Marketing Functions. |
| CO2 | Comprehension | Develop an Idea of Product Market evolution. |
| CO3 | Application | Familiarise students about Brand Management. |
| CO4 | Synthesis | Identify about brand positioning and Brand Equity |
| CO5 | Analysis | Develop students to make brand strategies. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| CO 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | |
| CO 3 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 1 | |
| CO 4 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 1 | 2 | 2 | |
| CO 5 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | |
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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Avg** | 2.2 | 2.4 | 2 | 2.4 | 2 | 2 | 2.2 | 2 | 2 | 2.4 | 2 | 2 | 2.2 | 2 | 1.8 | 2 | 2.1 |

## MBA SEMESTER – IV
## SUBJECT: SALES AND DISTRIBUTION MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

### A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- To acquaint the students with the concepts, theories, tools & techniques of sales management
- To develop skills of personal selling involving high involvement products
- To develop the skills of managing and leading a sales force
- To understand different channel formats to distribute the products
- To understand different sources, methods to resolve conflicts in marketing channels

### B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | Cos |
|---|---|---|---|
| [1] | Sales Management and the Business Enterprise:<br>Evolution of the sales department, Sales management, objectives of sales management, sales management & financial results, sales executive as coordinator | 2 | CO1 |
| [2] | Sales Management, Personal Selling and Salesmanship:<br>Buyer-Seller Dyads, Diversity of Personal-Selling Situations, Theories of Selling: AIDAS theory of selling, ―Right set of circumstances‖ theory of selling, ―Buying formula‖ theory of selling, ―Behavioral equation‖ theory, Prospecting, Sales Resistance, Closing Sales | 2 | CO1 |
| [3] | Setting Personal-Selling Objectives:<br>Types of personal selling objectives, Market potential, sales potential, sales forecast, Analyzing Market Potential: Market identification, Market motivation, Analysis of Market potential,<br>Market indexes, Sales forecasting Methods, Converting industry forecast to company sales forecast | 2 | CO1 |
| [4] | Determining Sales-Related Marketing Policies:<br>Product Policies- Relation to product objectives, product line policy, product design policy, product quality and service policy<br>Distribution policies: policies on marketing channels, policies on distribution intensity<br>Pricing Policies- Who to sell: policies on marketing channels, policies on pricing relative to costs, policy on uniformity of prices to different buyers, policy on list pricing, policy on discounts, geographical pricing policies, | 2 | CO2 |

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|---|---|---|---|
| | policy on price leadership, product line pricing policy, competitive bidding policy | | |
| **[5]** | Formulating Personal-Selling Strategy:<br>Competitive Settings and Personal-selling strategy, pure competition, Monopolistic competition, Oligopolistic competition, No direct competition, Personal-selling objectives and personal-selling strategy, sales-related marketing policies and personal-selling strategy | 2 | CO2 |
| **[6]** | The Effective Sales Executive:<br>Nature of sales management positions: position guide- sales manager, position guide- district sales manager<br>Functions of the sales executive, qualities of effective sale executives, relations with top management, compensation patterns for sales executives | 2 | CO3 |
| **[7]** | The Sales Organization:<br>Purpose of Sales organization, Setting up a sales organization, basic types of sales organizational structures, field organization of the sales department, Centralization versus decentralization in sales force management, schemes for dividing line authority in the sales organization | 2 | CO4 |
| **[8]** | Sales Department Relations: Interdepartmental relations and coordination, coordination of personal selling with other marketing activities, coordination of personal selling with other departments, sales department‘s external relations | 2 | CO4 |
| **[9]** | Distributive Network Relations: Setting up cooperative programs, role of manufacturer‘s sales force, objectives and methods of manufacturer-distributive-network cooperation, Distributive-Network changes and maintaining relations | 2 | CO3 |
| **[10]** | Quotas: Objectives in using quotas, Quotas, the sales forecast, and sales budget, types of quotas and quota-setting procedures, administering the quota system, reasons for not using sales quotas | 2 | CO3 |
| **[11]** | Sales Territories: The sales territory concept, reasons for establishing/ revising sales territories, procedures for setting up or revising sales territories, deciding assignment of sales personnel to territories, routing and scheduling sales personnel | 2 | CO3 |
| **[12]** | Marketing Channels: Structure and Functions:<br>What is a marketing channel?<br>Why do marketing channels exist and change?: Demand side factors, supply side factors Who belongs to a marketing channel?<br>A framework for channel analysis-<br>Channel Design: Segmentation, channel structure decisions, splitting the workload, degree of commitment, Gap analysis<br>Channel Implementation: Identifying power sources, Identifying channel conflicts, The goal of channel coordination, Insights for specific channel institutions | 2 | CO5 |

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|---|---|---|---|
| [13] | Segmentation for marketing channel design : service outputs-<br>End-User channel preferences, service outputs, Segmenting the market by service output demands, Meeting service output demands, The role of service output demand analysis in marketing channel design | 2 | CO4 |
| [14] | Supply-side channel analysis: channel flows and efficiency analysis-<br>Channel flows defined: Eight Generic channel flows, Customizing the list of flows for a particular channel, who does which channel flows?<br>Describing the current channel with the efficiency template, Using channel flow concepts to design a Zero-based channel, Matching Normative and actual profit Shares: The equity principle<br>Channel flow analysis as part of the overall channel audit process | 2 | CO4 |
| [15] | Supply-side channel analysis: channel structure and intensity:<br>Coverage versus Assortment: Framing the decisions of upstream and downstream channel members: Why more coverage is better for manufacturers of convenience goods, why downstream channel members dislike intensive distribution, Can the manufacturer sustain intensive distribution?<br>Degree of category exclusivity: The downstream channel member‘s decision<br>Striking a Deal: How much selectivity to trade away-<br>The Threat of complacency, The nature of the product category, Brand Strategy: Quality positioning and premium pricing, Brand Strategy: Target market<br>Bargaining for influence over channel members: Desired coordination, manufacturer-specific investments by downstream channel members, Dependence balancing: Trading Territory Exclusivity: for category exclusivity<br>Reassurance: Using selectivity to stabilize fragile relationships, The price of the concession: Factoring in opportunity cost<br>Back to the basics: Cutting costs and raising sales: Saving money by limiting the number of trading partners, do more trading partners really mean more revenue?, A caution on the issue of limiting the number of trading partners Simulating the benefits of selectivity while maintaining Intensive coverage, going to market via multiple types of channels, Dual distribution: Going to market via multiple types of channels, dual distribution, carrier-rider relationships | 2 | CO5 |
| [16] | Gap analysis:<br>Sources and types of channels Gaps, closing channel gaps, Pulling it together: the Gap analysis template | 2 | CO3 |
| [17] | Channel power: Getting it, using it, Keeping it-<br>The nature of power, power as the mirror image of dependence, The greatest source: Reward power, Four more sources of power, The balance of power, Exercising power: influence strategies | 2 | CO4 |
| [18] | Managing Conflict to increase channel coordination:<br>Assessing the Degree and nature of channel conflict, the consequences of conflict, major sources of conflict in marketing channels, clash of market | 2 | CO4 |

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|---|---|---|---|
| | domains, fueling conflict, conflict resolution strategies: How they drive conflict and shape channel performance-<br>Resolving conflict: Institutionalized mechanisms designed to contain conflict early, styles of conflict resolution: How channel members handle disputes and negotiate to achieve their goals, resolving conflict and achieving coordination via incentives | | |
| **[19]** | Strategic alliances in distribution: Strategic alliances: Their nature and the motives for creating them, building commitment by creating mutual vulnerability, building commitment by the management of daily interactions, decision structures that enhance trust, moving a transaction through stages of development to reach alliance status, Putting it all together: What does it take and when does it pay to create a marketing channel alliance? | 2 | CO4 |
| **[20]** | Vertical integration in Distribution:<br>The costs and benefits of vertical integration in marketing channels: Degrees of vertical integration, costs and benefits of the choice to make, the choice to buy distribution: Terms of payment to third parties<br>Deciding when to vertically integrate forward: An economic framework Return on Investment: The usual criterion, Outsourcing as the starting point, six reasons to outsource distribution, Vertical integration forward when competition is low, Vertical integration to cope with environmental uncertainty, vertical integration to reduce performance ambiguity, vertical integration as an observatory on the market or as an option: Economic rationality or rationalization? | 2 | CO4 |
| **[21]** | Legal constraints on marketing channel policies: market coverage policies, customer coverage policies, pricing policies, product line policies, product line policies, selection and termination policies, ownership policies | 1 | CO4 |
| **[22]** | Retailing: Retailing defined, choosing a retail positioning strategy, strategic issues in retailing | 2 | CO5 |
| **[23]** | Wholesaling: Wholesaling: An overview of the wholesaling sector, what the independent wholesaling sector offers: The essential tasks, Federations of wholesalers, voluntary and cooperative groups, consolidation, export distribution, The future of wholesaler-distributors, A sketch of vertical integration and of agents in wholesaling | 2 | CO5 |
| **[24]** | Franchising: What is franchising? What becomes a franchisee? What become a franchisor? The historical roots of franchising, The franchise contract, why franchise systems include company outlets, ongoing challenges facing the franchisor | 2 | CO5 |
| **[25]** | Logistics and supply chain management: The impact of logistics and supply chain management, Responding efficiently, Responding rapidly, and putting it all together: What is the right supply chain? | 1 | CO5 |
| **[26]** | Group Presentation | 2 | CO2 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

- Richard R Still, Cundiff W Edward Govoni A P Norman, "Sales Management: Decision Strategy and Cases", Pearson Education; 5th Edition
- Coughlan, Anderson, Stern, Ansary and Nattarajan, "Marketing Channels", Pearson Education, 7th edition

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

- David Jobber,Geoffrey Lancaster, "Selling & Sales Management", Pearson, Latest Edition
- Panda Tapan K., Sahadev Sunil, "Sales & Distribution Management", Oxford, Latest Edition
- Havaldar, K. K. and Cavale, VM. 'Sales and Distribution Management', Tata McGraw Hill
- Chunawalla, S.A. Sales and Distribution Management, Himalaya Publishing House

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | To make them explore and understand the different techniques of selling and distribution of products |
| CO2 | Comprehension | To provide knowledge to understand the efficient way of implementing the sales and distribution strategies along with case studies and practical examples |
| CO3 | Application | To enable them to understand the different techniques of sales and distribution strategies in order to enable the employment in the organization |
| CO4 | Synthesis | To help them understand the Sales & Distribution functions as integral part of marketing functions in a business firm |
| CO5 | Analysis | To make them understand various channel formats & distribution structures in the organization |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 2 | 3 | 1 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | |
| CO2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | |
| CO3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | |
| CO4 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | |
| CO5 | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 2 | 1 | 1 | |
| Avg | 2.6 | 2.2 | 2.6 | 2.4 | 2.4 | 2.2 | 2.4 | 2.2 | 2.6 | 2.4 | 2.4 | 2 | 2.2 | 2 | 2 | 2 | 2.288 |

## MBA. SEMESTER – IV
## SUBJECT: STRATEGIC FINANCIAL MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

### A. COURSE OVERVIEW

- To develop the perspective of financial policy as a subset of corporate strategy & to have insight on financial decision situation.
- Identify and evaluate appropriate sources of finance, their risks and costs.
- Assess potential investment decisions and strategies.

### B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **Present Values, The Objectives Of The Firm And Corporation Governance**<br>● Introduction To Present Value<br>● Foundation Of The Net Present Value<br>● Corporate Goals And Corporate Governance | 2 | CO1 |
| [2] | **How to Calculate Present Values**<br>● Valuing Long Lives Assets<br>● Compound Interest And Present Value<br>● Nominal and Real Rate Of Interest | 2 | CO1 |
| [3] | **Why Net Present Value Leads To Better Investment Decision Than Other Criteria**<br>● A Review of Basics<br>● Payback<br>● Internal Rate Of Return | 2 | CO1<br>CO2 |
| [4] | **Making Investment Decision With The Net Present Value Rule**<br>● What To Discount<br>● Equivalent Annual Costs | 2 | CO1<br>CO2 |
| [5] | **Introduction To Risk, Return And The Opportunity Cost Of Capital**<br>● Capital Market History<br>● Measuring Portfolio Risk<br>● Calculating Portfolio Risk<br>● Diversification And Value Additivity | 4 | CO1<br>CO2<br>CO3 |
| [6] | **Risk And Return**<br>● The Relationship Between Risk And Returns<br>● Validity And Role Of The CAPM | 4 | CO3 |

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|---|---|---|---|
| [7] | **Capital Budgeting And Risk**<br>● Company And Project Costs Of Capital<br>● Measuring Cost Of Capital<br>● Discount Rate Of International Projects | 4 | CO1<br>CO2<br>CO3 |
| [8] | **A Project Is Not A Black Box**<br>● Sensitivity Analysis<br>● Monte Carlo Simulation<br>● Real Option And Decision Trees | 2 | CO2<br>CO4 |
| [9] | **Financing And Valuation**<br>● The After Tax WACC<br>● Valuing Business<br>● Adjusted Present Value | 2 | CO1<br>CO2 |
| [10] | **Understanding Options**<br>● Calls, Puts And Shares<br>● What Determine Option Values? | 2 | CO4 |
| [11] | **How Corporation Issue Securities**<br>● Venture Capital<br>● The Initial Public Offerings<br>● Securities Sales By Public Companies | 2 | CO1 |
| [12] | **Pay-out Policy**<br>● The Choice Of Payout Policy<br>● Dividend Payments And Stock Repurchase<br>● How Do Companies Decide On The Payout | 4 | CO2 |
| [13] | **Real Option**<br>● The Value Of Follow On Investment Opportunities<br>● The Timing Option<br>● Flexible Production | 1 | CO4 |
| [14] | **Valuing Option**<br>● A Simple Option-Valuation Model<br>● The Binomial Model<br>● The Black-Scholes Formula | 4 | CO4 |
| [15] | **Leasing And Hire Purchase**<br>● What Is Leasing?<br>● Why Lease?<br>● Operating Lease<br>● Hire-Purchase Arrangement | 2 | CO5 |
| [16] | **Financial Management Of Sick Units**<br>● Definition Of Sickness<br>● Causes Of Sickness<br>● Symptoms Of Sickness<br>● Prediction Of Sickness<br>● Debt Restructuring | 2 | CO5 |
| [17] | **Working Capital Management: Extension**<br>● Cash Budget Simulation<br>● Advance In Inventory Management<br>● Working Capital Leverage | 5 | CO5 |

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|---|---|---|---|
| [18] | **Value Based Management**<br>● Methods And Key Premises Of VBM<br>● Alcar Approach<br>● EVA Approach<br>● BCG Approach | **4** | CO5 |

## C. TEXT BOOKS

- Myers, B. &. (n.d.). *Principles of Corporate Finance* (Latest Edition ed.). The McGraw Hill.
- Chandra, P. (n.d.). *Financial Management, Theory and Practice* (Latest Edition ed.). The McGraw Hill

## D. REFERENCE BOOKS

- D.Balbirer, A. C. (n.d.). *Modern Corporate Finance* (Latest Edition ed.). Pearson Education.
- Lasher, W. R. (n.d.). *Practical FInancial Management* (Latest Edition ed.). Thomos House Western Publication
- Pandey, I. M. (n.d.). *Financial Management* (Latest Edition ed.). Vikas Publication.
- Patel, C. D. (n.d.). *A Guide to corporate Finance* (Latest Edition ed.). Bharat Law Publication.
- Patel, C. D. (n.d.). *Financial Derivatives - A Theory, Concepts and Problems* (Latest Edition ed.). Bharat Law Publication.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Estimating Cost of capital and examine the impact of capital budgeting decisions on a company's value |
| CO2 | Synthesis | Business valuation of corporations with an alignment of various financial decisions especially dividend and retention policy. |
| CO3 | Application | Explain the relationship between the risks and returns Capital emphasizing on Market History, Measuring Portfolio Risk, Diversification And value additivity including validity and role Of The CAPM. |
| CO4 | Comprehension | Financing and valuation of options based on the Binomial Model and The Black-Scholes models including real options. |
| CO5 | Analysis | Managing of working capital with practical implications and appraising value based management based on EVA, MVA, BCG Approach and Alcar Approach along with Leasing And Hire Purchase and managing sick units. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | . |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | |
| CO2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | |
| **CO4** | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | |
| **CO5** | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | |
| **..** | | | | | | | | | | | | | | | | | |
| **Avg** | 2.8 | 2.8 | 2.6 | 2.2 | 2.2 | 2.2 | 2.8 | 2.2 | 2.2 | 2.8 | 2.2 | 2.2 | 2.8 | 2.2 | 2.8 | 2.2 | |

## MBA SEMESTER – III
## SUBJECT: STRATEGIC MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

- To introduce the students to the competitive strategy and the competitive advantage
- To make students knowledgeable about all concepts of strategy formulation, development and implementation
- To develop an understanding about how is strategy is cross-functional in nature – i.e. it cuts across marketing, finance, HR and other functional areas

## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | **Introduction to Strategy:** What is Strategy? Strategic Management, Strategy as a Subject of Study, Strategic Management in Different Contexts, The Challenges of Strategic Management | 4 | CO1 |
| [2] | **The Environment:** Introduction, The Macro Environment, Industries and Sectors, Competitors and Markets, Opportunities and Threats | 4 | CO1 |
| [3] | **Strategic Capability:** Introduction, Foundation of Strategic Capability, Cost Efficiency, Capabilities for Sustainable Competitive Advantage, Organizational Knowledge, Diagnosing Strategic Capability, Managing Strategic Capability | 4 | CO1 |
| [4] | **Expectations and Purpose:** Introduction, Corporate Governance, Stakeholder Expectations, Business Ethics and Social Responsibility, The Cultural Context, Communicating Organizational Purposes | 5 | CO3 |
| [5] | **Business-Level Strategy:** Introduction; Identifying Strategic Business Units; Sustaining Competitive Advantage; Competitive Strategy in Hypercompetitive Conditions; Competition and Collaboration; Game Theory | 4 | CO3 |
| [6] | **Corporate-Level and International Strategy:** Introduction; Product/market Diversity; International Diversity and International Strategy; Value Creation and the Corporate Parent; Managing the Corporate Portfolio | 4 | CO3 |
| [7] | **Directions and Methods of Development:** Introduction, Directions for Strategy Development, Methods of Strategy Development, Success Criteria | 5 | CO4 |
| [8] | **Organizing for Success:** Introduction; Structural types: functional, multidivisional, holding company, matrix, transnational, team-based, project-based, choice of structure; Processes: direct supervision, Planning | 5 | CO4 |

| | | | |
|---|---|---|---|
| | processes, Self-control and personal motivation, Cultural processes, Performance targeting processes, Market processes; Relationships: Relating internally, relating externally; Configurations: Stereotypical configurations, Reinforcing cycles, Configuration dilemmas | | |
| [9] | **Enabling Success: Managing people:** People as a resource, People and behaviour, organizing people, Implications for managers; Managing information: Information and Strategic Capability, Information and changing business models, Information and structuring, Implications for Managers<br>**Technology**: Technology and the competitive situation, Diffusion of innovation, Technology and strategic capability, organizing technology development; Integrating resources; **Managing Finance:** Managing for value, Funding strategy development, Financial expectations of shareholders; Managing; **Technology:** Technology and the competitive situation, Diffusion of innovation, Technology and strategic capability, organizing technology development; Integrating Resources | **5** | CO4 |
| [10] | **Managing Strategic Change:** Diagnosing the Change Situation: The characteristics of strategic decisions, Types of Strategic Change, The Importance of Context, Organizational Structure as Context, Forcefield Analysis Styles of Managing Change, Roles in Managing Change; Levers for Managing Strategic Change: Turnaround, Managing rapid strategy reconstruction, Challenging the taken-for-granted, Changing organizational routines, Symbolic processes, Power and political processes, Communicating and monitoring change, Change tactics; Potential Pitfalls of Change Programmes | **5** | CO2<br>CO5 |
| [11] | **Understanding Strategy Development:**<br>Intended and Emergent Strategies; Intended Strategy Development: Strategy planning systems, Strategy workshops and project groups, Strategy consultants, externally imposed strategy; Emergent Strategy Development: Logical incrementalism, Resource allocation routines, Cultural processes, Organizational politics<br>Multiple Processes of Strategy Development; Challenges and Implications for Strategy Development: Challenge of strategy drift, Learning organization, Strategy development in uncertain and complex conditions, Managing strategy development processes | **5** | CO2<br>CO5 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

1. Johnson, G., Scholes, K., & Whittington, R. (2008). *Exploring corporate strategy: Text and cases*. Pearson education.

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

1. Milliken, J. (1997). Strategic Management: Concepts and Cases-Arthur A. Thompson JR, Irwin (1996), TMH.

2. Porter, M. E. (1985). Competitive Advantage: Creating and Sustaining Superior Performance, (Free Press; New York, NY).

3. Hill, C. W., Jones, G. R., & Schilling, M. A. (2014). *Strategic management: theory: an integrated approach*. Cengage Learning.

4. Hitt, M. A., Freeman, R. E. & Harrison, J. S. (Latest Edition) Handbook of Strategic Management,

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | To learn how to analyse the environmental strategic positioning of the organisation. |
| CO2 | Comprehension | To develop an understanding of strategic management as important concept for business organizations functioning. |
| CO3 | Application | To know the basic concepts of strategy formulation. |
| CO4 | Synthesis | To learn the alternatives available in strategic functioning of organizations. |
| CO5 | Analysis | To know the bases for implementation and execution of strategies. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO1 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | |
| CO2 | 1 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 1 | 3 | 2 | |
| CO3 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 3 | |
| CO4 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | |
| CO5 | 2 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | |
| | | | | | | | | | | | | | | | | | |
| Avg | 2.2 | 2.2 | 2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 1.8 | 2.2 | 2.4 | 2 | 2 | 2 | 2.2 | 2 | 2.125 |

## MBA SEMESTER – I
## SUBJECT: TECHNOLOGY IN MANAGEMENT

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4.5 | 0 | 0 | 4.5 | 4 | 50% | 20% | 30% | - | 100% |

## A. COURSE OVERVIEW

This section may include motivation, objectives, scope etc. of the subject. It is preferred to describe all in less than 7 lines.

- To make students knowledgeable of different information systems of organization.

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## B. COURSE CONTENT

| NO | TOPIC | L+T (hrs) | COs |
|---|---|---|---|
| [1] | Basic of Computers | **3.5** | CO1 |
| [2] | Microsoft Word: Introduction to Word, editing a Document, Move and Copy Text and Help System, Formatting Text and Paragraph, Finding & Replacing Text and Spell Check, Using Tabs, enhancing a Document, Columns, Tables and Other features, Using Graphics, Templates and Wizards, Using Mail Merge, Some Miscellaneous Features of MS-Word | **3.5** | CO3 |
| [3] | **Overview of PowerPoint:** What is PowerPoint? Creating a Presentation, PowerPoint Views, running a Slide Show, Printing a Presentation | **4** | CO3 |
| [4] | **MS Excel:** Simple features of spreadsheet: Formula, Copying, data table etc. Financial analysis with spreadsheet: (NPV, Data Table, Goal seek, Scenario) | **4** | CO3 |
| [5] | **Lookup function** (VLOOKUP, HLOOKUP, INDEX, MATCH) **Database features in spreadsheet** (Advanced data, Filter, DCOUNT, DSUM, DMAX) **Date arithmetic in spreadsheet** (YEAR, MONTH, WEEKDAY, DATE, TODAY) **Regression analysis and Matrix** Operation in spreadsheet Required statistical tests through spreadsheet | **4** | CO3 |
| [6] | Review | **3** | CO3 |
| [7] | Information Systems in Global Business Today<br>**Role of Information System in Business Today, Perspectives on Information Systems, Contemporary Approaches to Information Systems** | **4** | CO1 |
| [8] | E-Business: How Businesses Use Information Systems<br>Business Processes and Information Systems, Types of Information Systems, Enterprise Resource Planning (ERP) / Enterprise Applications, The Information Systems Functions in a Business | **3** | CO4 |
| [9] | Information Systems, Organizations and Strategy<br>**Organizations and Information Systems, How Information Systems Impact Organizations and Business Firms, Using Information Systems to Achieve Competitive Advantage** | **3** | CO4 |

| | | | |
|---|---|---|---|
| [10] | Ethical and Social Issues in Information Systems<br>Understanding Ethical and Social Issues Related to Systems, Ethics in an Information Society, The Moral Dimensions of Information Technology | **3** | CO5 |
| [11] | IT Infrastructure and Emerging Technologies<br>IT Infrastructure<br>Infrastructure Components<br>Contemporary Hardware Platform Trends<br>**Contemporary Software Platform Trends** | **3** | CO4 |
| [12] | Telecommunications, the Internet, and Wireless Technology<br>Telecommunication and Networking in Today's Business World<br>Communications Networks<br>The Global Internet<br>The Wireless Revolution | **3** | CO4 |
| [13] | Securing Information Systems<br>System Vulnerability and Abuse<br>Business Value of Security and Control<br>Establishing a Framework for Security and Control<br>Technologies and Tools for Protecting Information Resources | **3** | CO4 |
| [14] | Achieving Operational Excellence and Customer Intimacy: Enterprise Application<br>Enterprises systems<br>Supply chain Management Systems<br>Customer Relationship Management Systems<br>Enterprises Application: New Opportunities and Challenges | **3** | CO4 |
| [15] | E-Commerce: Digital Markets, Digital Goods<br>E – Commerce and the Internet | **3** | CO4 |

## C. TEXT BOOKS

(It is necessary that at least 85% of course content is covered in prescribed textbooks. The format should be as per APA referencing format)

- Laudon Kenneth, Laudon Jane, Management Information Systems, Latest Edition, Pearson Educatioin

## D. REFERENCE BOOKS

(The format should be as per APA referencing format)

- Jawadekar W S, Management Information Systems, 2nd Edition, TMH
- Gupta Uma, Management Information Systems – A Managerial Perspective, Galgotia Publications
- O'Brien J., Management Information Systems - Managing Information Technology in Business Entreprise, Tata McGraw Hill, Latest Edition

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Evaluate | Students are familiar with different business functions and Information Systems. |
| CO2 | Comprehension | Familiarize with network topologies and network types. |
| CO3 | Application | Students are taught about spreadsheet, word processing and presentation preparations |
| CO4 | Synthesis | Students are familiarized with e-commerce, electronic data exchange and e-governance environments. |
| CO5 | Analysis | Students are familiarized with the impact of information systems on organizations, challenges posed by information systems and how they should be addressed. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | |
| CO1 | 3 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | |
| CO2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | |
| CO3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | |
| CO4 | 2 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | 2 | 2 | |
| CO5 | 1 | 2 | 1 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 2 | 1 | 2 | |
| Avg | 2.2 | 2 | 2.2 | 2.4 | 2 | 2.4 | 2.2 | 2 | 2.4 | 2.6 | 2.2 | 2.2 | 2.4 | 2.2 | 2.2 | 2.4 | 2.25 |

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राष्ट्रीय आयुर्विज्ञान आयोग
**National Medical Commission**
**(Undergraduate Medical Education Board)**

**No. U.14021/8/2023-UGMEB** **Dated, the 01st August, 2023**

**Subject: - Competency Based Medical Education Curriculum (CBME) Regulations, 2023- National Medical Commission.**

Under Graduate Medical Education Board invited comments on draft Competency Based Medical Education Regulation 2023 vide Public Notice of even no. dated 23/06/2023.

2. After consideration of comments received, in exercise of powers conferred by the National Medical Commission Act, 2019 and particularly by sections 10, 24, 25, and 57 of the said Act, Under Graduate Medical Education Board publishes the Competency Based Medical Education Regulation 2023.

3. Regulation shall be effective from the date of its publication i.e.; 01/08/2023.

01/8/2023
**(Shambhu Sharan Kumar)**
**Director, UGMEB**

(1) o/c

# CBME CURRICULUM

## 1. Preamble

The new Graduate Medical Education Regulations attempts to stand on the shoulder of the contributions and the efforts of resource persons, teachers and students (past and present). It intends to take the learner to provide health care to the evolving needs of the nation and the world.

About 25 years have passed since the existing Regulations on Graduate Medical Education, 1997 were notified, necessitating a relook at all aspects of the various components in the existing regulations and adapt them to the changing demography, socio-economic context, perceptions, values, advancements in medical education and expectations of stakeholders. Emerging health care issues particularly in the context of emerging diseases, impact of advances in science and technology and shorter distances on diseases and their management also need consideration. The strong and forward-looking fundamentals enshrined in the Regulations on Graduate Medical Education, 1997 has made this job easier. A comparison between the 1997 Regulations and proposed Graduate Medical Education Regulations, 2019 will reveal that the 2019 Regulations have evolved from several key principles enshrined in the 1997 Regulations.

The thrust in the new regulations is continuation and evolution of thought in medical education making it more learner-centric, patient-centric, gender- sensitive, outcome -oriented and environment appropriate. The result is an outcome driven curriculum which conforms to global trends. Emphasis is made on alignment and integration of subjects both horizontally and vertically while respecting the strengths and necessity of subject-based instruction and assessment. This has necessitated a deviation from using "broad competencies"; instead, the reports have written end of phase subject (sub) competencies. These "sub-competencies" can be mapped to the global competencies in the Graduate Medical Education Regulations.

The importance of ethical values, responsiveness to the needs of the patient and acquisition of communication skills is underscored by providing dedicated curriculum time in the form of a longitudinal program based on Attitude, Ethics and Communication (AETCOM) competencies. Great emphasis has been placed on collaborative and inter-disciplinary

teamwork, professionalism, altruism and respect in professional relationships with due sensitivity to differences in thought, social and economic position and gender.

## 2. Objectives of the Indian Graduate Medical Training Programme

The undergraduate medical education program is designed with a goal to create an "Indian Medical Graduate" (IMG) possessing requisite knowledge, skills, attitudes, values and responsiveness, so that she or he may function appropriately and effectively as a physician of first contact of the community while being globally relevant. To achieve this, the following national and institutional goals for the learner of the Indian Medical Graduate training program are hereby prescribed.

## 3. National Goals

At the end of undergraduate program, the Indian Medical Graduate should be able to:

a. Recognize "health for all" as a national goal and health right of all citizens and by undergoing training for medical profession fulfill his social obligations towards realization of this goal.

b. Learn key aspects of National policies on health and devote himself to its practical implementation.

c. Achieve competence in practice of holistic medicine, encompassing promotive, preventive, curative and rehabilitative aspects of common diseases.

d. Develop scientific temper, acquire educational experience for proficiency in profession and promote healthy living.

e. Become exemplary citizen by observance of medical ethics and fulfilling social and professional obligations, so as to respond to national aspirations.

## 4. Institutional Goals

In consonance with the national goals, each medical institution should evolve institutional goals to define the kind of trained manpower (or professionals) they intend to produce. The Indian Medical Graduates coming out of a medical institute should:

a. Be competent in diagnosis and management of common health problems of the individual and the community, commensurate with his/her position as a member of the health team at the primary, secondary or tertiary levels, using his/her clinical skills based on history, physical examination and relevant investigations.

b. Be competent to practice preventive, promotive, curative, palliative and rehabilitative medicine in respect to the commonly encountered health problems.

c. Appreciate rationale for different therapeutic modalities; be familiar with the administration of the "essential drugs" and their common side effects.

d. Appreciate the socio-psychological, cultural, economic and environmental factors affecting health and develop humane attitude towards the patients in discharging one's professional responsibilities.

e. Possess the attitude for continued self-learning and to seek further expertise or to pursue research in any chosen area of medicine, action research and documentation skills.

f. Be familiar with the basic factors which are essential for the implementation of the National Health Programs including practical aspects of the following:

    i) Family Welfare and Maternal and Child Health (MCH);

    ii) Sanitation and water supply;

    iii) Prevention and control of communicable and non-communicable diseases;

    iv) Immunization;

    v) Health Education and advocacy;

    vi) Indian Public Health Standards (IPHS) at various level of service delivery;

    vii) Bio-medical waste disposal

    viii) Organizational and or institutional arrangements.

g. Acquire basic management skills in the area of human resources, materials and resource management related to health care delivery, general and hospital management, principal inventory skills and counseling.

h. Be able to identify community health problems and learn to work to resolve these by designing, instituting corrective steps and evaluating outcome of such measures with maximum community participation.

i. Be able to work as a leading partner in health care teams and acquire proficiency in communication skills.

j. Be competent to work in a variety of health care settings.

k. Have personal characteristics and attitudes required for professional life including personal integrity, sense of responsibility and dependability and ability to relate to or show concern for other individuals.

**5. Goals for the Learner**

In order to fulfill these goals, the Indian Medical Graduate must be able to function in the following roles appropriately and effectively:-

a. Clinician who understands and provides preventive, promotive, curative, palliative and holistic care with compassion.

b. Leader and member of the health care team and system with capabilities to collect, analyze, synthesize and communicate health data appropriately.

c. Communicator with patients, families, colleagues and community.

d. Lifelong learner committed to continuous improvement of skills and knowledge.

e. Professional, who is committed to excellence, is ethical, responsive and accountable to patients, community and profession.

f. Critical thinker who demonstrates problem solving skills in professional practice

g. Researcher who generates and interprets evidence

## 6. Competency Based Training Programme of the Indian Medical Graduate

Competency based learning would include designing and implementing medical education curriculum that focuses on the desired and observable ability in real life situations. In order to effectively fulfill the roles, the Indian Medical Graduate would have obtained the following set of competencies at the time of graduation:

**Clinician, who understands and provides preventive, promotive, curative, palliative and holistic care with compassion**

- Demonstrate knowledge of normal human structure, function and development from a molecular, cellular, biologic, clinical, behavioral and social perspective.
- Demonstrate knowledge of abnormal human structure, function and development from a molecular, cellular, biological, clinical, behavioral and social perspective.
- Demonstrate knowledge of medico-legal, societal, ethical and humanitarian principles that influence healthcare.
- Demonstrate knowledge of national and regional health care policies including the National Health Mission that incorporates National Rural Health Mission (NRHM) and National Urban Health Mission (NUHM), frameworks, economics and systems that influence health promotion, health care delivery, disease prevention, effectiveness, responsiveness, quality and patient safety.
- Demonstrate ability to elicit and record from the patient, and other relevant sources including relatives and caregivers, a history that is complete and relevant to disease identification, disease prevention and health promotion.
- Demonstrate ability to elicit and record from the patient, and other relevant sources including relatives and caregivers, a history that is contextual to gender, age, vulnerability, social and economic status, patient preferences, beliefs and values.
- Demonstrate ability to perform a physical examination that is complete and relevant to disease identification, disease prevention and health promotion.
- Demonstrate ability to perform a physical examination that is contextual to gender,

social and economic status, patient preferences and values.

- Demonstrate effective clinical problem solving, judgment and ability to interpret and integrate available data in order to address patient problems, generate differential diagnoses and develop individualized management plans that include preventive, promotive and therapeutic goals.
- Maintain accurate, clear and appropriate record of the patient in conformation with legal and administrative frameworks.
- Demonstrate ability to choose the appropriate diagnostic tests and interpret these tests based on scientific validity, cost effectiveness and clinical context.
- Demonstrate ability to prescribe and safely administer appropriate therapies including nutritional interventions, pharmacotherapy and interventions based on the principles of rational drug therapy, scientific validity, evidence and cost that conform to established national and regional health programmers and policies for the following:
    - Disease prevention,
    - Health promotion and cure,
    - Pain and distress alleviation, and
    - Rehabilitation and palliation.
- Demonstrate ability to provide a continuum of care at the primary (including home care) and/or secondary level that addresses chronicity, mental and physical disability.
- Demonstrate ability to appropriately identify and refer patients who may require specialized or advanced tertiary care.
- Demonstrate familiarity with basic, clinical and translational research as it applies to the care of the patient.

**Leader and member of the health care team and system**

- Work effectively and appropriately with colleagues in an inter-professional health care team respecting diversity of roles, responsibilities and competencies of other professionals.
- Recognize and function effectively, responsibly and appropriately as a health care team leader in primary and secondary health care settings.

- Educate and motivate other members of the team and work in a collaborative and collegial fashion that will help maximize the health care delivery potential of the team.
- Access and utilize components of the health care system and health delivery in a manner that is appropriate, cost effective, fair and in compliance with the national health care priorities and policies, as well as be able to collect, analyze and utilize health data.
- Participate appropriately and effectively in measures that will advance quality of health care and patient safety within the health care system.
- Recognize and advocate health promotion, disease prevention and health care quality improvement through prevention and early recognition: in a) life style diseases and b) cancer, in collaboration with other members of the health care team.

**Communicator with patients, families, colleagues and community**

- Demonstrate ability to communicate adequately, sensitively, effectively and respectfully with patients in a language that the patient understands and in a manner that will improve patient satisfaction and health care outcomes.
- Demonstrate ability to establish professional relationships with patients and families that are positive, understanding, humane, ethical, empathetic, and trustworthy.
- Demonstrate ability to communicate with patients in a manner respectful of patient's preferences, values, prior experience, beliefs, confidentiality and privacy.
- Demonstrate ability to communicate with patients, colleagues and families in a manner that encourages participation and shared decision- making.

**7. Lifelong learner committed to continuous improvement of skills and knowledge**

- Demonstrate ability to perform an objective self-assessment of knowledge and skills, continue learning, refine existing skills and acquire new skills.
- Demonstrate ability to apply newly gained knowledge or skills to the care of the patient.
- Demonstrate ability to introspect and utilize experiences, to enhance personal and professional growth and learning.

- Demonstrate ability to search (including through electronic means), and critically re-evaluate the medical literature and apply the information in the care of the patient.
- Be able to identify and select an appropriate career pathway that is professionally rewarding and personally fulfilling.

**Professional who is committed to excellence, is ethical, responsive and accountable to patients, community and the profession**

- Practice selflessness, integrity, responsibility, accountability and respect.
- Respect and maintain professional boundaries between patients, colleagues and society.
- Demonstrate ability to recognize and manage ethical and professional conflicts.
- Abide by prescribed ethical and legal codes of conduct and practice.
- Demonstrate a commitment to the growth of the medical profession as awhile.

## A. CURRICULUM

➢ **1st Professional Year:**

### 1. ANATOMY

**a. Competencies**:

The undergraduate must demonstrate:

- Understanding of the gross and microscopic structure and development of human body,
- Comprehension of the normal regulation and integration of the functions of the organs and systems on basis of the structure and genetic pattern,
- Understanding of the clinical correlation of the organs and structures involved and interpret the anatomical basis of the disease presentations.

**b. Broad subject specific objectives**

**Knowledge:** At the end of the course the student should be able to

- Comprehend the normal disposition, clinically relevant interrelationships, functional and cross -sectional Anatomy of the various organs and structures of the body.
- Identify the microscopic structure and correlate elementary ultra structure of various organs and tissues with the functions as a prerequisite for understanding the altered state in various disease processes.
- Comprehend the basic structure and connections of the central nervous system to analyze the integrative and regulative functions of the organs and systems. He should be able to locate the site of gross lesions according to the deficits encountered
- Demonstrate knowledge of the basic principles and sequential development of the organs and systems; recognize the critical stages of development and the effects of common teratogens, genetic mutations and environmental hazards. He should be able to explain the developmental basis of the major variations and abnormalities.

**c. Skills:**

At the end of the course the student should be able to --

- Identify and locate all the structures of the body and mark the topography of the Living Anatomy.
- Understand clinical basis of some common clinical procedures i.e. intramuscular and intravenous injection, lumbar puncture and kidney biopsy etc.
- Identify the organs and tissues under the microscope.
- Understand the principles of karyotyping and identify the gross congenital anomalies.
- Understand principles of newer imaging techniques and interpretation of CT scan, sonogram, MRI & Angiography.

**d. Integration**:

The teaching should be aligned and integrated horizontally and vertically in organ systems with clinical correlation that will provide a context for the learner to

understand the relationship between structure and function and interpret the anatomical basis of various clinical conditions and procedures.

## 2. PHYSIOLOGY

**a. Competencies: The undergraduates must demonstrate:**

- Understanding of the normal functioning of the organs and organ systems of the body,
- Comprehension of the normal structure and organization of the organs and systems on basis of the functions,
- Understanding of age-related physiological changes in the organ functions that reflect normal growth and development,
- Understand the physiological basis of diseases.

**b. Broad subject specific objectives**

**Knowledge**

At the end of the course, the student will be able to:

- Describe the normal functions of all the systems, the regulatory mechanisms and interactions of the various systems for well-coordinated total body functions.
- Understanding the relative contribution of each organ system in the maintenance of the milieu interior (homeostasis)
- Explain the physiological aspects of the normal growth and development.
- Analyze the physiological responses and adaptation to environmental stress. Comprehend the physiological principles underlying pathogenesis and treatment of disease.
- Correlate knowledge of physiology of human reproductive system in relation to National Family welfare program.

**c. Skills**

At the end of the course the student shall be able to:

- Conduct experiments designed for study of physiological phenomenon.
- Interpret experimental /investigative data.
- Distinguish between normal and abnormal data derived as a result of clinical examination and tests, which he has performed and observed in the laboratory.
- Recognize and get familiar with newer computerized and advanced instruments like medspiror, semen quality analyzer, EMG and TMT

**d. Integration**: The teaching should be aligned and integrated horizontally and vertically in organ systems in order to provide a context in which normal function can be correlated both with structure and with the biological basis, its clinical features, diagnosis and therapy.

## 3. BIOCHEMISTRY

**a. Competencies:**

The learner must demonstrate an understanding of:

- Biochemical and molecular processes involved in health and disease,
- Importance of nutrition in health and disease,
- Biochemical basis and rationale of clinical laboratory tests, and demonstrate ability to interpret these in the clinical context.

**b. Broad subject specific objectives:**

**Knowledge:**

At the end of the course, the student shall be able to

- Enlist and describe the cell organelles with their molecular ad functional organization.
- Delineate structure, function and interrelationships of various biomolecules and consequences of deviation from the normal.
- Understand basic enzymology and emphasize on its clinical applications wherein regulation of enzymatic activity is disturbed.
- Describe digestion and assimilation of nutrients and consequences of malnutrition.
- Describe and integrate metabolic pathways of various biomolecules with their regulatory mechanisms.
- Explain the biochemical basis of inherited disorders with their associated squeal.
- Describe mechanisms involved in maintenance in water, electrolyte and acid base balance and consequences of their imbalances.
- Outline the molecular mechanisms of gene expression and regulation, basic principles of biotechnology and their applications in medicine.

**c. Skills**

At the end of the course, the student shall be able to:

- Make use of conventional techniques / instruments to perform biochemical analysis relevant to clinical screening and diagnosis;
- Analysis and interpret investigative data;
- Demonstrate the skills of solving scientific and clinical problems and decision making.

**d. Integration:**

The teaching/learning programme should be integrated horizontally and vertically, as much as possible, to enable learners to make clinical correlations and to acquire an understanding of the cellular and molecular basis of health and disease.

**2nd Professional Year:**

## 4. PATHOLOGY

**a. Competencies:**

The undergraduate must demonstrate:

- Comprehension of the causes, evolution and mechanisms of diseases,
- Knowledge of alterations in gross and cellular morphology of organs in disease states,
- Ability to correlate the natural history, structural and functional changes with the clinical manifestations of diseases, their diagnosis and therapy,

**b. Broad subject specific objectives**

**Knowledge:**

At the end of one and half years, the student shall be able to:-

- Describe the structure and ultra structure of a sick cell, causes and mechanisms of cell Injury, cell death and repair.
- Correlate structural and functional alterations in the sick cell.
- Explain the path physiological processes, which govern the maintenance of homeostasis, mechanisms of their disturbance and the morphological and clinical manifestation associated with it.
- Describe the mechanisms and patterns of tissue response to injury so as to appreciate the path physiology of disease processes and their application to clinical science.
- Correlate the gross and microscopic alterations of different organ systems in common disease to the extent needed for understanding disease processes and their clinical significance.
- Develop an understanding of steps in neoplastic changes in the body and their effects in order to appreciate need for early diagnosis and further management of neoplasia.
- Understand mechanisms of common hematological disorders and develop a logical approach in their diagnosis and management.
- Develop understanding of the blood banking, blood donors & transfusion of blood & blood products, (components).
- Understand pathophysiology of infectious diseases in relation with tissue changes.

- Describe the various immunological reactions in understanding the disease process & tissue transplant.
- Develop an understanding for genetic disorders.
- Understand the vital organ function test of Kidney, liver & thyroid.

**c. Skills**

At the end of one and half years, the student shall be able to:

- Describe the rationale and principles of routine technical procedures of the diagnostic laboratory tests & perform it.
- Interpret routine diagnostic laboratory tests and correlate with clinical,hematological and morphological changes.
- Perform the simple bed-side tests on blood, urine and other biological fluid samples:
- Draw a rational scheme of investigations aimed at diagnosing and managing the cases of common disorders.
- Able to understand the microscopic and macroscopic features of common diseases.
- Develop different type of skills such as observation skills, communication skill and presentation skill.
- Understand biochemical/physiological disturbances that occur as a result of disease in collaboration with all concerned departments.

**d. Integration:** The teaching should be aligned and integrated horizontally and vertically in organ systems recognizing deviations from normal structure and function and clinically correlated so as to provide an overall understanding of the etiology, mechanisms, laboratory diagnosis, and management of diseases.

## 5. MICROBIOLOGY

**a. Competencies:**

The undergraduate learner demonstrates:

- Understanding of role of microbial agents in health and disease,
- Understanding of the immunological mechanisms in health and disease,
- Ability to correlate the natural history, mechanisms and clinical manifestations of infectious diseases as they relate to the properties of microbial agents,
- Knowledge of the principles and application of infection control measures,
- An understanding of the basis of choice of laboratory diagnostic tests and their interpretation, antimicrobial therapy, control and prevention of infectious diseases.
- Knowledge of outbreak investigation and its control.

**b. Broad subject specific objectives**

At the end of the course the student will be able to :

- Explain how the different microorganisms can cause human infection.
- Understand commercial, opportunistic and pathogenic organisms and describe host parasite relationship.
- Describe the characteristics (morphology, cultural characteristics, resistance, virulence factors, incubation period, mode of transmission etc.) of different microorganisms.
- Explain the various defense mechanisms of the host against the microorganisms which can cause human infection.
- Describe the laboratory diagnosis of microorganisms causing human infections and disease.
- Describe the prophylaxis for the particular infecting microorganisms

**c. Skills**

At the end of the course the student shall be able to

- Plan the laboratory investigations for the diagnosis of infectious diseases.
- Perform laboratory procedures to arrive at the etiological diagnosis of infectious diseases caused by bacteria, fungi, viruses and parasites including the drug sensitivity profile.
- Perform and interpret immunological and serological tests.
- Operate routine and sophisticated instruments in the laboratory.
- Develop microteaching skills and Pedagogy
- Successfully implement the chosen research methodology

**d. Integration:** The teaching should be aligned and integrated horizontally and vertically in organ systems with emphasis on host-microbe-environment interactions and their alterations in disease and clinical correlations so as to provide an overall understanding of the etiological agents, their laboratory diagnosis and prevention.

## 6. PHARMACOLOGY

**a. Competencies:** The undergraduate must demonstrate:

- Knowledge about essential and commonly used drugs and an understanding of the pharmacologic basis of therapeutics,
- Ability to select and prescribe medicines based on clinical condition and the pharmacologic properties, efficacy, safety, suitability and cost of medicines for common clinical conditions of national importance,
- Knowledge of pharmacovigilance, essential medicine concept and sources of drug information and industry-doctor relationship,
- Ability to counsel patients regarding appropriate use of prescribed drug and drug delivery systems.

**b. Broad subject specific objectives**

(A) **Knowledge:**

At the end of the course, the student shall be able to

- Describe the Pharmacokinetics and Pharmacodynamics of essential and commonly used drugs.
- Enlist the indications, contraindications, interactions and adverse reactions of commonly used drugs.
- Tailor the use of appropriate drugs in disease with consideration of its cost, efficacy and safety for-
    a. Individual needs and
    b. Mass therapy, under National Health Programs.
- Integrate the list of drugs of addiction and recommend the management of drug addiction.
- Explain pharmacological basis of prescribing drugs in special medical situations such as

  pregnancy, lactation, infancy, old age, renal damage, hepatic damage and immuno-compromised patients.
- Explain the concept of rational drug therapy in clinical pharmacology.
- State the principles underlying the concept of 'Essential Drugs'.
- Evaluate the ethics and modalities involved in the development and introduction of new drugs.

**c. Skills**

At the end of the course, the student shall be able to

- Prescribe drugs for common ailments.
- Identify adverse reactions and drug interactions of commonly used drugs.
- Interpret the data obtained from the experiments designed for the study of effect of drugs in various experimental and clinical studies.
- Analyze the information regarding common pharmaceutical preparations and critically evaluate drug formulations.
- Appraise the Principles of Clinical Pharmacy and Dispense the Medications giving proper instructions.

**d. Integration:** Practical knowledge of use of drugs in Clinical Practice will be acquired through Integrated Teaching vertically with phase 1 subjects and horizontally with other phase 2 subjects.

**3rd Professional year**

## 7. FORENSIC MEDICINE AND TOXICOLOGY

**a. Competencies**: The learner must demonstrate:

- Understanding of medico-legal responsibilities of physicians in primary and secondary care settings,
- Understanding of the rational approach to the investigation of crime, based on scientific and legal principles,
- Ability to manage medical and legal issues in cases of poisoning /overdose,
- Understanding the medico-legal framework of medical practice and medical negligence,
- Understanding of codes of conduct and medical ethics,
- Understanding concept of deceased donor, brain death, and Human Organ Transplantation Act.

**b. Broad subject specific objectives:**

**Knowledge:** At the end of the course, the student shall be able to

- Identify the basic Medico-legal aspects of hospital and general practice.
- Define the Medico-legal responsibilities of a general physician while rendering community service either in a rural primary health centre or an urban health centre.

- Appreciate the physician's responsibilities in criminal matters and respect for the codes of Medical ethics.
- Diagnose, manage and identify legal aspect of common acute and chronic poisonings.
- Describe the Medico-legal aspects and findings of post-mortem examination in cases of death due to common unnatural conditions and poisonings.
- Detect occupational and environmental poisoning, prevention and epidemiology of common poisoning and their legal aspects particularly pertaining to Workmen's Compensation Act.
- Describe the general principles of analytical toxicology.

**c. Skills**

At the end of the course, the student shall be able to

- Make observations and draw logical inferences in order to initiate enquiries in criminal matters and Medico-legal problems and be able to -
- Carry on proper Medico-legal examination and documentation/Reporting of Injury and Age.
- Conduct examination for sexual offences and intoxication.
- Preserve relevant ancillary materials for medico-legal examination.
- Identify important post-mortem findings in common unnatural deaths.
- Diagnose and treat common emergencies in poisoning and chronic toxicity.
- Make observations and interpret findings at post-mortem examination.
- Observe the principles of medical ethics in the practice of his profession.

**d. Integration**:

The teaching should be aligned and integrated horizontally and vertically recognizing the importance of medico-legal, ethical and toxicological issues as they relate to the practice of medicine.

## 8. COMMUNITY MEDICINE

**a. Competencies**: The undergraduate must demonstrate:

- Understanding of the concept of health and disease,
- Understanding of demography, population dynamics and disease burden in National and global context,
- Comprehension of principles of health economics and hospital management,
- Understanding of interventions to promote health and prevent diseases as envisioned in National and State Health Programmes.
- Understanding of physical, social, psychological, economic and environmental determinants of health and disease,
- Ability to recognize and manage common health problems including physical, emotional and social aspects at individual family and community level in the context of National Health Programmes,
- Ability to Implement and monitor National Health Programmes in the primary care setting,
- General knowledge about Organ and Tissue donation,
- Knowledge of maternal and child wellness as they apply to national health care priorities and programmes,
- Ability to recognize, investigate, report, plan and manage community health problems including malnutrition and emergencies.

**b. Broad subject specific objectives:**

**Knowledge:** At the end of the course the student shall be able

- Explain the principles of sociology including demographic population dynamics.
- Identify social factors related to health, disease and disability in the context of urban and rural societies.
- Appreciate the impact of urbanization on health and disease.
- Observe and interpret the dynamic of community behaviors.

- Describe the elements of normal psychology and social psychology.
- Observe the principles of practice of medicine in hospital and community settings.
- Describe the health care delivery systems including rehabilitation of the disabled in the country.
- Describe the National Health Programmes with particular emphasis on maternal and child health programmes, family welfare planning and population control.
- Describe the epidemiological methods and techniques.
- Outline the demographic pattern of the country and appreciate the roles of the individuals, family, community and socio-cultural milieu in health and disease.
- Describe the health information systems.
- Acquire, understand, integrate, apply and manage information in context to health care problems and health care delivery system in various communities, health care settings and hospitals.
- Describe the principles and components of primary health care, National Rural Health Mission and the national health policies to achieve the goal of "Health for all" with regards to identify the environmental, bio-waste and occupational hazards and their control.
- Describe the importance of water and sanitation in human health.
- Describe the principles of health economies, health administration, health education in relation to community.
- Critically analyze the problem (s) and apply his/her knowledge to solve the problem in holistic manner.
- Describe and apply principles of prevention, promotion and maintenance of health.

**c. Skills:** At the end of the course, the student shall be able to –

- Use the principles and practice of medicine in hospital and community settings and familiarization with elementary practices.
- Use the Art of communication with patients including history taking and medico social work.

- Use epidemiology as a scientific tool to make rational decisions relevant to community and individual patient intervention.
- Organize health care services for vulnerable and disadvantages groups.
- Organize health care services in case of calamities.
- Collect, analyze, interpret and present simple community and hospital base data.
- Diagnose and manage common health problems (including communicable and non-communicable diseases) and emergencies at the individual, family and community levels keeping in mind the existing health care resources and in the context of the prevailing socio-culture beliefs.
- Diagnose and manage common nutritional problems at the individual and community level.
- Plan, implement and evaluate a health education Programme with skill to use simple audio-visual aids.
- Interact with other members of the health care team and participate in the organization of health care services, health advocacy and implementation of national health programmes.
- Perform Administrative functions at health centers
- Observe the principles of medical ethics in the practice of his profession.

**d. Integration:**

Department shall adopt an integrated approach towards other clinical disciplines, public health services, NGOs, environmental sciences, social sciences, management, hospital administration, research, etc. to impart training to enable the graduate to work at all levels of health care. The teaching should be aligned and integrated horizontally and vertically in order to allow the learner to understand the impact of environment, society and national health priorities as they relate to the promotion of health and prevention and cure of disease.

## 9. OTO-RHINOLARYNGOLOGY (ENT)

**a. Competencies:** The learner must demonstrate:

- Knowledge of the common Otorhinolaryngological (ENT) emergencies and problems,
- Ability to recognize, diagnose and manage common ENT emergencies and problems in primary care setting,
- Ability to perform simple ENT procedures as applicable in a primary care setting,
- Ability to recognize hearing impairment and refer to the appropriate hearing impairment rehabilitation programme.

**b. Broad subject specific objectives:**

- **Knowledge**: At the end of the course, the student shall be able to :
- Describe the basic pathophysiology of common Ear, Nose & Throat (ENT) diseases &emergencies.
- Adopt the rational use of commonly used drugs keeping in mind their adverse reactions.
- Suggest common investigative procedures & their interpretation.

**c. Skills:** At the end of the course the student shall be able to

- Examination & Diagnose common ENT problems including pre-malignant & Malignant disorders of the Head & Neck.
- Manage ENT problems at first level of care & be able to refer whenever necessary.
- Assist / carry out minor ENT procedures like ear syringing, ear dressing, nasal packing.
- Assist in certain procedures such as tracheotomy, endoscopy & removal of foreign bodies.

**d. Integration**:

The teaching should be aligned and integrated horizontally and vertically in

order to allow the learner to understand the structural basis of ENT problems, their management and correlation with function, rehabilitation and quality of life. The undergraduate training ENT will provide an integrated approach towards other disciplines especially, neurosciences, ophthalmology & general surgery.

## 10. OPHTHALMOLOGY

**a. Competencies**: The student must demonstrate:

- Knowledge of common eye problems in the community
- Recognize, diagnose and manage common eye problems and identify indications for referral,
- Ability to recognize visual impairment and blindness in the community and implement national programmes as applicable in the primary care setting.

**b. Broad subject specific objectives**

**Knowledge:** At the end of the course, student shall have the knowledge of

- Common problems affecting the eye.
- Principles of management of major ophthalmic emergencies.
- Main systemic disease affecting the eye.
- Effects of local and systemic diseases on patient's vision and the necessary action required minimizing the sequelae of such diseases.
- Adverse drug reaction with special reference to ophthalmic manifestations.
- Magnitude of blindness in India and its main causes.
- National programme for control of blindness and its implementation at various levels.
- Eye care education for prevention of eye problems.
- Role of primary health center in organization of eye camps.

- Organization of primary health care and the functioning of the ophthalmic assistant.
- Integration of the national programme for control of blindness with the other national health programmes.
- Eye bank organization.

**c. Skills**

- Elicit a history pertinent to general health and ocular status.
- Assist in diagnostic procedures such as visual acuity testing, examination of eye, Schiotz tonometry, Staining of Corneal pathology, confrontation, perimetry, Subjective refraction including correction of Presbyopia and aphakia, direct ophthalmoscopy and conjunctival smear examination and Cover test.
- Diagnose and treat common problems affecting the eye.
- Interpret ophthalmic signs in relation to common systemic disorders.
- Assist/observe therapeutic procedures such as Subconjunctival injection, corneal conjunctival foreign body removal, carbolic cautery for corneal ulcers, Nasolacrimal duct syringing and tarsorrhaphy
- Provide first aid in major ophthalmic emergencies.
- Assist to organize community surveys for visual check-up.
- Assist to organize primary eye care service through primary health centers.
- Use effective means of communication with the public and individual to motivate for surgery in cataract and for eye donation.
- Establish rapport with his seniors, colleagues and paramedical workers, so as to effectively function as a member of the eye care team.

**d. Integration**:

The teaching should be aligned and integrated horizontally and vertically in order to allow the student to understand the structural basis of ophthalmologic problems, their management and correlation with function,

rehabilitation and quality of life.

## 3rd PROFESSIONAL YEAR PART - II

**Medicine Allied Subjects:**

### 11. GENERAL MEDICINE

**a. Competencies**: The student must demonstrate ability to do the following in relation to common medical problems of the adult in the community:

- D emonstrate understanding of the pathophysiologic basis, epidemiological profile, signs and symptoms of disease and their investigation and management,
- Competently interview and examine an adult patient and make a clinical diagnosis,
- Appropriately order and interpret laboratory tests,
- Initiate appropriate cost-effective treatment based on an understanding of the rational drug prescriptions, medical interventions required and preventive measures,
- Follow up of patients with medical problems and refer whenever required,
- Communicate effectively, educate and counsel the patient and family,
- Manage common medical emergencies and refer when required,
- Independently perform common medical procedures safely and understand patient safety issues.

**b. Broad subject specific objectives:**

Knowledge: At the end of the course, the student shall be able to:

- Diagnose common clinical disorders with special reference to infectious diseases,

nutritional disorders, tropical and environmental diseases;

- Outline various modes of management including drug therapeutics especially dosage, side effects, toxicity, interactions, indications and contra-indications;
- Propose diagnostic and investigative procedures and ability to interpret them;
- Provide first level management of acute emergencies promptly and efficiently and decide the timing and level of referral, if required;
- Recognize geriatric disorders and their management.

**c. Skills**

At the end of the course, the student shall be able to

- Develop clinical skills (history taking. clinical examination and other instruments of examination) to diagnose various common medical disorders and emergencies;
- Refer a patient to secondary and/or tertiary level of health care after having instituted primary care;
- Perform simple routine investigations like hemogram, stool, urine, sputum and biological fluid examinations;
- Assist the common bedside investigative procedure like pleural tap. Lumbar puncture, bone marrow aspiration/biopsy and liver biopsy.

**d. Integration**: The teaching should be aligned and integrated horizontally and vertically in order to provide sound biologic basis and incorporating the principles of general medicine into a holistic and comprehensive approach to the care of the patient. With other relevant academic inputs which provide scientific basis of clinical medicine e.g. anatomy, physiology, biochemistry, microbiology, pathology and pharmacology.

## 12. PEDIATRICS

**a. Competencies:** The student must demonstrate:

- Ability to assess and promote optimal growth, development and nutrition of children and adolescents and identify deviations from normal,
- Ability to recognize and provide emergency and routine ambulatory and First

Level Referral Unit care for neonates, infants, children and adolescents and refer as may be appropriate,

- Ability to perform procedures as indicated for children of all ages in the primary care setting,
- Ability to recognize children with special needs and refer appropriately,
- Ability to promote health and prevent diseases in children,
- Ability to participate in National Programmes related to child health and in conformation with the Integrated Management of Neonatal and Childhood Illnesses (IMNCI) Strategy,
- Ability to communicate appropriately and effectively.

**b. Broad subject specific objectives:**

**Knowledge:-**At the end of the course, the students shall be able to:-

- Describe the normal Growth and Development during fetal life, Neonatal period, Childhood and Adolescence and the deviations thereof.
- Describe the common Pediatric disorders and emergencies in terms of Epidemiology, Etiopathogenesis, Clinical manifestations, Diagnosis and also describe the rational therapy and rehabilitation services.
- Workout age related requirements of calories, nutrients, fluids, dosages of drugs etc. in health and disease.
- Describe preventive strategies for common infectious disorders, Malnutrition, Genetic and Metabolic disorders, Poisonings, Accidents and Child abuse.
- Outline national programs related to child health including Immunization programs.

**c. Skills**

At the end of the course, the students shall be able to:-

- Take detailed Pediatric and Neonatal history and conduct an appropriate physical examination of children and neonates, make clinical diagnosis, conduct common

bedside investigative procedures, interpret common laboratory investigations, plan and institute therapy.

- Take anthropometric measurements, resuscitate newborn, prepare oral rehydration solution, perform tuberculin test, administer vaccines available under current National programs, perform venesection, start intravenous fluids and provide nasogastric feeding.
- Conduct diagnostic procedures such as lumbar puncture, liver and kidney biopsy, bone marrow aspiration, pleural and ascitic tap.
- Distinguish between normal Newborn babies and those requiring special care and institute early care to all newborn babies including care of preterm and low birth weight babies, provide correct guidance and counseling about breastfeeding and Complementary feeding.
- Provide ambulatory care to all not so sick children, identify indications for specialized/ inpatient care and ensure timely referral to those who require hospitalization.

**d. Integration**:

The teaching should be aligned and integrated horizontally and vertically in order to provide comprehensive care for neonates, infants, children and adolescents based on a sound knowledge of growth, development, disease and their clinical, social, emotional, psychological correlates in the context of national health priorities.

## 13. DERMATOLOGY

**a. Competencies**:

The undergraduate student must demonstrate:

- Understanding of the principles of diagnosis of diseases of the skin, hair, nail and mucosa,
- Ability to recognize, diagnose, order appropriate investigations and treat common diseases of the skin including leprosy in the primary care setting and refer as

appropriate,

- A syndromic approach to the recognition, diagnosis, prevention, counseling, testing and management of common sexually transmitted diseases including HIV based on national health priorities,
- Ability to recognize and treat emergencies including drug reactions and refer as appropriate.

b. **Broad subject specific objectives:**

**Knowledge:**

At the end of the course of Dermatology the student shall be able to :

- Demonstrate sound knowledge of common diseases, their clinical manifestations, including emergent situations and of investigative procedures to confirm their diagnosis
- Demonstrate comprehensive knowledge of various modes of therapy used in treatment of cutaneous, sexually transmitted diseases and leprosy
- Describe the mode of action of commonly used drugs, their doses, side effects/toxicity, indications and contra-indications and interactions
- Describe commonly used modes of management including the medical and surgical procedures available for the treatment of various diseases and to offer a comprehensive plan of management for a given disorder

**c. Skills:**

The student shall be able to

- Interview the patient, elicit relevant and correct information and describe the history in a chronological order:
- Conduct clinical examination, elicit and interpret physical findings and diagnose common disorders and emergencies.
- Demonstrate simple, routine investigative and laboratory procedures required for making the bed-side diagnosis, especially the examination of scrapings for fungus,

preparation of slit smears and staining for AFB for leprosy patients and for STD cases and take a skin biopsy for diagnostic purposes.

- Manage common diseases and recognizing the need for referral for specialized care, in case of inappropriateness of therapeutic response.

**d. Integration**:

The teaching should be aligned and integrated horizontally and vertically in order to emphasize the biologic basis of diseases of the skin, sexually transmitted diseases and leprosy

## 14. PSYCHIATRY

**a. Competencies: The** student must demonstrate:

Ability to promote mental health and mental hygiene,

- Knowledge of etiology (bio-psycho-social-environmental interactions), clinical features, diagnosis and management of common psychiatric disorders across all ages,
- Ability to recognize and manage common psychological and psychiatric disorders in a primary care setting, institute preliminary treatment in disorders difficult to manage, and refer appropriately,
- Ability to recognize alcohol/ substance abuse disorders and refer them to appropriate centers,
- Ability to assess risk for suicide and refer appropriately,
- Ability to recognize temperamental difficulties and personality disorders,
- Assess mental disability and rehabilitate appropriately,
- Understanding of National and State programmes that address mental health and welfare of patients and community.

**b. Broad subject specific objectives:**

**Knowledge:**

At the end of the course the student shall be able to:

- Understand the comprehensive nature & development of different aspects of normal human behavior like learning, memory, motivation, personality & intelligence
- Recognize differences between normal & abnormal behavior
- Classify psychiatric disorders
- Recognize clinical manifestations of the following common syndromes & plan their appropriate management of organic psychosis, functional psychosis, schizophrenia, affective disorders, neurotic disorders, personality disorders, psycho physiological disorders, drug & alcohol dependence, psychiatric disorders of childhood & adolescence
- Describe rational use of different mode of therapy in psychiatric disorders.

**c. Skills**:

The student shall be able to:

- Interview the patient & understand different methods of communications in patient-doctor relationship
- Elicit detailed psychiatric case history & conduct clinical examination for assessment of mental status
- Define, elicit & interpret psychopathological symptoms & signs
- Diagnose & manage common psychiatric disorders
- Identify & manage common psychological reactions & psychiatric disorders in medical & surgical patients in clinical practice & in community setting

**d. Integration**:

The teaching should be aligned and integrated horizontally and vertically in order to allow the student to understand bio-psycho-social-environmental interactions that lead to diseases/ disorders for preventive, promotive, curative, rehabilitative services and medico-legal implications in the care of patients both in family and

community.

## 16. GENERAL SURGERY

### a. Competencies:

The student must demonstrate:

- Understanding of the structural and functional basis, principles of diagnosis and management of common surgical problems in adults and children
- Ability to choose, calculate and administer appropriately intravenous fluids, electrolytes, blood and blood products based on the clinical condition
- Ability to apply the principles of asepsis, sterilization, disinfection, rational use of prophylaxis, therapeutic utilities of antibiotics and universal precautions in surgical practice
- Knowledge of common malignancies in India and their prevention, early detection and therapy
- Ability to perform common diagnostic and surgical procedures at the primary care level
- Ability to recognize, resuscitate, stabilize and provide Basic & Advanced Life Support to patients following trauma
- General knowledge about organ retrieval from deceased donor and living donor
- Ability to administer informed consent and counsel patient prior to surgical procedures,
- Commitment to advancement of quality and patient safety in surgical practice.

### b. Broad subject specific objectives.

**Knowledge:**

At the end of course, the student should be able to:

- Describe aetiology, pathophysiology, principles of diagnosis and management of common surgical problems including emergencies in adult and children.
- Define indications and methods for fluid and electrolytes replacement therapy including blood transfusion.
- Define asepsis, disinfection and sterilization and recommend judicious use of antibiotics.
- Describe common malignancies in the country and their management including prevention.
- Enumerate different types of anaesthetic agents, their indications, contraindications, mode of administration, and side effects.

**c. Skills**

At the end of the course, the student should be able to:

- Diagnose common surgical conditions both acute and chronic, in adults and children.
- Plan various laboratory tests for surgical conditions and interpret the results.
- Identify and manage patients of hemorrhagic, septicaemia and other types of shock.
- Be able to maintain patent air-way and resuscitate.
- Monitor patient of head, chest, spinal and abdominal injuries, both in adults and children.
- Provide primary care for a patient of burns.
- Acquire principles of operative surgery including preoperative, operative and post operative care and monitoring.
- Treat open wound including preventive measures against tetanus and gas gangrene.

- Diagnose neonatal and pediatric surgical emergencies and provide sound primary care before referring the patient to secondary/tertiary centres.
- Identify congenital anomalies and refer them for appropriate management.

**d. Integration**: The teaching should be aligned and integrated horizontally and vertically in order to provide a sound biologic basis and a holistic approach to the care of the surgical patient.

- Apply knowledge of basic medical sciences and other relevant subjects to support understanding of various pathologies, facilitate examination of and intervention for the patients.
- To apply the principles of quality of health care, legal and ethical principles and regulations as recommended by Medical Council of India and WHO.

## 17. OBSTETRICS AND GYNAECOLOGY

**a. Competencies**:

The student must demonstrate ability to:

- Provide peri-conceptional counseling and antenatal care,
- Identify high-risk pregnancies and refer appropriately,
- Conduct normal deliveries, using safe delivery practices in the primary and secondary care settings,
- Prescribe drugs safely and appropriately in pregnancy and lactation,
- Diagnose complications of labor, institute primary care and refer in a timely manner,
- Perform early neonatal resuscitation,
- Provide postnatal care, including education in breast-feeding,
- Counsel and support couples in the correct choice of

contraception,

- Interpret test results of laboratory and radiological investigations as they apply to the care of the obstetric patient,
- Apply medico-legal principles as they apply to tubectomy, Medical Termination of Pregnancy (MTP), Pre-conception and Prenatal Diagnostic Techniques (PC PNDT Act) and other related Acts.
- Elicit a gynecologic history, perform appropriate physical and pelvic examinations and PAP smear in the primary care setting,
- Recognize, diagnose and manage common reproductive tract infections in the primary care setting,
- Recognize and diagnose common genital cancers and refer them appropriately.

**b. Broad subject specific objectives**

**Knowledge**

At the end of the course, the student shall be able to:

- Outline the anatomy, physiology and pathophysiology of the reproductive system and the common conditions affecting it.
- Diagnose normal pregnancy, labour, puerperium and manage the problems he is likely to encounter therein.
- List of leading causes of maternal and perinatal morbidity and mortality.
- Understand the principles of contraception and various techniques employed, methods of medical termination of pregnancy, sterilization and their complications.
- Identify the use, abuse and side effects of drugs in pregnancy, peri- menopausal and post menopausal periods.
- Describe the national programme of maternal and child health and family welfare and their implementation at various levels.

- Identify common gynecological diseases and describe principles of their management.
- State the indications, techniques and complications of surgeries like Caesarian section, laparotomy, abdominal and vaginal hysterectomy, Fothergill's operation and vacuum
- Aspiration for Medical Termination of pregnancy (MTP) and minor surgeries like EB, D and C, Cervical Biopsy and Cervical encirclage.

**c. Skills**

At the end of the course, the student should be able to

- Take proper history and writing a good case sheet
- Writing a good discharge summary, proper referral letter
- Examination of patient and arrival at a diagnosis
- Planning for investigation and treatment
- Community orientation, participation in community health promoting and preventing programmes
- Examine a pregnant woman, recognize high- risk pregnancies and make appropriate referrals.
- Conduct a normal delivery, plot and interprete partogram
- recognize complications and decision of referral, provide postnatal care,
- Resuscitate the newborn and recognize the congenital anomalies.
- Advise a couple on the use of various available contraceptive devices (student should see at least 5 Cu-T insertions and 5 cases of female sterilization operations.)
- Perform pelvic examination, diagnose and manage common. gynecological problems including early detection of genital malignancies.
- Make a vaginal cytological smear, perform a post coital test and wet vaginal smear examination for Trichomonas vaginalis, Moniliasis and gram stain for gonorrhea, catheterization of urinary bladder
- Interpretation of data of investigations like biochemical, histopathological, radiological ultrasound etc.

**d. Integration**:

The teaching should be aligned and integrated horizontally and vertically in order

to provide comprehensive care for women in their reproductive years and beyond, based on a sound knowledge of structure, functions and disease and their clinical, social, emotional, psychological correlates in the context of national health priorities. The student shall be able to integrate clinical skills with other disciplines and bring about coordination of family welfare programme for the national goal of population control.

## 18. ORTHOPAEDICS (INCLUDING TRAUMA)

**a. Competencies**:

- The student must demonstrate:
- Ability to recognize and assess bone injuries, dislocation and poly-trauma and provide first contact care prior to appropriate referral,
- Knowledge of the medico-legal aspects of trauma,
- Ability to recognize and manage common infections of bone and joints in the primary care setting,
- Recognize common congenital, metabolic, neoplastic, degenerative and inflammatory bone diseases and refer appropriately,
- Ability to perform simple orthopedic techniques as applicable to a primary care setting,
- Ability to recommend rehabilitative services for common orthopaedic problems across all ages.

**b. Broad subject specific objectives**

**Knowledge:**

The student shall be able to understand:

- The principles, diagnosis and primary management and be able to give appropriate referral for further definitive management of bones and joint injuries.

- Osteogenesis, manifestation and diagnosis, primary management and give their referral for appropriate correction or rehabilitation of common musculoskeletal disorders including infections of bones and joints; congenital skeletal anomalies, metabolic bone diseases and neoplasm affecting bones.

**c. Skills**

At the end of the course, the student shall be able to:

- Detect soft tissue injuries such as sprains and strains.
- Detect common fractures of extremities.
- Deliver first aid measures for common fractures and sprains.
- Deliver emergency measures to poly trauma patients.
- Manage uncomplicated fractures of clavicle, forearm, phalanges etc.
- Use techniques of splinting such as application of Thomas splint, plaster slab and casts, immobilization by skin tractions etc.
- Learn indications for closed reductions, open reductions, internal fixation and external fixations of fracture.
- Manage common bone infection; learn indications for sequestration, amputation and corrective measures for bone deformities.
- Advice and counsel patient for rehabilitation for post traumatic, poliomyelitis, cerebral palsy and amputation.
- Be able to perform certain orthopedic skills, provide sound advice of skeletal and related conditions at primary or secondary health care level.

d. **Integration**:

The teaching should be aligned and integrated horizontally and vertically in order to allow the student to understand the structural basis of orthopedic problems, their management and correlation with function, rehabilitation and quality of life.

## 19. ANAESTHESIOLOGY

**a. Competencies:**

The student must demonstrate ability to:

- Describe and discuss the pre-operative evaluation, assessing fitness for surgery and the modifications in medications in relation to anesthesia /surgery,
- Describe and discuss the roles of Anesthesiologist as a peri-operative physician including pre-medication, endotracheal intubation, general anesthesia and recovery (including variations in recovery from anesthesia and anaesthetic complications),
- Describe and discuss the management of acute and chronic pain, including labour analgesia,
- Demonstrate awareness about the maintenance of airway in children and adults in various situations,
- Demonstrate the awareness about the indications, selection of cases and execution of cardio- pulmonary
- Resuscitation in emergencies and in the intensive care and high dependency units,
- Choose cases for local / regional anesthesia and demonstrate the ability to administer the same,
- Discuss the implications and obtain informed consent for various procedures and to maintain the documents.

**b. Broad subject specific objectives:**

**Knowledge:**

At the end of the course, the student shall be able to

- Know of simple nerve block and pain relief
- Awareness of the principles of administration of general, regional and local anesthesia.

- Know importance of hypoglycemia/hyperglycemia, hypotension/hypertension, IHD, Myocardial infarction.
- Know ventilators.

**c. Skills**

At the end of the training, the students should be able to:

- Perform cardio-pulmonary resuscitation with the available resources and transfer the patients to a bigger hospital for advanced life support.
- Set up intravenous infusion and manage fluid therapy
- Clear and maintain airway in unconscious patient.
- Administer oxygen correctly
- General knowledge about diagnosis of brain death and relevance in deceased donor organ transplantation

**d. Integration**: The teaching should be aligned and integrated horizontally and vertically in order to provide comprehensive care for patients undergoing various surgeries, in patients with pain, in intensive care and in cardio respiratory emergencies. Integration with the departments of Anatomy, Pharmacology and horizontal integration with any/all surgical specialties is proposed.

## 20. RADIODIAGNOSIS

**a. Competencies**: The student must demonstrate:

- Understanding of indications for various radiological investigations in common clinical practice,
- Awareness of the ill effects of radiation and various radiation protective measures to be employed,

- Ability to identify abnormalities in common radiological investigations.

**b. Broad subject specific objectives:**

**Knowledge:**

At the end of the course, the student shall be able to

- Enlist and describe the various diagnostic modalities
- Delineate normal and abnormal radiological findings
- Understand basic radiology and emphasize on its clinical applications
- Describe radiographic, ultra sonographic, CT, MRI features of common pathologies.
- Describe and integrate radiological findings in CNS, GIT, RS, CVS, MSK, GUT

**d. Skills**

- At the end of the course, the student shall be able to:
- Make use of Imaging findings to reach to a diagnosis;
- Analysis and interpret radiological data;
- Demonstrate the skills of solving clinical problems by illustrative evidences and decision making.

**e. Integration:** Horizontal and vertical integration to understand the fundamental principles of radiologic imaging, anatomic correlation and their application in diagnosis and therapy.

## B. PHASE WISE TRAINING AND TIME DISTRIBUTION FOR PROFESSIONAL DEVELOPMENT

The Competency based Undergraduate Curriculum and Attitude, Ethics and Communication (AETCOM) course, as published by the Medical Council of India and also made available on the Council's website, shall be the curriculum for the batches admitted in MBBS from the academic year 2019-20 onwards.

In order to ensure that training is in alignment with the goals and competencies required for a medical graduate, there shall be a **Foundation Course**_to orient medical learners to MBBS programme, and provide them with requisite knowledge, communication (including electronic), technical and language skills.

### I. Training period and time distribution:

Universities shall organize admission timing and admission process in such a way that teaching in the first Professional year commences with induction through the Foundation Course by the 1st of August of each year from academic year 2024-25. There shall be no admission of students in respect of any academic session beyond 30th August from academic year 2024-25. The Universities shall not register any student admitted beyond the said date.

The National Medical Commission may direct, that any student identified as having Obtained admission after the last date for closure of admission be discharged from the Course of study, or any medical qualification granted to such a student shall not be a recognized qualification by National Medical Commission.

The institution which grants admission to any student after the last date specified from the same shall also be liable to face such action as may be prescribed by National Medical Commission.

Every learner shall undergo a period of certified study extending over 4 ½ academic years, divided into four professional years from the date of commencement of course to the date of completion of examination which shall be followed by one year of compulsory rotating internship.

Each academic year will have at least 39 teaching weeks with a minimum of eight hours of working on each day including one hour as lunch break.

Didactic lectures shall not exceed one third of the schedule; two third of the schedule shall include interactive sessions, practicals, clinical or/and group discussions. The learning process should include clinical experiences, problem- oriented approach, case studies and community health care activities.

Teaching and learning shall be aligned and integrated across specialties both vertically and horizontally for better learner comprehension. Learner centered learning methods should include Early Clinical Exposure, problem-oriented learning, case studies, community- oriented learning, self- directed, experiential learning& Electives

At the end of each professional year university examination will be conducted. If any student fails to clear university examination, he will appear in supplementary examination.

**Supplementary examinations and declaration of results shall be processed within 3-6 weeks from the date of declaration of the results of the main examination for every professional year, so that the candidates, who pass, can join the main batch for progression.**

**If the candidate fails in the supplementary examination of first MBBS, he shall join the batch of next academic /subsequent year. There shall be no supplementary batches. Partial attendance of examination in any subject shall be counted as an attempt.**

- **A candidate, who fails in the First Professional examination, shall not be allowed to join the Second Professional.**
- **A candidate, who fails in the second Professional examination, shall be allowed to join the third Professional Part I training, however he shall not be allowed to appear for the examination unless he has passed second professional examination.**
- **A candidate who fails in the third Professional (Part I) examination shall be**

**allowed to join third Professional part II training, however he shall not be allowed to appear for the examination unless he has passed second professional examination.**

**II. The period of 4½ years is divided as follows:**

**Phase I –Total 12 months**

**i) First Professional phase of 12 months including Foundation Course of one week and university exams.** It shall consist of – Anatomy, Physiology, Biochemistry, Introduction to Community Medicine, Humanities, Professional development including Attitude, Ethics & Communication (AETCOM) module, family adoption programme through village outreach where-in each student shall adopt minimum of three (03) families and preferably at least five (05) families, Pandemic module and early clinical exposure, ensuring alignment & all types of integration and simulation- based learning.

**Phase II- Second Professional (12 months) including university exams**. It will consist of Pathology, Pharmacology, Microbiology, family visit under Community Medicine, General Surgery, General Medicine & Obstetrics & Gynecology Professional development including AETCOM module, simulation-based learning and introduction to clinical subjects ensuring both alignment & all types of integration.

The clinical exposure to learners will be in the form of learner-doctor method of clinical training in all phases. The emphasis will be on primary, preventive and comprehensive health care. A part of training during clinical postings should take place at the *primary level* of health care. It is desirable to provide learning experiences in secondary health care, wherever possible. This will involve:

- Experience in recognizing and managing common problems seen in outpatient, inpatient and emergency settings,
- Involvement in patient care as a team member,
- Involvement in patient management and performance of basic procedures.

**iii) Phase III - 30 months**

**a. Third Professional Part I (12 months, including University exams)**

Forensic Medicine and Toxicology, Community Medicine, Medicine & allied, Surgery & allied, Pediatrics and Obstetric & Gynecology including AETCOM, Pandemic module, Clinical teaching in General Medicine, General Surgery, Obstetrics & Gynecology, Pediatrics, Orthopedics, Dermatology, Community Medicine, Psychiatry, Respiratory Medicine, Radio-diagnosis (& Radiotherapy) and Anesthesiology & Professional development.

**b. Electives** (1 month) shall be included here. These will be in 2 blocks of 15 days each in Final first; 1st block after annual exam of III MBBS part 1 and 2nd block after the end of 1st elective.

**c. Third Professional Part II (18 months, including University exam)-**

**Subjects include:**

- M edicine and allied specialties (General Medicine, Psychiatry, Dermatology, Venereology and Leprosy (DVL), Respiratory Medicine including Tuberculosis)
- S urgery and allied specialties (General Surgery, Otorhinolaryngology, Ophthalmology, Orthopedics, Dentistry, Physical Medicine and rehabilitation, Anesthesiology and Radiodiagnosis)
- O bstetrics and Gynecology (including Family Welfare)
- P ediatrics
- A ETCOM module

**III. Distribution of teaching hours phase wise**

**a. First, second and third Professional part-I, teaching hours:**

**Time allotted:** 12 months (approx. 52weeks)

**Time available:** Approx. **39 weeks** (excluding13 weeks) (39 hours/ week)

Prelim / University Exam & Results: 9 weeks

Vacation: 2 weeks

Public Holidays: 2 weeks

**Time distribution in weeks: 39 weeks x 39 hours = 1521** hours for Teaching- Learning

**b. Final MBBS part-2, teaching hours:**

**Time allotted:** 18 months (approx. 78 weeks)

**Time available:** Approx. **62 weeks** (excluding 16 weeks) (39 hours/ week)

Prelim / University Exam & Results: 10 weeks

Vacation: 3 weeks

Public Holidays: 3 weeks

**Time distribution in weeks: 62 x 39 hrs = 2418 hrs** available for Teaching- Learning

**(Clinical Postings: 15 hours/ week II MBBS onwards included in academic schedule)**

These are attached in sperate annexure with all relevant tables.

Academic calender shall be as per the Table 1.

Distribution of subjects for Professional Phase – wise training is given in Table 2.

Minimum teaching hours prescribed in various disciplines are given in Tables 3-7.

Distribution and duration of clinical postings is given in Table 8.

Time allotted excludes time reserved for internal /University examinations, and vacation.

Second professional clinical postings shall commence before / after declaration of results of the first professional phase examinations, as decided by the institution/ University.

Third Professional parts I and part II clinical postings shall start no later than two weeks after the completion of the previous professional examination.

A total of 25% of allotted time of third Professional shall be utilized for integrated learning with phase I and II subjects. This will be included in the assessment of clinical subjects.

**Note**

- The period of training is minimum suggested. Adjustments where required depending on availability of time may be made by the concerned college/ institution. This period of training does not include university examination period.
- An exposure to skills lab for at least two (02) weeks prior to clinical postings shall be made available to all student.

**C) New teaching /learning elements**

**1) Foundation Course**

**Goal:** The goal of the Foundation Course is to prepare a learner to study medicine effectively.

**Objectives:**

**(a) Orient the learner to:**

- The medical profession and the physician's role in society
- The MBBS programme
- Alternate health systems i.e. AYUSH in India and history of Medicine
- Medical ethics, attitudes and professionalism
- Health care system and its delivery
- National health programmes and policies
- Universal precautions and vaccinations
- Patient safety and biohazard safety
- Principles of primary care(general and community based care)
- The academic ambience

**(b) Enable the learner to acquire enhanced skills in:**

- Language
- Interpersonal relationships

- Communication
- Learning including self-directed learning
- Time management
- Stress management
- Use of information technology, and artificial intelligence

(c) **Train the learner to provide:**

- First-aid
- Basic life support
- In addition to the above, learners maybe enrolled in one of the following programmes which will be run concurrently:
- Local language programme
- English language programme
- Computer skills
- These may be done in the last two hours of the day. These sessions must be as interactive as possible.

Sports (to be used through the Foundation Course as protected 04 hours /week).

Leisure and extracurricular activity (to be used through the Foundation Course as projected 02 hours per week).

Institutions shall develop learning modules and identify the appropriate resource persons for their delivery.

The time committed for the Foundation Course may not be used for any other curricular activity.

The Foundation Course shall have a minimum of 75% attendance of all students mandatorily. This will be certified by the Dean of the college.

The Foundation Course shall be organized by the Coordinator appointed by the Dean

of the college and shall be under supervision of the Heads of MBBS phase 1 departments.

Every college shall arrange for a meeting with parents/ wards of all students and records of the same shall be made available to UGMEB of NMC.

**2) Early Clinical Exposure**

**Objectives:** The objectives of early clinical exposure of the first-year medical learners are to enable the learner to:

- Recognize the relevance of basic sciences in diagnosis, patient care and management,
- Provide a context that will enhance basic science learning,
- Relate to experience of patients as a motivation to learn,
- Recognize attitude, ethics and professionalism as integral to doctor-Patient relationship,
- Understand the socio-cultural context of disease through the study of humanities.

**Elements**

- Basic science correlation: i.e. apply and correlate principles of basic sciences as they relate to patient care (this shall be part of integrated modules).
- Clinical skills: to include basic skills in interviewing patients, doctor-patient communication, ethics and professionalism, critical thinking and analysis and self-learning (this training shall be imparted in the time allotted for early clinical exposure).
- Humanities: To introduce learners to a broader understanding of the socio-economic framework and cultural context within which health is delivered through the study of humanities and social sciences.

**3) Electives**

**Objectives**: To provide the learner with opportunities:

- For diverse learning experiences,
- It is mandatory for learners to do an elective. The elective time shall not be used to make up for missed clinical postings, shortage of attendance or other purposes.
- Institutions will pre-determine the number and nature of electives, names of the supervisors, and the number of learners in each elective based on the local conditions, available resources and faculty.

- Electives on topics in areas such as Research methodology, Use of Artificial intelligence and computers in Health and Medical Education, Health Management, Health economics, Indian system of medicine, Medical photography /clinical photography, Global health, Evidence based medicine, Art and music in medicine, Literary activities, etc. may be provided by the college/ institution.

- It shall be preferable that elective choices are made available to the learners in the beginning of the academic year.
- The learner must submit a learning log book based on both blocks of the electives.
- 75% attendance in the electives and submission of log book maintained during electives is required for eligibility to appear in the final MBBS examination/ NEXT.
- Institutions may use part of this time for strengthening basic skill certification.

**4) Professional Development including Attitude, Ethics and Communication Module (AETCOM)**

**Objectives** of the programme: At the end of the programme, the learner must demonstrate ability to:

- Understand and apply principles of bioethics and law as they apply to medical practice and research, understand and apply the principles of clinical reasoning as they apply to the care of the patients,
- Understand and apply the principles of system-based care as they relate to the care of the patient,
- Understand and apply empathy and other human values to the care of the patient,
- Communicate effectively with patients, families, colleagues and other health care professionals,
- Understand the strengths and limitations of alternative systems of medicine,
- Respond to events and issues in a professional, considerate and humane fashion,
- Translate learning from the humanities in order to further his professional and personal growth.

**Learning experiences**:

- This will be a longitudinal programme spread across the continuum of the MBBS programme including internship,
- Learning experiences shall include small group discussions, patient care scenarios, workshops, seminars, role plays, lectures etc.
- Attitude, Ethics & Communication Module (AETCOM module) developed by the erstwhile Medical Council of India should be used longitudinally for purposes of instruction.
- 75% attendance in Professional Development Programme (AETCOM Module) shall be mandatory for eligibility to appear for final examination in each professional year.

**Internal Assessment shall include:**

- Written tests comprising of short notes and creative writing experiences,

OSCE based clinical scenarios /viva voce.

- At least one question in each paper of each clinical specialty in the University examination shall test knowledge competencies acquired during the professional development programme.
- Skill competencies acquired during the Professional Development Programme must be tested during the clinical, practical and viva voce.

**5) Learner-doctor method of clinical training (Clinical Clerkship)**

**a. Goal**: To provide learners with experience in:

- Longitudinal patient care,
- Being part of the health care team,
- Hands-on care of patients in outpatient and in-patient setting.

**b. Structure**:

- The first clinical posting in second professional shall orient learners to the patient, their roles and the specialty.
- The learner-doctor programme shall progress as outlined in Table 9.
- The learner shall function as a part of the health care team with the following responsibilities:
  - Be a part of the units' out-patient services on admission days,
  - Remain with the admission unit until at least 6 PM except during designated class hours,
  - Be assigned patients admitted during each admission day for whom he will undertake responsibility, under the supervision of a senior resident or faculty member,

- Participate in the unit rounds on its admission day and will present the assigned patients to the supervising physician,
- Follow the patient's progress throughout the hospital stay until discharge,
- Participate, under supervision, in procedures, surgeries, deliveries etc. of assigned patients,
- Participate in unit rounds on at least one other day of the week excluding the admission day,
- Discuss ethical and other humanitarian issues during unit rounds,
- Attend all scheduled classes and educational activities,
- Document his observations in a prescribed log book /case record.

**No learner will be given independent charge of the patient in the capacity of primary physician of the concerned patient.**

The supervising physician shall be responsible for all patient care decisions and guide the learner from time to time as required.

**6) Assessment:**

- A designated faculty member in each unit will coordinate and facilitate the activities of the learner, monitor progress, provide feedback and review the log book/ case record.
- The log book/ case record must include the written case record prepared by the learner including relevant investigations, treatment and its rationale, hospital course, family and patient discussions, discharge summary etc.
- The log book shall also include records of outpatients assigned. Submission of the log book/ case record to the department is required for eligibility to appear for the final examination of the subject.

**D) Assessment**

**I. Eligibility to appear for Professional examinations**

The performance in essential components of training are to be assessed, based on:

**(a) Attendance**

- There shall be a minimum of 75% attendance in theory and 80% in practical /clinical for eligibility to appear for the examinations in that subject. In subjects that are taught in more than one phase – the learner must have 75% attendance in theory and 80% in practical in each phase of instruction in that subject. There shall be minimum of 80% attendance in family visits under Family adoption programme. Each student shall adopt minimum 3 families and preferably five families. The details shall be as per Family Adoption Program guidelines.
- If an examination comprises more than one subject (for e.g., General Surgery and allied branches), the candidate must have a minimum of 75% attendance in each subject including its allied branches, and 80% attendance in each clinical posting.
- Learners who do not have at least 75% attendance in the electives will not be eligible for the Third Professional - Part II examination/ NEXT.

**(b)** **Internal Assessment**: Internal assessment shall be based on day-to-day assessment. It shall relate to different ways in which learners participate in learning process including assignments, preparation for seminar, clinical case presentation, preparation of clinical case for discussion, clinical case study/ problem solving exercise, participation in project for health care in the community. Internal assessment shall not be added to summative assessment. However, internal assessment should be displayed under a separate column in detailed marks card.

**(c)** Learners must have completed the required certifiable competencies for that phase of training and completed the log book

appropriate for that phase of training to be eligible for appearing at the final university examination of that subject.

**(d)** Regular periodic examinations shall be conducted throughout the course. There shall be no less than three internal assessment examinations in each subject of first and second professional year, and no less than two examinations in each subject of final professional year. An end of posting clinical assessment shall be conducted for each clinical posting in each professional year.

- When subjects are taught in more than one phase, the internal assessment must be done in each phase and must contribute proportionately to final assessment. For example, General Medicine must be assessed in second Professional, third Professional Part I and third Professional Part II, independently.
- Day to day records and log book (including required skill certifications) should be given importance in internal assessment. Internal assessment should be based on competencies and skills.
- The final internal assessment in a broad clinical specialty (e.g., Surgery and allied specialties etc.) shall comprise of marks from all the constituent specialties. The proportion of the marks for each constituent specialty shall be determined by the time of instruction allotted to each.
- Learners must secure at least 50% marks of the total marks (combined in theory and practical / clinical; not less than 40% marks in theory and practical separately) for internal assessment in a particular subject in order to be eligible for appearing at the final University examination of that subject. Internal assessment marks will reflect as separate head of passing at the summative examination.
- The results of internal assessment should be displayed on the notice board within one week of the test.
- Universities shall guide the colleges regarding formulating policies for remedial measures for students who are either not able to score qualifying marks or have missed on some assessments due to any reason.

**II. University Examinations:**

University examinations are to be designed with a view to ascertain whether the candidate has acquired the necessary knowledge, minimal level of skills, ethical and professional values with clear concepts of the fundamentals which are necessary for him/her to function effectively and appropriately as a physician of first contact. Assessment shall be carried out on an objective basis to the extent possible.

- Nature of questions shall include different types such as structured assays (Long-Answer Questions -LAQ), Short-Answer Questions (SAQ) and objective type questions (e.g. Multiple Choice Questions - MCQ). Marks for each part shall be indicated separately. MCQs shall be accorded a weightage of not more than 20% of the total theory marks. Practical /clinical examinations shall be conducted in the laboratories and /or hospital wards. The objective will be to assess proficiency and skills to conduct experiments, interpret data and form logical conclusion. Clinical cases kept in the examination must be common conditions that the learner may encounter as a physician of first contact in the community. Selection of rare syndromes and disorders as examination cases is to be discouraged. Emphasis should be on candidate's capability to elicit history, demonstrate physical signs, write a case record, analyze the case and develop a management plan.
- Viva/oral examination should assess approach to patient management, emergencies, and attitudinal, ethical and professional values. Candidate's skill in interpretation of common investigative data, X-rays, identification of specimens, ECG, etc. is to be also assessed.

**University Examinations shall be held as under:**

**(a) First Professional**

The first Professional examination shall be held at the end of first Professional training (in the 12th month of that training), in the subjects of Anatomy, Physiology and Biochemistry.

**(b) Second Professional**

The second Professional examination shall be held at the end of second

professional training (12th month of that training), in the subjects of Pathology, Microbiology, and Pharmacology.

**(c) Third Professional**

- Third Professional Part I examination shall be held at end of third Professional part 1 of training (12th month of that training) in the subjects of Community Medicine, and Forensic Medicine including Toxicology
- Third Professional Part II / National Exit Test (NExT) as per NExT regulations- (Final Professional) examination shall be at the end of 17th / 18th month of that training, in the subjects of General Medicine, General Surgery, Ophthalmology, Otorhinolaryngology, Obstetrics & Gynecology, and Pediatrics, and allied subjects as per NExT REGULATIONS.

**Note**:

- At least one question in each paper of each PHASE shall test the knowledge, and competencies acquired during the professional development programme (AETCOM module).
- Skills competencies acquired during the Professional Development Programme (AETCOM module) shall be tested during clinical, practical and viva.

**In subjects that have two papers, the learner must secure** minimum 50% of marks in aggregate (both papers together) to pass in the said subject.

**Criteria for passing in a subject**: A candidate shall obtain 50% marks in University conducted examination separately in Theory and in Practical (practical includes: practical/ clinical and viva voce) in order to be declared as passed in that subject.

**Appointment of Examiners**

- **Person appointed as an examiner in the particular subject must have at least four years of total teaching experience as Assistant Professor after obtaining postgraduate degree following MBBS,** in the subject in a

college affiliated to a recognized medical college (by UGMEB of NMC).

- For Practical /Clinical examinations, there shall be at least four examiners for every learner, out of whom not less than 50% must be external examiners. Of the four examiners, the senior-most internal examiner shall act as the Chairman and coordinator of the whole examination programme so that uniformity in the matter of assessment of candidates is maintained.
- A University having more than one college shall have separate sets of examiners for each college, with internal examiners from the concerned college. External examiner may be from outside the college/ university/ state/ union territory.
- There shall be a Chairman of the Board of paper-setters who shall be an internal examiner and shall moderate the questions.
- All eligible examiners with requisite qualifications and experience can be appointed internal examiners by rotation in their subjects.
- All theory paper assessment should be done as central assessment program (CAP) of concerned university.
- Internal examiners shall be appointed from the same institution for unitary examination in the same institution. For pooled examinations at one centre, the approved internal examiners from same university may be appointed.
- The Examiners for General Surgery and allied subjects as well as for General Medicine and allied subjects, shall be from General Surgery and General Medicine respectively.
- There shall be no grace marks to be considered for passing in an examination.

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(2)

## ANNEXURES:

1. COMPETENCIES
2. TABLES RELATED TO CBME/ CURRICULUM, ASSESSMENTS
3. FAMILY ADOPTION PROGRAMME
4. GUIDELINES FOR MANPOWER REQUIREMENT FOR RESEARCH FACILITIES
5. DISABILITY CRITERIA FOR ADMISSION TO MBBS

## AETCOM COMPETENCIES

### AETCOM Competencies for First MBBS

| Subject | Competency Number | Competency |
|---|---|---|
| Anatomy | Module 1.5 | The cadaver as our first teacher<br>Demonstrate respect and follow the correct procedure when handling cadavers and other biologic tissue |
| | Module 1.1 | Identify, discuss Physician's role and responsibility to society and the community that she/he serves |
| Physiology | Module 1.2, Module 1.3 | Demonstrate empathy in patient encounters |
| | Module 1.4 | Demonstrate ability to communicate to patients in a patient, respectful, non- threatening, non-judgmental and empathetic manner |
| Biochemistry | Module 1.1, | Enumerate and Describe the role of a physician in health care system |
| | Module 1.1 | Describe and discuss the commitment to lifelong learning as an important part of physician growth |

**AETCOM Competencies for Second MBBS**

| Subject | Competency Number | Competency |
|---|---|---|
| Pathology | 2.6 | Identify, discuss and defend medico-legal, socio-cultural and ethical issues as they pertain to refusal of care including do not resuscitate and withdrawal of life support. |
| | 2.4 A | Demonstrate ability to work in a team of peers and superiors. |
| | 2.4 B | Demonstrate respect in relationship with patients, fellow team members, superiors and other health care workers. |
| | 2.7 | Identify, discuss and defend, medico-legal, socio-cultural and ethical issues as they pertain to consent for surgical procedures. |
| Microbiology | Module 2.2 A | Describe and discuss the role of non-malfeasance as a guiding principle in patient care |
| | Module 2.2 B | Describe and discuss the role of autonomy and shared responsibility as a guiding principle in patient care |
| | Module 2.2 C | Describe and discuss the role of beneficence of a guiding principle inpatient care |
| | Module 2.2 D | Describe and discuss the role of a physician in health care system |
| | Module 2.2 E | Describe and discuss the role of justice as a guiding principle in patient Care |
| | Module 2.3 | Describe and discuss the role of justice as a guiding principle in patient care |
| | Module 2.5 | Identify, discuss and defend medico-legal, socio-cultural and ethical issues as it pertains to patient autonomy, patient rights and shared responsibility in health care |
| Pharmacology | Module 2.1 | Demonstrate ability to communicate to patients in a patient, respectful, non-threatening, non-judgmental and empathetic manner. |
| | Module 2.8 | Demonstrate empathy in patient encounters. |

**AETCOM Competencies for Third Year (Part I)**

| Subject | Competency Number | Competency |
|---|---|---|
| Ophthalmology | 3.1 | Demonstrate ability to communicate to patients in a patient, respectful, nonthreatening, non-judgmental and empathetic manner |
| | 3.2 | Demonstrate an understanding of the implications and the appropriate procedure and response to be followed in the event of medical error |
| ENT | 3.3 A | Demonstrate ability to communicate to patients in a patient, respectful, nonthreatening, non-judgmental and empathetic manner |
| | 3.3 B | Identify, discuss and defend, medico-legal, socio-cultural and ethical issues as they pertain to consent for surgical procedures |
| Forensic Medicine & Toxicology | 3.3 C | Administer informed consent and appropriately address patient queries to a patient undergoing a surgical procedure in a simulated environment |
| | 3.4 | Identify, discuss and defend medico-legal, socio-cultural and ethical issues as it pertains to confidentiality in patient care |
| Community Medicine | 3.5 A | Identify, discuss and defend medico-legal, socio-cultural, professional and ethical issues as it pertains to the physician - patient relationship (including fiduciary duty) |
| | 3.5 B | Identify and discuss physician's role and responsibility to society and the community that she/ he serves |

**AETCOM Competencies for Third Year (Part II)**

| Subject | Competency Number | Competency |
|---|---|---|
| **Medicine and Allied Subjects** | **4.1 A** | **The student should be able to: Demonstrate ability to communicate to patients in a patient, respectful, nonthreatening, non-judgmental and empathetic manner** |
| | **4.1 B** | **The student should be able to: Communicate diagnostic and therapeutic options to patient and family in a simulated environment** |
| | **4.3** | **The student should be able to: Identify and discuss medico-legal, socio-economic and ethical issues as it pertains to organ donation** |
| **Surgery and Allied Subjects** | **4.4 A** | **The student should be able to: Demonstrate empathy in patient encounters** |
| | **4.4 B** | **The student should be able to: Communicate care options to patient and family with a terminal illness in a simulated environment** |
| | **4.5** | **The student should be able to: Identify and discuss and defend medico-legal, socio-cultural, professional and ethical issues in physician - industry relationships** |
| | **4.6** | **The student should be able to: Identify conflicts of interest in patient care and professional relationships and describe the correct response to these conflicts** |
| **Obstetrics and Gynecology** | **4.2** | **The student should be able to: Identify, discuss and defend medico-legal, socioeconomic and ethical issues as it pertains to abortion / Medical Termination of Pregnancy and reproductive rights** |
| | **4.7** | **The student should be able to: Identify conflicts of interest in patient care and professional relationships and describe the correct response to these conflicts** |
| | **4.8 A** | **The student should be able to: Identify conflicts of interest in patient care and professional relationships and describe the correct response to these conflicts.** |

| | | |
|---|---|---|
| | | |
| | **4.8 B** | **The student should be able to: Demonstrate empathy to patient and family with a terminal illness in a simulated environment.** |
| **Pediatrics** | **4.9 A** | **The student should be able to: Identify, discuss and defend medico-legal, socio-cultural, professional and ethical issues pertaining to medical negligence** |
| | **4.9 B** | **The student should be able to: Identify, discuss and defend medico-legal, socio-cultural, professional and ethical issues pertaining to malpractice** |

**Table1: Time distribution of MBBS Programme & Examination Schedule**

Proposed AcademiCalenderfor CBME 2023-24 Batch 2023

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023 | | | | | | | | | 1 | 2 | 3 | 4 |
| 2024 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12-Ist Prof, exam, result | 13- 2nd MBBS | 14 | 15 | 16 |
| 2025 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24- 2nd Prof exam, result | 25- Final 1st | 26 | 27 | 28 |
| 2026 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36- Final 1st exam, result | 37- Final 2nd | 38 | 39 | 40 |
| 2027 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 |
| 2028 | 53 | 54 NEXT-1 | 1- CRMI | 2 | 3 | 4 | 5- 2nd propose d NEXT | 6 | 7 | 8 | 9 | 10 |
| 2029 | 11 | 12-NEXT-Step 2 | | | | | | | | | | |

***Legends:***

***AETCOM: Attitude, Ethics and Communication skills***

***FAP: Family Adoption Programme (village outreach)***

***SDL: Self Directed Learning***

***SGL: Small Group Learning (tutorials/ Seminars/ Integrated Learning)***

***PCT (mentioned in Assessments): Part Completion Test***

**Table2: Distribution of subjects in each Professional Phase**

| Phase & year of MBBS training | Subjects & Teaching Elements | Duration (months) | University Exam-ination |
|---|---|---|---|
| First Professional MBBS | (i) Foundation course -1 week, remaining spread over 6 months at the discretion of college<br>(ii) Anatomy, Physiology & Biochemistry, Introduction to Community Medicine, including Family adoption programme (FAP) through village outreach<br>(iii) Early Clinical Exposure<br>(iv) Attitude, Ethics, and communication Module (AETCOM) including Humanities | 12 months | 1st professional |
| Second Professional MBBS | (i) Pathology, Microbiology, Pharmacology<br>(ii) Introduction to clinical subjects<br>(iii) Clinical postings, Family visits for FAP<br>(iv) AETCOM | 12 months | 2nd professional |
| Third Professional part 1, MBBS, including Electives 1 month | (i) Community Medicine, Forensic Medicine and Toxicology, Medicine & allied, Surgery & allied, Pediatrics, Obstetrics & Gynecology<br>(ii) Family visits for FAP<br>(iii) Clinical postings<br>(iv) AETCOM<br>(v) Electives- 1 month, 2 blocks, 15 days each | 12 months | Final professional - Part 1 |
| Third Professional part 2, MBBS | (i) General Medicine, Dermatology, Psychiatry, Respiratory medicine, Pediatrics, General Surgery, Orthopedics, Oto-rhinolaryngology, Ophthalmology, Radiodiagnosis, Anesthesiology, Obstetrics & Gynecology<br>(ii) Clinical postings<br>(iii) AETCOM | 18 months | Final Profession-al - Part II |

**Table 3: Foundation Course**

(one week + spread over 6 months at the discretion of college)

| **Subjects/Contents** | **Teaching hours** |
|---|---|
| Orientation | 30 |
| Skills Module | 34 |
| Field visit to Community Health Center | 08 |
| Introduction to Professional Development & AETCOM module | 40 |
| Sports, Yoga and extra-curricular activities | 16 |
| Enhancement of language/computer skills | 32 |
| **Total** | **160** |

**Table no. 4 Distribution of Subject Wise Teaching Hours for 1st MBBS**

| Subject | Lectures | SGL | SDL | Total |
|---|---|---|---|---|
| Foundation Course | | | | 39 |
| Anatomy | 210 | 400 | 10 | 620 |
| Physiology | 130 | 300 | 10 | 440 |
| Biochemistry * | 78 | 144 | 10 | 232 |
| Early Clinical Exposure** | 27 | - | 0 | 27 |
| Community Medicine | 20 | 20 | | 40 |
| FAP | | | 27 | 27 |
| (AETCOM)*** | - | 26 | - | 26 |
| Sports and extra-curricular activities | - | - | - | 10 |
| Formative Assessment and Term examinations | - | - | - | 60 |
| **Total** | **464** | **918** | **30** | **1521 #** |

* Including Molecular Biology

** Early Clinical exposure hours to be divided equally in all three subjects.

***AETCOM module shall be a longitudinal programme.

\# Includes hours for Foundation course also

**Table no. 5- Distribution of Subject Wise Teaching Hours for II MBBS**

| Subjects | Lectures | SGL | Clinical Postings* | SDL | Total |
|---|---|---|---|---|---|
| Pathology | 80 | 165 | - | 10 | 255 |
| Pharmacology | 80 | 165 | - | 10 | 255 |
| Microbiology | 70 | 135 | - | 10 | 215 |
| Community Medicine | 15 | 0 | 0 | 10 | 25 |
| FAP | 0 | 0 | 30 | | 30 |
| Forensic Medicine and Toxicology | 12 | 22 | - | 08 | 42 |
| Clinical Subjects | 59 | | 540 | - | 599 |
| AETCOM | - | 29 | - | 8 | 37 |
| Sports, Yoga and extra-curricular activities | - | - | - | 20 | 35 |
| Pandemic module | | | | 28 | 28 |
| | | | | | |
| Final total | 316 | 516 | 585 | 104 | 1521 |

***Pl. note: Clinical postings shall be for 3 hours per day, Monday to Friday.***

***There will be 15 hours per week for all clinical postings.***

**Table no. 6 - Distribution of Subject Wise Teaching Hours for Final MBBS part 1.**

| Subject | Lectures | SGL | SDL | Total |
|---|---|---|---|---|
| Electives | 0 | 156 | 0 | 156 |
| Gen. Med. | 30 | 50 | 10 | 90 |
| Gen Surgery | 30 | 50 | 10 | 90 |
| Obs. & Gyn | 30 | 50 | 10 | 90 |
| Pediatrics | 25 | 30 | 10 | 65 |
| Orthopedics | 15 | 20 | 10 | 45 |
| For. Med.& Tox. | 40 | 70 | 20 | 130 |
| Community Med | 55 | 70 | 20 | 145 |
| FAP (Visits +log book submission) | - | 21 | 10 | 31 |
| Otorhinolaryngology (ENT) | 15 | 20 | 10 | 45 |
| Ophthalmology | 15 | 20 | 10 | 45 |
| Clinical posting | | | 540 | 540 |
| AETCOM | 0 | 19 | 12 | 31 |
| Pandemic module | 18 | 0 | 0 | 18 |
| | | | | |
| **Total** | **273** | **546** | **672** | **1521** |

**Table 7: Distribution of Subject wise Teaching Hours for**

**Third professional part-2/ Final MBBS**

| Subjects | Lectures | SGL | SDL | Total |
|---|---|---|---|---|
| General Medicine | 95 | 155 | 55 | **260** |
| General Surgery | 80 | 140 | 40 | **260** |
| Obstetrics and Gynecology | 80 | 140 | 40 | **260** |
| Pediatrics | 30 | 60 | 30 | **120** |
| Orthopedics | 25 | 35 | 25 | **85** |
| AETCOM | 30 | 0 | 22 | **52** |
| Dermatology | 15 | 10 | 15 | **40** |
| Psychiatry | 15 | 15 | 15 | **45** |
| Otorhinolaryngology (ENT) | 15 | 25 | 15 | **55** |
| Ophthalmology | 15 | 25 | 15 | **55** |
| Radiodiagnosis | 8 | 15 | 15 | **38** |
| Anesthesiology | 8 | 15 | 15 | **38** |
| Pandemic module | 28 | - | - | **28** |
| | | | | |
| **TOTAL** | **444** | **610** | **302** | **1356** |

*Extra hours may be used for preparation of NExT or SDL.*

**Table no. 8: Clinical Posting Schedules in weeks**

| Subjects | Period of training in weeks | | | Total Weeks |
|---|---|---|---|---|
| | II MBBS | III MBBS Part I | III MBBS Part II | |
| Electives | 0 | 4 | 0 | 4 |
| General Medicine | 9 | 4 | 14 | 27 |
| General Surgery | 7 | 4 | 10 | 21 |
| Obstetrics & Gynaecology | 7 | 4 | 10 | 21 |
| Pediatrics | 4 | 4 | 5 | 13 |
| Community Medicine | 4 | 4 | 0 | 8 |
| Orthopaedics | 2 | 2 | 4 | 8 |
| Otorhinolaryngology | 0 | 3 | 4 | 7 |
| Ophthalmology | 0 | 3 | 4 | 7 |
| Psychiatry | 0 | 2 | 4 | 6 |
| Radio-diagnosis | 0 | 0 | 2 | 2 |
| Dermatology | 2 | 2 | 2 | 6 |
| Dentistry | 1 | 0 | 0 | 1 |
| Anaesthesiology | 0 | 0 | 3 | 3 |
| **Total** | **36** | **36** | **62** | **134** |

**Table 9: Learner- Doctor programme (Clinical Clerkship)**

| Year of Curriculum | Focus of Learner-Doctor programme |
|---|---|
| Year 1 | Introduction to hospital environment, early clinical exposure, understanding perspectives of illness, family adoption program |
| Year 2 | History taking, physical examination, assessment of change in clinical status, communication and patient education, family adoption program |
| Year 3 | All of the above and choice of investigations, basic procedures and continuity of care |
| Year 4 | All of the above (except Family adoption programme) and decision making, management and outcomes |

**Table 10 : Marks distribution for various subjects for University Annual Examinations**

| Phase of Course | Theory | Practicals | Passing criteria |
|---|---|---|---|
| **1st MBBS** | | | |
| Anatomy- 2 papers | Paper 1- 100 | 100 | Mandatory to get 40% marks separately in theory and in practicals; and totally 50% for theory plus practicals. |
| | Paper 2 -100 | | |
| Physiology- 2 papers | Paper 1- 100 | 100 | |
| | Paper 2 -100 | | |
| Biochemistry- 2 papers | Paper 1- 100 | 100 | |
| | Paper 2- 100 | | |
| **2nd MBBS** | | | |
| Pathology - 2 papers | Paper 1- 100 | 100 | |
| | Paper 2 -100 | | |
| Microbiology- 2 papers | Paper 1- 100 | 100 | |
| | Paper 2- 100 | | |
| | | | |
| Pharmacology- 2 papers | Paper 1 -100 | 100 | |
| | Paper 2- 100 | | |
| **Final MBBS part 1** | | | |
| Forensic Med. Tox.- 1 paper | Paper 1 - 100 | 50 | |
| Community Med- 2 papers | Paper 1 -100 | 100 | |
| | Paper 2- 100 | | |
| | | | |

**For NEXT, as per NEXT regulations.**

**Name of Institute:**

**DEPARTMENT OF Anatomy/Physiology/Biochemistry**

| Faculty : MBBS | Year/Phase- I | | Date : dd/mm/yyyy |
|---|---|---|---|

| | | Formative Assessment Theory | | | Continuous Internal assessment Theory | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Roll No.** | **Name of Student** | **1st PCT Theory** | **2nd PCT Theory** | **Prelims Theory (Paper I & II)** | Home Assignment | Continuous Class Test (LMS) | Seminar | Museum study | Library assignments | Attendance Theory | **Total** |
| | | | | | | | ***Self Directed Learning*** | | | | |
| | | **100** | **100** | **200** | **15** | **30** | **15** | **15** | **15** | **10** | **500** |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

**Professor & Head**
**Department of _____**
**Name of Institute**

**Name of Institute :**

**Department of Anatomy/Physiology/Biochemistry**

**Faculty** : MBBS | **Year/Phase- I** | **Date : dd/mm/yyyy**

| | | | Formative Assessment | | | Continuous Internal Assessment (Practical) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.No. | Roll No. | Name of Student | 1st PCT Practical/First Ward Leaving Examination | 2nd PCT Practical /Second Ward Leaving Examination | Prelims Practical | Log book (150) | | | | Journal *(Record book/ Portfolio)* | Attendance (Practical) | Total |
| | | | | | | Certifiable skill based competencies (Through OSPE/OSCE/Spots/Exercise/Other ) | AETCOM competencies | SVL Lab activity | Research | | | |
| | | | 100 | 100 | 100 | 60 | 30 | 40 | 20 | 40 | 10 | 500 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**Professor & Head**
**Department of _____**
**Name of Institute**

**Name of Institute :**

**DEPARTMENT OF Pathology/Pharmacology/Microbiology**

| Faculty : MBBS | Year/Phase- II | |
|---|---|---|

| | | | Formative Assessment Theory | | | Continuous Internal assessment Theory | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **S.No.** | **Roll No.** | **Name of Student** | **1st PCT Theory** | **2nd PCT Theory** | **Prelims Theory (Paper I & II)** | Home Assignment | Continuous Class Test (LMS) | Seminar | Museum study | Library assignments | Attendance Theory | **Total** |
| | | | | | | | | ***Self Directed Learning*** | | | | |
| | | | **100** | **100** | **200** | **15** | **30** | **15** | **15** | **15** | **10** | **500** |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**Professor & Head**
**Department of** _____
**Name of Institute**

## Name of Institute :

**Department of Pathology/Pharmacology/Microbiology**

| Faculty : MBBS | Year/Phase- II | | Date : dd/mm/yyyy |
|---|---|---|---|

| | | | Formative Assessment | | | Continuous Internal Assessment (Practical) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.No. | Roll No. | Name of Student | 1st PCT Practical/First Ward Leaving Examination | 2nd PCT Practical /Second Ward Leaving Examination | Prelims Practical | Log book (150) | | | | Journal *(Record book/ Portfolio)* | Attendance (Practical) | Total |
| | | | | | | Certifiable skill based competencies (Through OSPE/OSCE/Spots/Exercise/ Other) | AETCOM competencies | SVL Lab activity | Research | | | |
| | | | 100 | 100 | 100 | 60 | 30 | 40 | 20 | 40 | 10 | 500 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**Professor & Head**
**Department of _____**
**Name of Institute**

## DEPARTMENT OF Community Medicine

**Faculty :** MBBS **Year/Phase 3, part 1**

| | | | Formative Assessment_Theory | | | Continuous Internal assessment_Theory | | | | | | | | | Cumulative percent of Theory & Practical |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.No. | Roll No. | Name of Student | 1st PCT Theory | 2nd PCT Theory | Prelims Theory (Paper I & II) | Home Assignment | Seminar | Continuous Class Test (LMS) | Museum study | Library assignments | Attendance Theory | Total | Percentage Theory *(Minimum cut off 40%)* | | Theory+ Practical = 500+500= 1000 *(Minimum cut off 50%)* *Note: Minimum 40% separately for theory and practical and 50% cumulative in IA for eligibility in Summative examination* |
| | | | | | | | | | *Self Directed Learning* | | | | | | |
| | | | 100 | 100 | 200 | 15 | 15 | 30 | 15 | 15 | 10 | 500 | % | | |
| 1 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | |

## DEPARTMENT OF FMT

Faculty: MBBS,
Year/ Phase 3, part 1

| | | | Formative Assessment_Theory | | | Continuous Internal assessment_Theory | | | | | | Total | Percentage Theory *(Minimum cut off 40%)* | | Cumulative percent of Theory & Practical |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.No. | Roll No. | Name of Student | 1st PCT Theory | 2nd PCT Theory | Prelims Theory (Paper I & | Home Assignment | Seminar | Continuous Class Test (LMS) | Museum study | Library assignments | Attendance Theory | | | | Theory+ Practical = 375+500= 875 *(Minimum cut off 50%)* |
| | | | | | | | | | *Self Directed Learning* | | | | | | |
| | | | 100 | 100 | 100 | 10 | 10 | 25 | 10 | 10 | 10 | 375 | % | | |
| 1 | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |

**S/d**
**Professor & Head**
**Department of _____**
*** Medical College**
**University**
**State/**
**U.T.**

Name of Institute :

Faculty : Final MBBS | Year/Phase- Part - II

Date : dd/mm/yyyy

## DEPARTMENT OF Paediatrics/ENT/Ophthalmology

| S.No. | Roll No. | Name of Student | Formative Assessment_Theory | | | Continuous Internal assessment_Theory | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1st PCT Theory | 2nd PCT Theory | Prelims Theory (Paper I & II) | Home Assignment | Continuous Class Test (LMS) | Seminar | Museum study | Library assignments | Attendance Theory | |
| | | | | | | | | *Self Directed Learning* | | | | |
| | | | 100 | 100 | 100 | 10 | 25 | 10 | 10 | 10 | 10 | 375 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

| Name of Institute : | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Department of Paediatrics/ENT/Ophthalmology | | | | | | | | | | | | |
| Faculty : Final MBBS | | | Year/Phase- Part -II | | | | | | | | | Date : dd/mm/yyyy |
| | | | Formative Assessment | | | Continuous Internal Assessment (Practical) | | | | | | |
| S.No. | Roll No. | Name of Student | 1st PCT Practical/First Ward Leaving Examination | 2nd PCT Practical /Second Ward Leaving Examination | Prelims Practical | Log book (150) | | | | Journal *(Record book/Portfolio)* | Attendance (Practical) | Total |
| | | | | | | Certifiable skill based competencies (Through OSPE/OSCE/Spots/Exercise/Other) | AETCOM competencies | SVL Lab activity | Research | | | |
| | | | 100 | 100 | 100 | 60 | 30 | 50 | 20 | 40 | 10 | 500 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

## DEPARTMENT OF Medicine, Surgery, OBGY

Final MBBS Year-3, Part II

| S.No. | Roll No. | Name of Student | Formative Assessment_Theory | | | Continuous Internal assessment_Theory | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **1st PCT Theory** | **2nd PCT Theory** | **Prelims Theory (Paper I & II)** | Home Assignment | Continuous Class Test (LMS) | Seminar | Museum study | Library assignments | Attendance Theory | **Total** |
| | | | | | | | | ***Self Directed Learning*** | | | | |
| | | | **100** | **100** | **200** | **15** | **30** | **15** | **15** | **15** | **10** | **500** |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**Professor & Head**
**Department of _____**
**Name of Institute**

| DEPARTMENT OF Medicine, Surgery, OBGY | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Faculty : Final MBBS | | | Year/Phase- Part - II | | | | | | | | Date : dd/mm/yyyy | |
| | | | Formative Assessment | | | Continuous Internal Assessment (Practical) | | | | | | |
| S.No. | Roll No. | Name of Student | 1st PCT Practical/First Ward Leaving Examination | 2nd PCT Practical /Second Ward Leaving Examination | Prelims Practical | Log book (200) | | | | Journal *(Record book/Portfolio)* | Attendance (Practical) | Total |
| | | | | | | Certifiable skill based competencies (Through OSPE/OSCE/Spots/Exercise/Other) | AETCOM competencies | SVL Lab activity | Research | | | |
| | | | 100 | 100 | 200 | 100 | 40 | 40 | 20 | 40 | 10 | 650 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**Professor & Head**
**Department of _____**
**Name of Institute**

# National Medical Commission (Undergraduate Medical Education) Guidelines, 2023

## CURRICULUM FOR FAMILY ADOPTION PROGRAMME

### FAMILY ADOPTION PROGRAM:

This is being introduced with the aim of village outreach program for MBBS students. Every student shall ideally adopt 5(five) families. However, minimum 3(three) families are mandatorily to be adopted by every MBBS students. Every college may arrange one diagnostic medical camp in the village wherein identification of:

a) anaemia, malnutrition in children, hypertension, diabetes mellitus, ischemic heart diseases, kidney diseases, any other local problems may be addressed.
b) If required, patients shall be admitted in the hospital for acute illness under care of student, charges may be waived off or provide concession or govt. schemes.
c) For chronic illness, students shall be involved.
d) Subsidized treatment charges may be provided under govt. schemes or welfare schemes.
e) Medical student may be allocated about 5 families and introduced in the first visit.
f) Camps may be arranged by Dean and Community Medicine/ P.S.M. department with active involvement of Associate/ Asst. Professors, social worker and supporting staff. Local population may be involved with village leaders.
g) Visit by students be made to the visit as mentioned in table below. Annual follow up diagnostic camp can be continued by the PSM department.

### TARGETS TO BE ACHIEVED BY STUDENTS:

**First Professional Year:**

a) Learning communication skills and inspire confidence amongst families
b) Understand the dynamics of rural set-up of that region
c) Screening programs and education about ongoing government sponsored health related programs
d) Learn to analyse the data collected from their families
e) Identify diseases/ ill-health/ malnutrition of allotted families and try to improve the standards

**Second Professional Year**

a) Inspire active participation of community through families allotted
b) Continue active involvement to become the first doctor /reference point of the family by continued active interaction
c) Start compiling the outcome targets achieved

**Third Professional Year**

Analysis of their involvement and impact on existing socio-politico-economic dynamics in addition to improvement in health conditions

**-Final visit to have last round of active interaction with families**
**-prepare a report to be submitted to department addressing:**

1) Improvement in general health
2) Immunization
3) Sanitation,
4) De-addiction
5) Whether healthy lifestyles like reading good books, sports/ yoga activities have been inculcated in the house-holds.
6) Improvement in anaemia, tuberculosis control
7) Sanitation awareness
8) Any other issues
9) Role of the student in supporting family during illness/ medical emergency
10) Social responsibility in the form of environment protection programme in form of plantation drive (medicinal plants/trees), cleanliness and sanitation drives with the initiative of the medical student

**Curriculum for Family Adoption Programme**

| Professional Year | Competency The student should be able to | Objectives | Suggested Teaching Learning methods | Suggested Assessment methods | Teaching Hours |
|---|---|---|---|---|---|
| 1st Professional | • Collect demographic profile of allotted families, take history and conduct clinical examination of all family members | By the end of this visit, students should be able to compile the basic demographic profile of allocated family members | Family survey, Community clinics | Community case presentation, OSPE, logbook, journal of visit | 6 hrs |
| | • Organize health check-up and coordinate treatment of adopted family under overall guidance of mentor | By the end of this visit, students should be able to report the basic health profile and treatment history of allocated family members | Community clinics, Multispecialty camps | Community case presentation, OSPE, logbook, journal of visit | 9 hrs |
| | • Maintain communication & follow up of remedial measures | By the end of this visit, students should be able to provide details of communication maintained with family members for follow-up of treatment and | Reporting of follow up visits, PRA techniques (transact walk, group discussion) Community | Community case presentation, OSPE, logbook based certification of competency, journal of visit | 6 hrs |

| | | | | | |
|---|---|---|---|---|---|
| | | suggested remedial measures | clinics. | | |
| | • Take part in environment protection and sustenance activities. | By the end of this visit, students should be able to report the activities undertaken for environment protection and sustenance like study of environment of families, tree plantation herbal plantation activities conducted in the village | Participation in and Process documentation of activities (NSS activities) along with reporting of photographic evidences | logbook based certification of competency, journal of visit | 6hrs<br><br>( Total27 hrs, 9 visits) |
| 2nd Professional | • Take history and conduct clinical examination of all family members | By the end of this visit, students should be able to compile the updated medical history of family members and report their vitals and anthropometry | Family survey, Community clinics | Community case presentation, OSPE, logbook, journal of visit | 6 hrs |
| | • Organize health check-up and coordinate treatment of adopted family under overall guidance of mentor | By the end of this visit, students should be able to report the details of clinical examination like Hb %, blood group, urine routine and blood sugar along with treatment history of allocated family members | Community clinics, Multispecialty camps | Community case presentation, OSPE, logbook, journal of visit | 9 hrs |

| | | | | | |
|---|---|---|---|---|---|
| | • Maintain communication & follow up of remedial measures | By the end of this visit, students should be able to provide details of communication maintained with family members for follow-up of treatment, and suggested remedial measures along with details of vaccination drive | Reporting of follow up visits, PRA techniques (transact walk, group discussion) Community clinics, | Community case presentation, OSPE, logbook based certification of competency, journal of visit | 9 hrs |
| | • Take part in environment protection and sustenance activities. | By the end of this visit, students should be able to report the activities undertaken for environment protection and sustenance like study of environment of families, tree plantation herbal plantation activities conducted in the village | Participation in and Process documentation of activities (NSS activities) along with reporting of photographic evidences | logbook based certification of competency, journal of visit | 6 hrs<br><br>( Total 30 hrs, 10 visits) |
| 3rd Professional | • Take history and conduct clinical examination of all family members | By the end of this visit, students should be able to update the medical history of family members and their vitals and anthropometry | Family survey, Community clinics | Community case presentation, OSPE, logbook, journal of visit | 3hrs |
| | • Organize health check-up and coordinate treatment of adopted family under overall guidance of mentor | By the end of this visit, students should be able to report the details of clinical examination like Hb %, blood group, urine | Community clinics, Multispecialty camps | Community case presentation, OSPE, logbook, journal of visit | 3hrs |

| | | | | | |
|---|---|---|---|---|---|
| | | routine and blood sugar along with treatment history of allocated family members | | | |
| | • Maintain communication & follow up of remedial measures | By the end of this visit, students should be able to provide details of communication maintained with family members for follow-up of treatment, and suggested remedial measures along with details of vaccination drive | Reporting of follow up visits, PRA techniques (transact walk, group discussion) Community clinics, | Community case presentation, OSPE, logbook based certification of competency, journal of visit | 3hrs |
| | • Take part in environment protection and sustenance activities.<br>• Council the family members of allotted families and analyze the health trajectory of adopted family under overall guidance of mentor | By the end of this visit, students should be able to report the activities undertaken for environment protection and sustenance like study of environment of families, tree plantation herbal plantation activities conducted in the village.<br>By the end of this visit, students should be able to analyze and report the health trajectory of adopted family along with remedial measures adopted at individual, family and community level | Participation in and Process documentation of activities (NSS activities) along with reporting of photographic evidences, Small group discussion (report of the health trajectory of adopted family) | logbook based certification of competency, journal of visit | 3hrs<br><br>( total 21 hrs, 7 visits) |

## LOG BOOK FOR FAMILY ADOPTION

**COLLEGE NAME** :

**UNIVERSITY** :

**ADDRESS DETAILS** :

**NAME OF THE STUDENT** :

ROLL NO. :

VILLAGE NAME :

TEHSIL/ DISTRICT :

STATE/ UNION TERITORY :

NAME OF THE MENTOR :

MENTOR STATUS :
Asst. Prof/ S.R. And Details
(If changed, details of subsequent mentors)

NAME OF ASHA WORKER :

ADDRESS OF ASHA WORKER :

EXPERIENCE :
(SINCE HOW MANY YEARS IS HE/ SHE EMPLOYED)
(SEPARATE PAGE FOR EACH FAMILY BE MAINTAINED)

- Family name and address
- Approximate size of living space of house-hold
- Malaria/ flu/ etc pertinent to the region

1) If there is any illness or medical emergency required by the house-hold, the student should take initiative in being the primary contact for the family.
2) The student in turn should consult his/her mentor for further management of the patient.
3) The hospital to which the college is attached must provide treatment facilities to the patient.
4) Government schemes may be utilized for optimal management.
5) Follow-up records must be maintained by the student. These must be periodically evaluated by mentors with the help of senior residents.
6) The entire data sheet may be prepared by every student and submitted by the end of 6th semester for evaluation.
7) Progress notes must include every demographic point and history recorded.

## GUIDELINES FOR MANPOWER REQUIREMENT FOR RESEARCH FACILITIES IN A MEDICAL COLLEGE

Research labs can be under following categories:

1. Molecular lab
2. Stem cell research lab
3. Cytogenetics
4. HLA and tissue typing research lab

Applied Clinical research for organ perfusion, cancer research, in vitro fertilization, etc. can be under any of the above research facilities.

**MAN POWER**

**(1) Lab Director post-1**

| | | |
|---|---|---|
| **Minimum Qualifications required** | : | MD Path/MD Microbiology/MD Transfusion Medicine/MD Biochemistry. Faculty with PhD ( Medical subject will be preferred) |
| **Lab work** | : | 10 years experience |
| **Lab research related publications** | : | Minimum 10 in last 10 years |

**(2) Lab Supervisor post-1 (per research facility)**

| | | |
|---|---|---|
| **Minimum Qualifications required** | : | MD Path/ MD Microbiology/ MD Transfusion Medicine/ MD Biochemistry Faculty with PhD (Medical subject) will be preferred or MSc in life sciences with Ph.D. from Medical college |
| **Lab work** | : | 7 years experience |
| **Lab research related publications** | : | Minimum 5 in last 5 years |

**(3) Senior Scientific Research Officer posts- 1 or more (per research facility)**

| | | |
|---|---|---|
| **Minimum Qualifications required** | : | PhD with MD Path/ MD Microbiology/ MD Transfusion Medicine/ MD Biochemistry/PhD in medical college or MSc in life sciences with PhD from medical college |
| **Lab work** | : | 4years experience |
| **Lab research related publications** | : | Minimum 3 in last 3 years |

**(4) Junior Research Officer-posts- 1 or more (per research facility)**

| | | |
|---|---|---|
| **Minimum Qualifications required** | : | MD Path/ MD Microbiology/ MD Transfusion Medicine/ MD Biochemistry or Diploma in Clinical Pathology/ MSc in life sciences, PhD scholar/ Postdoc fellow<br>Diploma holder in any branch may pursue PhD if experience / research inclinations proved for minimum of 1 year. They can be enrolled for integrated Master's PhD course. |
| **Lab work** | : | 1 year experience |
| **Lab research related publications** | : | Preferably 1 in last 2 years |

**(5) Laboratory Technicians- Posts- 2 (minimum)**

| | | |
|---|---|---|
| **Minimum Qualifications required** | : | B.Sc/ M.Sc, in life sciences including Biotechnology,<br>DMLT |

**(6) Data entry operator/ Clerk – (As per requirement)**

**(7) Store keeper – post 1 (minimum)**

(8) **Biostatistician- post 1**(minimum)

**(9) Lab attendant (As per requirement)**

**(10) Peon/ Multi-task worker (As per requirement)**

(11) **Clinical Monitors (As per requirement)**

| | | |
|---|---|---|
| **Minimum Qualifications required** | : | A medical professional having MBBS degree or above with research inclination |

**(12) Social worker/ MSW with applied research inclinations (As per requirement)**

**Guidelines regarding admission of students with "Specified Disabilities" under the Rights of Persons with Disabilities Act, 2016 with respect to admission in MBBS Course.**

Note : 1. The "Certificate of Disability" shall be issued in accordance with the Rights of Persons with Disabilities Rules, 2017 notified in the Gazette of India by the Ministry of Social Justice and Empowerment [Departmentof Empowerment of Persons with Disabilities (*Divyangjan*)] on 15th June 2017.

2. The extent of "specified disability" in a person shall be assessed in accordance with the "Guidelines forthe purpose of assessing the extent of specified disability in a person included under the Rights of Persons with Disabilities Act, 2016 (49 of 2016)" notified in the Gazette of India by the Ministry of Social Justice and Empowerment [Department of Empowerment of Persons with Disabilities (*Divyangjan*)] on 4th January 2018.

3. The minimum degree of disability should be 40% (Benchmark Disability) in order to be eligible for availing reservation for persons with specified disability.

4. **The term 'Persons with Disabilities' (PwD) is to be used instead of the term 'Physically Handicapped' (PH).**

| S. No. | Disability Type | Type of Disabilities | Specified Disability | Disability Range | | |
|---|---|---|---|---|---|---|
| | | | | Eligible for Medical Course, Not Eligible for PwD Quota | Eligible for Medical Course, Eligible for PwD Quota | Not Eligible forMedical Course |
| 1. | Physical Disability | A. LocomotorDisability, including Specified Disabilities(a to f). | a. Leprosy cured person* | Less than 40% disability | 40-80% disability Persons with more than 80% disability may also be allowed on case to case basis and their functional competency will be determined with the aid of assistive devices, if it is being used, to see if it is brought below 80% and whether they possess sufficient motor ability as required to pursue and complete the course satisfactorily. | More than 80% |
| | | | b. Cerebral Palsy** | | | |
| | | | c. Dwarfism | | | |
| | | | d. Muscular Dystrophy | | | |
| | | | e. Acid attack victims | | | |
| | | | f. Others*** such as Amputation, Poliomyelitis, etc. | | | |
| | | | * Attention should be paid to loss of sensations in fingers and hands, amputation, as well as involvement of eyes and corresponding recommendations be looked at.<br>** Attention should be paid to impairment of vision, hearing, cognitive function etc and corresponding recommendations be looked at.<br>*** (i) Both hands intact, with intact sensations, sufficient strength and range of motion are essential tobe considered eligible for medical course.<br>(ii) Movement of the upper limb with respect to all the joints (shoulder, elbow, forearm, wrist and all fingers) to be considered – full power, intact, in the dominant upper limb is necessary.<br>(iii) For non-dominant upper limb, power of 4/5 or above is recommended. | | | |
| | | B. Visual Impairment (*) | a. Blindness | Less than 40% disability | - | Equal to or More than 40% Disability |
| | | | b. Low vision | | | |
| | | C. Hearing impairment@ | a. Deaf | Less than 40% Disability | - | Equal to or more than 40% Disability |
| | | | b. Hard of hearing | | | |
| | | | (*) Persons with Visual impairment / visual disability of equal to or more than 40% may be made eligible to pursue MBBS Course and may be given reservation, subject to the condition that the visual disability is brought to a level of less than the benchmark of 40% with advanced low vision aids such as telescopes / magnifier etc.<br>@Person with hearing disability of more than 40% may be made eligible to pursue MBBS Course and may be given reservation subject to condition that the hearing disability is brought to a level of less than the bench mark of 40% with the aid of assistive devices/cochlear implants (CI).<br>In addition to this, the individual should have speech discrimination score of more than 60% | | | |

| | | Type of Disabilities | Disability Range | | | |
|---|---|---|---|---|---|---|
| | | | **Specified Disability** | **Eligible for Medical Course, Not Eligible for PwD Quota** | **Eligible for Medical Course,Eligible for PwD Quota** | **Not Eligible for Medical Course** |
| | | D. Speech & language disability$ | Organic/ neurologi calcauses | Less than 40% Disability | - | Equal to or more than 40% Disability |
| | | $ Persons with Speech Intelligibility Affected (SIA) shall be eligible to pursue MBBS Courses, provided Speech Intelligibility Affected (SIA) score shall not exceed 3 (three), which is 40% or below.<br>Persons with Aphasia shall be eligible to pursue MBBS Courses, provided Aphasia Quotient (AQ) is 40% or below. | | | | |
| 2. | Intellectual disability | a. Specific learning disabilities (Perceptual disabilities, Dyslexia, Dyscalculia, Dyspraxia & Developmental aphasia)# | # currently there is no Quantification scale available to assess the severity of SpLD, therefore the cut-off of 40% is arbitrary and more evidence is needed. | | | |
| | | | | Less than 40% Disability | Equal to or more than 40% disability and equal to or less than 80%.<br>But selection will be based on the learning competency evaluated with the help of the remediation/assisted technology/aids/infrastructural changes by the Expert Panel. | More than 80% or severe nature or significant cognitive/ intellectual disability. |
| | | b. Autism spectrum disorders | | Absence or Mild Disability, Asperger syndrome (disability of upto 60% as per ISAA) where the individual is fit for MBBS course by an expert panel. | Currently not recommended due to lack of objective method to establish presence and extent of mental illness.<br>However, the benefit of reservation/quota may be considered in future after developing better methods of disability assessment. | More than 60% disabilityor presence of cognitive/intellectual disability and/or if the person is unfit for pursuing MBBS course by an expert panel. |
| 3. | Mental behavior | Mental illness | | Absence or mild Disability: less than 40% (under IDEAS) | Currently not recommended due to lack of objective method to establish presence and extent of mental illness.<br>However, the benefit of reservation/quota may be considered in future after developing better methods of disability assessment.<br><br>According to the Notification dated 09.12.2020 by the Department of Empowerment of Persons with Disabilities (Divyangjan), Ministry of Social Justice, a diagnosis of SLD using NIMHANS SLD Battery should be equated to more than 40% disability. Any person with SLD and more than 40% disability should be allowed to complete on par with other PwDs under the reservation quota for PwDs. | Equal to or more than 40% disability or if the person is unfit to perform his/her duties.<br>Standards may be drafted for the definition of "fitness to practice Medicine" as are used by serval institutions of countries other than India. |

| 4. | Disability Type | Type of Disabilities | Specified Disability | Disability Range | | |
|---|---|---|---|---|---|---|
| | | | | **Eligible for Medical Course, Not Eligible for PwD Quota** | **Eligible for Medical Course, Eligible for PwD Quota** | **Not Eligible for Medical Course** |
| | Disability caused due to | a. Chronic Neurological Conditions | i. Multiple Sclerosis<br>ii. Parkinsonism | Less than 40% Disability | 40-80% disability | More than 80% |
| | | b. Blood Disorders | i. Haemophilia<br>ii. Thalassemia<br>iii. Sickle cell disease | Less than 40% Disability | 40-80% disability | More than 80% |
| 5. | Multiple disabilities including deaf | | More than one of the abovespecified disabilities | Must consider all above while deciding in individual cases recommendations with respect to presence any of the above, namely, Visual, Hearing, Speech & Language disability, Intellectual Disability, and Mental Illness as a component of Multiple Disability.<br>Combining Formula as notified by the related Gazette Notificationissued by the Govt. of India<br>$a + \frac{b(90-a)}{90}$<br>(where a= higher value of disability % and b=lower value of disability % as calculated for different disabilities)<br>is recommended for computing the disability arising when more than one disabling condition is present in a given individual. This formula may be used in cases with multiple disabilities, and recommendations regarding admission and/or reservation made as per the specific disabilities present in a given individual | | |

# DHARMSINHDESAI UNIVERSITY,NADIAD
# DHARMSINHDESAI INSTITUTE OF COMMERCE
**NewSyllabus as perSemesterPattern forM. Com.**

**M. Com. SemesterWise Subject Titles**

(Effective from 2022–2023)

| Semester-I | | |
|---|---|---|
| **No** | **Subject** | **Credit** |
| **1** | Economics of Growthand Development | **4** |
| **2** | Financial Management | **4** |
| **3** | Cost Accounting | **4** |
| **4** | AdvancedFinancial Accounting | **4** |
| **5** | Advanced Managerial Accounting | **4** |
| **6** | Organizational Behaviour | |

| Semester-II | | |
|---|---|---|
| **No** | **Subject** | **Credit** |
| **1** | Economics of Developing Countries | **4** |
| **2** | WorkingCapitalManagement | **4** |
| **3** | Financial Markets and Services | **4** |
| **4** | Management Concepts and Practices | **4** |
| **5** | ServiceIndustryAccounting | **4** |
| **6** | Human Resource Management | |

**DHARMSINHDESAI UNIVERSITY,NADIAD DHARMSINH DESAI INSTITUTE OF COMMERCE**

**Effective Syllabus as perSemesterPattern forM. Com.**

**M. Com. Semester Wise Subject Titles**

**(Effective from2022–2023)**

| **Semester 1** | | |
|---|---|---|
| **No** | **Subject** | **Credit** |
| **Core -1** | Economics of Growth and Development | **4** |
| **Core-2** | Financial Management | **4** |
| **Core -3** | Cost Accounting | **4** |
| **Core-4** | Advanced FinancialAccounting | **4** |
| **Anyone elective paper from the below list** | | |
| **Elective Paper -1** | Advanced Managerial Accounting | **4** |
| **Elective Paper -2** | Organizational Behaviour | **4** |

| **Semester 2** | | |
|---|---|---|
| **No** | **Subject** | **Credit** |
| **Core -1** | Economics of Developing Countries | **4** |
| **Core-2** | Working Capital Management | **4** |
| **Core -3** | Financial Markets and Services | **4** |
| **Core-4** | Management Concepts and Practices | **4** |
| **Anyone elective paper from the below list** | | |
| **Elective Paper -1** | Service Industry Accounting | **4** |
| **Elective Paper -2** | Human Resource Management | **4** |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1**
**Subject: Economic Growth & Development**
**(Effective from 2022–2023)**

| **Teaching Scheme (Hr/Week)** | | **Exam Schedule (Marks)** | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:** 60 Marks ( 3 Hours) | **40 Marks Theory:** 36 Marks (1.5 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

| **Sr. No** | **Effective Syllabus** |
|---|---|
| 1 | **Unit 1 : Introduction:**<br>Concept of growth, development & underdevelopment<br>-indicators & measurements of development – minimum needs-<br>PQIL , HDI, HPI1 , HPI 2,<br>Gender development Index (GDI)<br>N. Caldor model, Schumpeter model |
| 2. | **Unit 2 : (A)Population** –Inter- relationship between population and development- demographic transition- population trap-problem of population explosion population policy<br>(B) Poverty Concept of povrty line- indicators of poverty, dimensions of povert in the third world,- Anti poverty policies and programmes _ inter relatiomship between population , povert and unemployment |
| 3. | **Unit 3 :** (A) Unemployment Nature & problems of unemploymentin developing countries – Alternative employment strategies & policies _Arthur Levis Model for migration(Philips Curve |
| 4. | **Unit 4 : Agriculture**<br>Transformation of agriculture it importance , technological and institutional changes in agriculture and their impact on production, productivity and equity<br>**Industrialization:** Importance of industrialization in developing countries – strategies of industrialization – its impact on growth self reliance and employment Government policies & their impact – choice of techniques of production – appropriate technique for developing countries technological progress |

| | |
|---|---|
| 5. | **Unit 5 : Environment and Development**<br><br>Environmental protection and sustainable development, growth and environment degradation, Externalities, environment degradation and market failures, The Global Concerns |
| 6. | **Unit 6 :MACRO STRATEGIES AND REGULATORY ACTS OF INDIAN BUSINESS** LIBERALIZATION Concepts, Issues and Implications on Indian Economy • PRIVATIZATION Meaning of Privatization, Nature and Objectives of Privatization, Various Forms of privatizing the Public Sector Enterprises, Merits and Demerits of Privatization, Disinvestment in India • GLOBALIZATION Globalization of Business: Meaning and Dimensions, Globalization of World Economy, Features of Current Globalization, Stages of |

**Reference Books:**

| No. | Title | Author |
|---|---|---|
| 1 | Economics of Growth and Development | M. L. Jingan |
| 2 | Public Finance | Musgrave and Musgrave |
| 3 | Indian Economy | Mishra and Puri |
| 4 | Economic Survey | Government of India Publications |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1**
**Subject: Financial Management**

**(Effective from 2022–2023)**

| Teaching Scheme (Hr/Week) | | Exam Schedule (Marks) | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:** 60 Marks ( 3 Hours) | **40 Marks Theory:** 36 Marks (1.5 Hours) **Assignment:** 02 Marks **Attendance:** 02 Marks | **100 Marks** |

| Sr. No | Effective Syllabus |
|---|---|
| | **SECTION-I** |
| 1. | **Cost of Capital**<br>• Different concepts of Cost<br>• Cost of Capital; Weighted Average Cost of Capital;<br>• Capital Assets Pricing Model,<br>• Practical Problems |
| 2. | **Capital Structure**<br>• Features of an Appropriate Capital Structure;<br>• Type of Capital Structure;<br>• Factors affecting<br>• Capital Structure while planning the Initial Capital Structure;<br>• Approaches to Capital Structure;<br>• Net Income Approach;<br>• Net Operating Income Approach;<br>• Traditional Approach;<br>• Modigliani – Miller Approach,<br>• Practical Problems |
| 3. | **Leverage**<br>• Types of Leverage;<br>• Operating Leverage; Financial Leverage; Combined Leverage;<br>• Importance of Leverage;<br>• Impact of Financial Leverage on Earning per Share;<br>• Risk of Shareholder by Leverage;<br>• Advanced Level Practical Problems |
| | **SECTION-II** |
| 4. | **Dividend Policy**<br>• Dividend and Retained earnings; definitions of Dividend Policy; |

| | |
|---|---|
| | • Factors affecting Dividend Policy;<br>• Objectives of Dividend Policy;<br>• Basic issues involved in Dividend Policy; constraints on paying Dividends; Dividend Policy and Share valuation;<br>• Dividends policy of Indian Company; Law of Dividends; Dividend relevance;<br>• Walters Model; Traditional theory of Dividend Caravan and dead model; Gordon Model; Miller and Modigliani position,<br>• Practical Problems |
| 5. | **Capital Budgeting**<br>• Introduction,<br>• techniques of evaluating capital investment projects<br>• Pay Back Period,<br>• Accounting Rate of Return,<br>• Profitability Index,<br>• Net Present Value,<br>• Internal Rate of Return<br>• Practical Problems |
| 6. | **Decisions under uncertainty**<br>• Meaning of Risk & Uncertainty,<br>• Techniques of dealing with risks,<br>• risks Risk Adjusted Discount Rate,<br>• Certainty Equivalent Coefficient,<br>• Sensitivity Analysis,<br>• Probability Assignment,<br>• Decision Tree |

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Basic Financial Management | M. Y. Khan & P. K. Jain | Taxmann Allied Service Pvt. Ltd. |
| 2 | Financial Management with Problems and Solution | Ravi M. Ki shore | Taxmann Allied Service Pvt. Ltd. |
| 3 | Financial Management | P. V. Kulkami& B. G. Satyaprasad | Himalaya Publishing House |
| 4 | Financial Management | I. M. Pandey | Vikas Publishing House |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1**
**Subject: Cost Accounting**
**(Effective from 2022–2023)**

| Teaching Scheme (Hr/Week) | | Exam Schedule (Marks) | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:**<br>60 Marks ( 3 Hours) | **40 Marks Theory:**<br>36 Marks (1.5 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

| Sr. No | Effective Syllabus |
|---|---|
| | **SECTION-I** |
| 1. | **Introduction**<br>• Meaning; Definition;<br>• Scope and Use of Cost Accounting;<br>• Cost Centers& its types;<br>• Profit Centre; Cost Unit;<br>• Cost Accounting & Financial Accounting;<br>• Cost Concepts – Product & Period Cost; Controllable & Non – construable Cost; Replacement & Historical Cost; Imputed & Sunk Cost; Opportunity & Incremental Differential Cost; Conversion Cost; Committed Cost; Shut Down & Abandonment Cost; Marginal Cost; Notional Cost;<br>• Relevant & Irrelevant Cost Classification of Cost – Financial Nature; Element wise; Functional; Cost Behavior |
| 2. | **Inventory Control:**<br>• Meaning of Material (Direct and Indirect)<br>• Determining Various Stock Level (Maximum, Minimum, Ordering, Danger, Reordering, Safety)<br>• Economic Ordering Quantity (E.O.Q)<br>• ABC Method, VED & FNSD Analysis;<br><br>**Labour Cost Control:**<br>Labour Productivity / Efficiency; Labour Turnover Rate<br>• Methods; Reasons; Causes; Remedies; Examples (Separation Method, Replacement Method and Joint Method) |
| 3. | **Overhead Cost Control:**<br>• Treatment of ‘Under and Over Absorption’ of it. |

| | |
|---|---|
| | • Methods of Rate determination of Over/Under Absorption<br>**Learning Curve** |
| **SECTION-II** | |
| 4. | **Activity Based Costing:**<br>• Definition and need for ABC;<br>• Concept of ABC,<br>• Characteristics, development and implementation of ABC,<br>• Cost drivers and cost tools;<br>• Main Activities and its cost drivers;<br>• Allocation of overheads under ABC,<br>• Application of ABC (when to use) |
| 5. | **Standard Costing - I:**<br>• Meaning of Standard Cost and Standard Costing;<br>• Necessity; Use of Standard Cost;<br>• Types of Standards; Utility and Limitations of Standard Costing;<br>• Use (Application) of Standard Costing; Control through Variance Analysis<br>• Practical Problems |
| 6. | **Standard Costing - II:**<br>• Reconciliation of Standard Profit with Actual Profit – Computation of all Variances<br>• Preparation of reconciliation statement; Recognition of responsible departments or executive for adverse variances;<br>• Reporting of Variances<br>• Accounting treatments for Variances<br>• Traditional Variances and planning and operative variance |

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Advanced Management Accounting | Jawahar Lai | S. Chand & Co. Ltd. |
| 2 | Accounting and Finance for Managers | T. P. Ghosh | Taxmann Allied Service Pvt. Ltd. |
| 3 | Accounting for Managers | J. Made Gowda | Himalaya Publishing House |
| 4 | Accounting Theory and Practice | Dr. Jawahar Lai | Himalaya Publishing House |
| 5 | Cost & Management Accounting | Ravi M. Kishore | Taxmann Allied Service Pvt. Ltd. |
| 6 | Management Accounting | Paresh Shah | Oxford University Press |
| 7 | Cost Accounting | Jawahar Lai & Seema Srivastava | Tata McGraw Hill |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1**
**Subject: Advanced Financial Accounting**
**(Effective from 2022–2023)**

| Teaching Scheme (Hr/Week) | | Exam Schedule (Marks) | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:**<br>60 Marks ( 3 Hours) | **40 Marks Theory:**<br>36 Marks (1.5 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

| Sr. No | Effective Syllabus |
|---|---|
| | **SECTION-I** |
| 1. | **Consolidated Financial Statements**<br>• Consolidated Trading and Profit & Loss Account, Balance Sheet & Cash Flow<br>• Statement; Statement to be prepared under Sec. 129 of Companies Act, 2013 (including simple chain holding)<br>• Practical problems relating to Merger and Acquisition |
| 2. | **Hire Purchase and Installments Payment Systems**<br>• Difference between Hire Purchase and Installment System<br>• Accounts of Hire-Purchase System:<br>• Accounting records under Hire Purchase System;<br>• Hire Purchase Trading Account;<br>• Stock and Debtor Method. |
| 3. | **Lease Accounting**<br>• AS–19,<br>• Difference between Lease and Hire Purchase,<br>• Types of Lease,<br>• Factors affecting Lease<br>• Accounting treatment in the books of Lessee and Lessor |
| | **SECTION-II** |
| 4. | **Inflation Accounting**<br>• Introduction; Explanation of Terms; |

| | |
|---|---|
| | • Methods of Adjusting Accounts for Inflation;<br>• CPP & CCA Method;<br>• Replacement Cost Method;<br>• Discounted Cash flow Method<br>• Practical Problems<br>**Introduction to Forensic Accounting** |
| 5. | **Human Resource Accounting,**<br>• Definition; Advantages; Limitations;<br>• Methods of Valuing HR;<br>• HR as an Asset;<br>• Capital or Revenue Exp.;<br>• Utility of HRA<br>**Value Added Accounting,**<br>• Definition; Presentation of VA Statement;<br>• How to Increase VA;<br>• Utility of VA;<br>• Diversities and Disclosures Range in Preparation of VAS;<br>• Diff. between VAS & P&L Acc.<br>**Environment Accounting:**<br>• Meaning,<br>• Scope; Utility; Procedure;<br>• Development of EA in Different Countries |
| 6. | **Auditing:**<br>• Meaning and Definition of Auditing, Auditor<br>• Types of Audit<br>• Importance and Scope<br>• Internal Audit<br>• Statutory Audit<br>• Qualities of Auditor<br>• Role of C&AG |

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| **1** | Accounting Standards and Corporate Accounting Practices | T. P. Ghosh | Taxmann Allied Service Pvt. Ltd. |
| **2** | Fundamentals of Accounting and Financial Analysis | Anil Chaudhary | Pearson Education |
| **3** | Financial Accounting for Management - An analysis perspectives | Ambrish Gupta | Pearson Education |
| **4** | Financial Accounting and Analysis | P. PremchandBalu& M. Madan Mohan | Himalaya Publishing House |
| **5** | Fundamentals of Corporate Accounting | J. R. Mongs | Mayar Noida, Delhi |
| **6** | Management Accounting - Principles & Practice | Shashik Gupta, R. K. Sharma | Kalyani Publication, Noida |
| **7** | International Accounting | ShirinRathod | PHI Learning Pvt. Ltd. |
| **8** | Accounting for Managers | J. Made Gowda | Himalaya Publishing House |
| **9** | Advanced Accounting | R.L.Gupta, M. Radhaswami | Sultan Chand and Sons |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1**
**Subject: Advanced Managerial Accounting**
**(Effective from 2022–2023)**

| Teaching Scheme (Hr/Week) | | Exam Schedule (Marks) | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:**<br>60 Marks ( 3 Hours) | **40 Marks Theory:**<br>36 Marks (1.5 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

| Sr. No | Effective Syllabus |
|---|---|
| | **SECTION-I** |
| 1. | **Accounting – An overview:**<br>• Nature and Objectives of Corporate Financial Statements;<br>• Legal requirements – Form & Content (under Section 129 of Companies Act, 2013);<br>• Accounting Standards (Indian and International) and IFRS |
| 2. | **Company Final Accounts – Advanced Level**<br>• Legal requirements under the Companies Act, 2013;<br>• Sums on Financial Statement,<br>• Depreciation and Tax Provision;<br>• Managerial Remuneration (including problems) |
| 3. | **Ratio Analysis:**<br>Preparation of Financial Statements from given Ratios and Other information (Advanced Level) |
| | **SECTION-II** |
| 4. | **Tally with Accounting**<br>• Introduction of Tally<br>• Creation of Company<br>• Creation of Ledger<br>• Creation Groups<br>• Accounting Entry<br>• Reports |

| | |
|---|---|
| 5. | **Tally With Inventory**<br>• Creation of Stock Group<br>• Creation of Stock Category<br>• Creation of Unit of Measures<br>• Creation of Stock Item<br>• Inventory Entry<br>• Reports |
| 6. | Tally with Taxation<br>• Basic Introduction of GST<br>• Creation of Tax Ledger<br>• Creation of Stock Item with Tax<br>• Taxation Entry<br>• Report |

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Accounting for Finance for Managers | T. P. Ghosh | Taxmann Allied Service Pvt. Ltd. |
| 2 | Accounting for Managers | J. Made Gowda | Himalaya Publishing House |
| 3 | Accounting for Managers | T. P. Ghosh | Taxmann Allied Service Pvt. Ltd. |
| 4 | Financial Accounting for Business Managers | Ahish K Bhattarcharyya | PHI Pvt. Ltd. |
| 5 | Advanced Management Accounting | Jawahar Lai | S. Chand & Co. Ltd. |
| 6 | Accounting for Managers | J. Made Gowda | Himalaya Publishing House |
| 7 | Cost & Management Accounting | Ravi M. Kishore | Taxmann Allied Service Pvt. Ltd. |
| 8 | Cost Accounting | Jawahar Lai &Seema Srivastava | Tata McGraw Hill Publishing Co. Ltd. |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1**
**Subject: Organizational Behavior**
**(Effective from 2022–2023)**

| **Teaching Scheme (Hr/Week)** | | **Exam Schedule (Marks)** | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:** 60 Marks ( 3 Hours) | **40 Marks Theory:** 36 Marks (1.5 Hours) **Assignment:** 02 Marks **Attendance:** 02 Marks | **100 Marks** |

| **SECTION-I** |
|---|
| **Unit-1FundamentalsofOrganizationalBehavior:**<br>• Definition and Meaning<br>• Concept<br>• Nature<br>• Characteristics<br>• Importance<br>• ModelsofOrganizationalBehavior<br>• Relationof Organizational Behavior with otherfields |
| **Unit-2**ConflictManagement:<br>• Nature<br>• LevelsofConflict<br>• Traditionalvis–à–visModernviewofConflict<br>• ConflictProcess |
| **Unit-3**GroupDynamics:<br>• Types<br>• Nature<br>• Emergence<br>• Benefits<br>• ProblemsofInformalOrganization<br>• FormalOrganization<br>• System Factor<br>• Potentialoutcomeof FormalGroupprocesses |
| **SECTION-II** |

**Unit-4Motivation:**

- MotivesClassificationofMotives
- Theoriesofworkmotivation: (ERG,Equity,Expectancy theory)
- Appraising & Rewarding
- Performance appraisal (360 degrees)
- WageIncentives
- Profit-Sharingandgain sharing

**Unit-5Leadership:**

Nature, Types of Skills, Leadership styles, Theories/ Approaches to Leadership: Hersey& Blanchard's Situational Model, Path-Goal Model, Managerial grid model, Fielder'scontingencymodel, coaching

**Unit-6Stress&Counseling:**

- Concept
- Sources of stress
- Effect of stress
- Strategies to cope up with stress & briefoverviewof counseling

**ReferenceBooks:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | OrganizationalBehavior | StephenRobbins | PearsonEducation |
| 2 | OrganizationalBehavior | KeithDavis | TataMcGrawHill,New Delhi |
| 3 | OrganizationalBehavior | K.Aswathappa | HimalayaPublication |
| 4 | OrganizationalBehavior | L.M.Prasad | S.ChandPublication |
| 5 | OrganizationalBehavior | M.N. Mishra | VikasPublication |

# SEMESTER -II

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1I**
**Subject: Economics of Developing**
**(Effective from 2022–2023)**

| Teaching Scheme (Hr/Week) | | Exam Schedule (Marks) | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:** 60 Marks ( 3 Hours) | **40 Marks Theory:** 36 Marks (1.5 Hours) **Assignment:** 02 Marks **Attendance:** 02 Marks | **100 Marks** |

| Sr. No | Effective Syllabus |
|---|---|
| 1 | **Unit 1 :**<br>Role of monetary policy and fiscal policy in economics development- limitation – tax structure and policies in developing countries – taxation , public , borrowing Debt & deficit financing as methods of financing public expenditure & their effects IS –LM Model |
| 2. | **Unit 2 : Market economy**<br>Market economy and its limitation, Laffer Curve – Importance & role of planning in development _ model of planning ( Aggregate , sectoral and input – output model basic concepts ) experience and lesson from process of planning in developing countries , Mahalnobis Model in Indian Planning , H.D model in planning |
| 3. | **Unit 3 : foreign trade & development**<br>introvert & extrovert trade policy and development, Custom union in developing countries – foreign capital , foreign aid & burden of repayment of public debt a special case study of SRI LANKAN economy - Transfer of technology – Multinational corporation and international trade |
| 4. | **Unit 4 : International monetary system**<br>International monetary system and its working – exchange rate policies- Problems of international monetary system – reforms in the present monetary system with reference to developing countries<br>New International Economic Order – Emergence of **W**orld **T**rade **O**rganization |
| 5. | **Unit 5 : international investment**<br>Types of foreign investment , significance – Limitation and risk from foreign capital, factors affecting international investment- growth of FDI – directional trends- sectorial trends- cross boarder M & As – Foreign investments in India – Foreign investment by Indian Companies |

| | |
|---|---|
| 6. | **Unit 6 : regional economic cooperation & international institution for development of foreign trade**<br>A) free trade : custom Union in developing countries; European Union ; NAFTA ; LAFTA ; ASEAN<br>B) International institutions : IBRD ; Asian Development Bank ; African Development Bank |

**Reference Books:**

| No. | **Title** | **Author** | **Publication** |
|---|---|---|---|
| 1 | Economics of Growth and Development | M. L. Jingan | |
| 2 | Public Finance | Musgrave and Musgrave | |
| 3 | Indian Economy | Mishra and Puri | |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1I**
**Subject: Working Capital Management**
**(Effective from 2022–2023)**

| Teaching Scheme (Hr/Week) | | Exam Schedule (Marks) | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:**<br>60 Marks ( 3 Hours) | **40 Marks Theory:**<br>36 Marks (1.5 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

| Sr. No | Effective Syllabus |
|---|---|
| | **SECTION-I** |
| 1. | **Introduction:**<br>• Definition of Working Capital<br>• Objectives<br>• Types<br>• Characteristics<br>• Factors determining Working Capital<br>• Factors affecting Working Capital<br>• Sources of Working Capital |
| 2. | **Practical Problems of Estimation of Working Capital:**<br>• Problems based on Operating Cycle<br>• Problems based on Estimation of W.C<br>  ➢ By using Profit based Method<br>  ➢ Cash Method<br>  ➢ Cash-Cost Method |
| 3. | **Management of Receivables**<br>• Scope and Importance of Receivables Management<br>• Objectives of granting credit<br>• Cost of maintaining receivables<br>• Optimum credit policy variables<br>• Objectives of maintaining receivables<br>• determinants of size of receivables<br>• determinants of size of investment in receivables<br>• Credit Policies ;credit procedure for individual accounts<br>• forecasting of receivables<br>• Practical Problem |
| | **SECTION-II** |

| | |
|---|---|
| 4. | **Management of inventories**<br>• Forms of inventories<br>• need to hold inventories<br>• importance<br>• meaning of inventory management;<br>• objectives of inventory management<br>Inventory control systems; determining economics order quantity; techniques of inventory management; Quality of discount and E. O. Q. ordering or Reorder point; Maximum level and minimum level; safety level; methods of A. B. C. (Always Better Control)<br><br>• inventory management process. |
| 5. | **Cash Management**<br>• Explanation of Cash Management<br>• Importance of Cash Management<br>• Motives of holding Cash<br>• Functions of Cash Management<br>• Problems of Cash Management<br>• Factors determining Cash Flow<br>• Cash planning methods; Long term cash factoring;<br>• Determining the optimum Cash Balance |
| 6. | **Working Capital Finance:**<br><br>• Trade Credit,<br>• Bank Finance<br>• Commercial Papers |

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Basic Financial Management | M. Y. Khanand& P. K. Jain | Taxmann Allied Service Pvt. Ltd. |
| 2 | Financial Management with Problems and Solution | Ravi M. Ki shore | Taxmann Allied Service Pvt. Ltd. |
| 3 | Financial Management | P. V. Kulkami& B. G. Satyaprasad | Himalaya Publishing House |
| 4 | Financial Management | I. M. Pandey | Vikas Publishing House |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1I**
**Subject: Financial Markets and Financial Services**
**(Effective from 2022–2023)**

| Teaching Scheme (Hr/Week) | | Exam Schedule (Marks) | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:** 60 Marks ( 3 Hours) | **40 Marks Theory:** 36 Marks (1.5 Hours) **Assignment:** 02 Marks **Attendance:** 02 Marks | **100 Marks** |

| Sr. No | Effective Syllabus |
|---|---|
| | **SECTION-I** |
| 1. | **Financial Markets: An Introduction**<br>• Meaning, Nature and Role of Financial System;<br>• Financial Markets as a component of Financial System;<br>• Financial system and Economic Growth; Financial System Designs: Bank – based and Market–based. |
| 2. | **Money Market**<br>• Meaning, Characteristics and Functions of Money Market;<br>• Role of the Reserve Bank in the Money Market; Intermediaries in the Money Market;<br>• Development of Money Market in India;<br>• Money Market Instruments: Treasury Bills, Commercial Paper; Certificate of Deposit; Commercial Bills; Collateralized Borrowing and Lending Obligation; Call Money Market and Term Money Market. |
| 3. | **Capital Market**<br>• Meaning, Functions and Types of Capital Market; Reforms in the Capital market;<br>• Intermediaries; Issue Mechanisms; Types of Primary Issues: Public, Rights and Private Placement; Resource Mobilization from International Capital Markets: ADRs, GDRs and ECBs; Primary Market Scenario in India; Debt Market: Private Corporate. Role of SEBI in the Capital Market<br>• Functions of the Secondary Market;<br>• Post Reforms Stock Market Scenario; Organization, Management and Membership of Stock Exchanges; Listing of Securities; Trading Arrangements; Stock Market Index; Stock Exchanges in India. |
| | **SECTION-II** |

| | |
|---|---|
| 4. | **Financial Services**<br>• Meaning and need for financial services;<br>• Financial Services as a component of financial system;<br>• Depositories<br>• Custodians;<br>• Credit Rating;<br>• Factoring and Forfeiting. |
| 5. | **Investment Banking**<br>• Investment Banks: Functions and Types of Investment Banks; Investment Banking Services; Merchant Banking Services.<br>• Housing Finance: Role of Housing and Housing Finance in the Economy; Policy initiatives and measures to develop housing finance in India; Housing Finance Institutions in India; Types of Housing Loans; Marketing Strategies of housing finance institutions; Role of National Housing Bank; Reverse Mortgage Loan. |
| 6. | **Mutual Funds**<br>• Meaning, Concepts of Mutual Funds; Growth of mutual fund Industry in India;<br>• Organization of a mutual fund; Types of mutual funds schemes; Role of Intermediaries and marketing of mutual funds;<br>• Methods of investing in a mutual fund scheme; Tax implications for mutual fund investors; |

**Reference Books:**

| No. | **Title** | **Author** | **Publication** |
|---|---|---|---|
| 1 | Indian Financial System | Bharati V. Pathak | Pearson Education |
| 2 | Indian Financial System | M. Y. Khan | McGraw Hill |
| 3 | Indian Financial System | Machiraju H. R. | Economic Times |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1I**
**Subject: Management Concepts And Practices**
**(Effective from 2022–2023)**

| Teaching Scheme (Hr/Week) | | Exam Schedule (Marks) | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:** 60 Marks ( 3 Hours) | **40 Marks Theory:** 36 Marks (1.5 Hours) **Assignment:** 02 Marks **Attendance:** 02 Marks | **100 Marks** |

**NEW SUBJECT IS EFFECTIVE**

**MANAGEMENTCONCEPTSANDPRACTICES (100MARKS)**
**SECTION - I**

- **Unit-1Conceptof Management:**
- Managing and Managers
- Functions,SkillsofaManager,
- ProcessofManagement,
- Developmentofmanagement(ScientificManagement-Taylor,
  - Modern Approach-Fayol,
  - HumanRelations Approach- Mayo)

**Unit-2Planning:**

- Concept,Process,
- Type,
- Importance;
- Decisionmaking:
- typesofDecision,
- Process ofdecisionmaking,
- Models&Issues.

**Unit-3Principlesof Organization:**

- Structure& TypesofOrganization;
- Departmentation,
- Decentralization,
- Delegation,
- Spanof management.

- Line&Staff Organization,
- Matrix Organization.

## SECTION – II

**Unit-4: Motivation and LEADERSHIP**

**MOTIVATION:**

- Process of motivation;
- Theories of motivation-
- need hierarchy theory,
- theory Xandtheory Y,
- twofactortheory,
- Alderfer`sERGtheory,
- McClelland's learned need theory,
- Victor Vroom`s expectancytheory,
- Stacy Adams equitytheory.

**LEADERSHIP**

- concept;
- Leadershipstyles;
- Theories-traittheory,
- behavioraltheory,
- Fiedler'scontingency theory;
- HarseyandBlanchard'ssituationaltheory;
- Managerialgrid;
- Likert'sfoursystemsofleadership.

**Unit-5 Coordination andControlling:**

- Principle ofCoordination–
- ProcessofCoordination,
- Control
  - ToolsandTechniques, -MBO.

**Unit-6Contemporary Issues:**

- RecentTrends andChallenges,
- RoleofManagersinChanging environment,
- ContemporaryOrganizational Structure,
- TrendsinManagement,
- Challenges in today'sglobal environmentandcompetitiveness.

***References:***


1. *EssentialsofManagement–Koontz,O'Donnel&Weihrich(TataMc.Graw)-*
2. *Management–Robbins& Coulter(Pearson)*
3. *PrinciplesofManagement–Stoner&Freeman*
4. *rinciplesofManagement–ChandraBose(PHI)*
5. *Management;JamesA.F.Stoner,R.EdwardFreeman,DanielR.Gilbert,PearsonEducation*
6. *PrinciplesofManagement,PC TripathiandPNReddy,McGrwHillEducation*

*SuggestedReadings:-*


1. *Griffin,RickyW:;Organisational Behaviour,HoughtonMifflinco.,Boston.*
2. *Hellreigel, Don, John W. Slocum, Jr., andRichards W. Woodman: OrganizationalBehavior,southwesterncollegePublishing,Ohio.*
3. *Hersey,Paul,KennethH.BlanchardandDeweyEJohnson:Managementof OrganisationalBehaviour:*
4. *Utilising HumanResources,PrenticeHall,NewDelhi.*
5. *Ivancevich; JohnandMicheeolT.Matheson:OrganisationalBehaviourand Management,TataMcGraw-Hill,NewDelhi.*
6. *Luthans,Fred: Organizational Behaviour,McGraw-Hill,NewYork*

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1I**
**Subject: Service Industry Accounting**
**(Effective from 2022–2023)**

| Teaching Scheme (Hr/Week) | | Exam Schedule (Marks) | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:**<br>60 Marks ( 3 Hours) | **40 Marks Theory:**<br>36 Marks (1.5 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

| Sr. No | Effective Syllabus |
|---|---|
| | **SECTION-I** |
| 1. | **Functions of Banks & Services**:<br>• Importance and Functions of Banks<br>• Practical Aspects of selected Nationalized and Schedule Banks (Excluding Co–Operative Banks) regarding various services offered<br>• Variations in Services offered by banks and charges levied terms and conditions of services<br>• Various types of deposits accepted their rate of interest and terms and conditions<br>• Various types of advances made their rate of interest and terms and conditions |
| 2. | **Banking Final Accounts:**<br>• Prohibition of Trading<br>• Disposal of Non–Banking Assets<br>• Management<br>• Capital and Reserve<br>• Reserve Fund<br>• Restrictions as to payment of dividend<br>• Cash Reserve<br>• Liquidity Norms<br>• Restriction on acquisition of shares in other company<br>• Restrictions on Loans and Advances<br>• Preparation of Balance Sheet as per new revised third Schedule–Form ‘A’<br>• Profit and Loss account –Form ‘B’ |
| 3. | **Banking and Non-Banking Services**<br>• RBI Introduction and Functions<br>• IMF<br>• World Bank<br>• Postal Savings Schemes:- Time Deposit, Recurring Deposit, Monthly Income Schemes, National Savings Certificates, KisanVikasPatra, Public Provident Fund, Postal Life Insurance. |

| SECTION-II | |
|---|---|
| 4. | **Electricity Company Accounts:**<br>• Accounting terms–Depreciation; Reasonable Return; Capital Base; Clear Profit; Disposal of Surplus; Contingencies Reserve; Development Reserve; Restrictions on Dividends;<br>• Practical problems regarding Disposal of Profit, Preparation of Statement of Share and Loan capital, Statement of Capital Expenditure, and General Balance Sheet in prescribed form. |
| 5. | **Insurance:**<br>• Life Insurance<br>• Basic features of endowment assurance<br>• Money back Plan,<br>• Whole life assurance & Term assurance<br>• General Insurance Introduction<br>• Basic features of Vehicle Insurance<br>• Medical Insurance<br>• Accident Insurance |
| 6. | **General Insurance Company Accounts:**<br>• Various types of Fire, Marine and miscellaneous insurance policies<br>• Important terms–Claims paid, Net Premiums earned, Co–insurance, Commission, Loans, Investments, Unexpired Risk Reserve, Re Insurance IRDA Regulations 2002,<br>• Preparation of Revenue Account as per Form B–RA<br>• Profit and Loss Account as per Form B–PL<br>• Balance Sheet as per Form B–BS |

**Reference Books:**

| No. | Title | Author | Publication |
|---|---|---|---|
| 1 | Corporate Accounting | Mukheijee&Hanif, AmitabhaMukheijee Mohammed Hanif | Tata McGraw Hill |
| 2 | Accountancy for CAPEE | P. C. Tulsian | Tata McGraw Hill |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# DHARMSINH DESAI INSTITUTE OF COMMERCE

**Syllabus as per Semester Pattern for M.Com**
**Semester -1I**
**Subject: Human Resource Management:**
**(Effective from 2022–2023)**

| Teaching Scheme (Hr/Week) | | Exam Schedule (Marks) | | |
|---|---|---|---|---|
| **Lecture** | **Total** | **External** | **Sessional** | **Total** |
| **4** | **4 Hours** | **60 Marks Theory:**<br>60 Marks ( 3 Hours) | **40 Marks Theory:**<br>36 Marks (1.5 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

**SECTION-I**

**Unit-1 HumanResourceManagement:**

- Meaning&Definition,Characteristics
- Scope
- Functions
- ObjectivesofH.R.M
- Qualitiesof H. R. Manager

**Unit-2 H.R.Planning:**

- Concept and Need
- Importance
- Objectives
- HRPlanningProcess
- Factorsaffecting H.R.M
- RequisitesforsuccessfulH.R.P
- JobAnalysis,JobDescription,JobSpecification.

**Unit-3 RecruitmentandSelection:**

**Recruitment**:

- Definition and Meaning
- Purposeand Importance
- External &Internalsourcesofmanpower

**Selection:**

- Meaning andDefinition
- SelectionProcess
- BarrierstoeffectiveSelection

**SECTION-II**

| |
|---|
| **Unit-4 Training:**<br>• Definition and Meaning<br>• Concepts<br>• Identification of Training needs,<br>• Methods (On-the-job and OFF-the –job)<br>• Difference between Training andDevelopment |
| **Unit-5 PerformanceAppraisal&Promotion:**<br>• Meaning and Definition<br>• PurposesandPrinciplesofpromotion<br>• Basesandtypesforpromotion,Transfer,Separation.<br>• Identificationofissuesinperformanceappraisal<br>• usesandlimitations<br>• Methodsofappraisal ( SevenMethods to be taught in detail) |
| **Unit-6 CompensationofHumanResource:**<br>• Meaning and Definition of Compensation<br>• Concept of JobEvaluation<br>• Concept of WageandSalary AdministrationScope<br>• TypesofWage<br>• Systemsof WagePayment (piece-rate system, bonus system, commission system, bonus pay, merit system). |

**References:**


| No. | Title | Author |
|---|---|---|
| 1 | Human Resource Management | K. Ashwathappa |
| 2 | Personnel Management | Dr. C. B. Memoria |
| 3 | Personnel Management | T. V. Rao |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE
**Syllabus as per Semester Pattern for M. Com.**

**M. Com. Semester Wise Subject Titles**

(Effective from 2015–2016)

| Semester 3 | | |
|---|---|---|
| **No** | **Subject** | **Credit** |
| **1** | Marketing Management | **4** |
| **2** | Business Policy | **4** |
| **3** | Cost and Management Accounting | **4** |
| **4** | Corporate Financial Reporting | **4** |
| **5** | Research Methodology | **4** |

| Semester 4 | | |
|---|---|---|
| **No** | **Subject** | **Credit** |
| **1** | Strategic Management | **4** |
| **2** | Business Ethics and Corporate Governance | **4** |
| **3** | Operations Research | **4** |
| **4** | Advanced Cost, Financial and Management Accounting | **4** |
| **5** | Project | **4** |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE
**Syllabus as per Semester Pattern for M. Com.**

**Semester – 3**
**Subject: Marketing Management**
**(Effective 2015 – 2016)**

| Teaching Scheme (Hr/Week) | | | Exam Schedule (Marks) | | |
|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Total** | **External** | **Sessional** | **Total** |
| **3** | **1** | **4 Hours** | **60 Marks**<br><br>**Theory:**<br>60 Marks ( 3 Hours) | **40 Marks**<br>**Theory:**<br>36 Marks (1.25 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

**Section – I**

1. (A) **Defining Marketing for the 21st Century:**The Importance ofMarketing, The Scope of Marketing, Core Marketing Concepts, The New Marketing Realities, Company Orientation toward the Market place

   (B) **Scanning the Marketing Environment, Forecasting Demand and Conducting Marketing Research:** Components of a Modern Marketing Information System, Internal Records, Marketing Intelligence, Analyzing the Macro Environment, Forecasting and Demand Measurement, the Marketing Research System

2. (A) **Analyzing Business Markets:** What is Organizational Buying? Participants in the Business Buying Process, the Purchasing / Procurement Process Stages in the Buying Process, Developing Compelling Customer Value Propositions, Managing Business–to–Business Customer Relationships, Establishing Corporate Trust, Credibility and Reputation, Institutional and Government Markets

   (B) **Identifying Market Segments and Targets:** Bases for Segmenting Consumer Markets, Psychographic Segmentation, Bases for Segmenting Business Markets, Market Targeting

**Section – II**

3. (A) **Setting Product Strategy:** Product Characteristics and Classifications, Product and Services Differentiation; Product and Brand Relationships

   (B) **Developing Pricing Strategies and Programs:**

4. (A) **Designing and Managing Integrated Marketing Channels:** Marketing Channels and Value Networks, the Role of Marketing Channels, Channel–Design Decisions, Channel–Management Decisions, Channel Integration and Systems, Conflict, Cooperation, and Competition

   (B) **Designing and Managing Integrated Marketing Communication:** The Role of Marketing Communications, Developing Effective Communications, Deciding on the Marketing Communications Mix, Managing the Integrated Marketing Communications Process

**Reference Books:**

| No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Marketing Management: A South Asian Perspective | Philip Kotler Et All | Pearson |
| 2 | Marketing Management Global Perspective, Indian Context | V. S. Ramaswamai& S. Namakumari | Mac Milan |
| 3 | Marketing – An Introduction | Amstrong, Gary | Pearson |
| 4 | Principles of Marketing | Philip Kotler | Pearson |

The question paper to be set in such a manner not a single unit of syllabus should be excluded.

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE
**Syllabus as per Semester Pattern for M. Com.**

**Semester – 3**
**Subject: Business Policy**
**(Effective 2015 – 2016)**

| Teaching Scheme (Hr/Week) | | | Exam Schedule (Marks) | | |
|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Total** | **External** | **Sessional** | **Total** |
| **3** | **1** | **4 Hours** | **60 Marks**<br><br>**Theory:**<br>60 Marks ( 3 Hours) | **40 Marks**<br>**Theory:**<br>36 Marks (1.25 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

**Section – I**

1. **Overview of Strategic Management:**
   (A) **Introduction to Business Policy & Strategic Management:**
   (B) **Introduction to Government Economic Policy and State Policy:** Dimensions of Strategic Decision: Three levels of Strategy Characteristic of Strategic Management Decisions, Formality in Strategic Management: The Strategy Makers, The interactive and iterative flow of the strategic process, Value of Strategic Management: Financial Benefits of Strategies, Risks of Strategic Management, Summary
2. **The Strategic Management Process:** Components of the Strategic Management Model: Company vision, Mission, Company Profile, External Environment, Strategic Analysis and Choice, Long–Term Objectives, Grand Strategy, Control and Evaluation, Strategic Management as a Process, Practical Limitations of the Model, Holistic, Analytic Versus Prescriptive, Non – Political, Evolutionary, Summary.

**Section – II**

3. **The Company Profile:** Internal Analysis of the Firm: The Value of Systematic Internal Assessment, Developing the Company Profile: Identification of Strategic Internal Factors, Evaluation of Strategic Internal Factors, Quantitative Versus Qualitative Approaches in Evaluating Internal Factors, Summary: Viewing Internal Analysis as a Process, Appendix: Using Financial Analysis
4. **Strategic Analysis and Choice:** Strategic Analysis at the Corporate Level, The BCG Growth / Share Matrix, The GE Nine–Cell Planning Grid, Grand Strategy, Selection at the Business Level: SWOT Analysis, Grand Strategy Selection Matrix, Model of Grand Strategy Clusters, Behavioral Consideration Affecting Strategic Choice, Role of Past Strategy, Degree of the Firms, External Dependence, Attitudes toward Risk, Internal Political Considerations, Timing Considerations, Competitive Reaction, Contingency Approach to Strategic Choice

**Reference Books:**

| No. | Title | Author |
|---|---|---|
| 1 | Business Policy & Strategic Management | AzharKazmi |
| 2 | Strategic Management, 12th Ed.<br>Concepts and Cases | Arthur A. Thompson Jr.<br>& A. J. Strickland |
| 3 | Management Policy and Strategic<br>Management (Concepts, Skills and Practices) | R. M. Shrivastava |
| 4 | Business Policy and Strategic Management | P. SubbaRao |
| 5 | Strategic Planning Formulation of Corporate Strategy | Ramaswamy |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE

**Syllabus as per Semester Pattern for M. Com.**

**Semester – 3**

**Subject: Cost and Management Accounting**

**(Effective 2015 – 2016)**

| Teaching Scheme (Hr/Week) | | | Exam Schedule (Marks) | | |
|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Total** | **External** | **Sessional** | **Total** |
| **3** | **1** | **4 Hours** | **60 Marks**<br><br>**Theory:**<br>60 Marks ( 3 Hours) | **40 Marks**<br>**Theory:**<br>36 Marks (1.25 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

**Section – I**

1. **Introduction**

   Meaning; Definition; Scope and Use of Cost Accounting; Cost Centers& its types; Profit Centre; Cost Unit; Cost Accounting & Financial Accounting;

   Cost Concepts – Product & Period Cost; Controllable & Non – construable Cost; Replacement & Historical Cost; Imputed & Sunk Cost; Opportunity & IncrementalDifferential Cost; Conversion Cost; Committed Cost; Shut Down & Abandonment Cost; Marginal Cost; Notional Cost; Relevant & Irrelevant Cost

   Classification of Cost – Financial Nature; Element wise; Functional; Cost Behavior

   Management Accounting – Definition; Scope; Functions; Functions of Management Accountant; Difference between Management Accounting & Cost Accounting; Management Accounting and Financial Accounting

2. **The use of costs in pricing Decisions:**

   Influence of various parties – Determinations of Pricing Relationship among demand, supply and cost, return on assets employed, gross margin pricing. Cost – plus PricingMethods: Variable cost pricing; Differential cost pricing; Full cost pricing; Conversion cost Pricing; Direct cost – pricing – Evaluation of all cost based pricing method – Social responsibility and pricing – Principal Budget Factor and pricing – New product pricing – Established product pricing special order and pricing

**Section – II**

3. **Accounting for decision making:**

   Decision accounting; Budget Factor and Limiting Factor decision – opportunity costs with limiting factors – make or buy decisions, Accepting or rejecting order – shutdown decisions – Equipment replacement decisions

4. **Responsibility Accounting and Divisional Performance Measurement**

   Decentralization; Functional Organizational Structure; Advantages & Disadvantages of Divisionalisation; Degree of Decentralization; Responsibility Centre & its Types – Cost; Revenue, Profit & Investment

   Responsibility Accounting: Responsibility Performance Reporting; MeasuringDivisional Performance; Variance Analysis; Division Contribution Margin; Divisional NetProfit; Return on Investment & Residual Income; Non – financial Measures of Performance; Evaluating a division v/s evaluating a division manager;

   Transfer Pricing & its Methods: Market Price; Cost Based Price; Negotiated Price; Dual Price

**Reference Books:**

| No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Cost & Management Accounting | Ravi M. Kishore | Taxmann Publication |
| 2 | Managerial Accounting | JawaharLal | Himalaya Publishing House |
| 3 | Advanced Management Accounting | Ravi M. Kishore | Taxman Allied Services Pvt. Ltd., New Delhi |
| 4 | Management Accounting Concepts & Cases | N. K. Kulshreshtha | Tata McGraw Hill Co., New Delhi |
| 5 | Theory & Problems of Management & Cost Accounting | M. Y. Khan & P. K. Jain | Tata McGraw Hill co., New Delhi |

The question paper to be set in such a manner not a single unit of syllabus should be excluded.

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE

**Syllabus as per Semester Pattern for M. Com.**
**Semester – 3**
**Subject: Corporate Financial Reporting**
**(Effective 2015 – 2016)**

| Teaching Scheme (Hr/Week) | | | Exam Schedule (Marks) | | |
|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Total** | **External** | **Sessional** | **Total** |
| **3** | **1** | **4 Hours** | **60 Marks**<br><br>**Theory:**<br>60 Marks ( 3 Hours) | **40 Marks**<br>**Theory:**<br>36 Marks (1.25 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

**Section – I**

1. **Financial Reporting:**
   An Overview; Accounting and Economic Development; Concept; Objectives; Users; Qualitative Characteristics

2. **Recent Trends in Financial Reporting:**
   Introduction to Corporate Financial Reports, Meaning, Statutory requirements, Components of financial reports, Utility of corporate financial reports
   (a) Mandatory components analysis
   (b) Voluntary components analysis

**Section – II**

3. **Specific Accounting Standards for Financial Reporting:**
   (i) AS 1 Disclosure of accounting policies,
   (ii) AS 10 Accounting for fixed assets,
   (iii.) AS 18 Related Party disclosure
   (iv) AS 20 Earnings per share
   (v) Events occurring after the Balance Sheet date.

4. **Segment Reporting:**
   Nature, Benefits, Bases Merits and De–merits, Disclosure

References:


| No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Accounting Standards and Corporate Accounting Practices | T. P. Ghosh | Taxman Allied Service Pvt. Ltd |
| 2 | Fundamentals of Accounting and Financial Analysis | Anil Chaudhary | Pearson Education |
| 3 | Financial Accounting for Management –An Analysis Perspectives | Ambrish Gupta | Pearson Education |
| 4 | Financial accounting and Analysis | P. PremchandBalu &M. Madan Mohan | Himalaya Publishing Stores |
| 5 | Fundamentals of Corporate Accounting | J. R. Mongs | Mayar Noida, Delhi |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE
**Syllabus as per Semester Pattern for M. Com.**

**Semester – 3**
**Subject: Research Methodology**
**(Effective 2015 – 2016)**

| Teaching Scheme (Hr/Week) | | | Exam Schedule (Marks) | | |
|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Total** | **External** | **Sessional** | **Total** |
| **3** | **1** | **4 Hours** | **60 Marks**<br><br>**Theory:**<br>60 Marks ( 3 Hours) | **40 Marks**<br>**Theory:**<br>36 Marks (1.25 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

**Section – I**

1. **Introduction to Research:**

   Managerial Decision Making and Business Research, Nature and Scope of Business Research, Meaning and types of Research: Basic Research, Pure Research, Applied Research, Modern Scientific approach to Research, Research in Business, Research process, Structuring a Research proposal, Designing a research study: Exploratory, Descriptive and Causal Research Designs, Criteria of Good Research, Scope of a Research Study, Structuring a Research Proposal, Evaluations of Research study, Research Design: Sampling Design, Survey Design, Statistical design, Operational Design, Qualitative Vs. Quantitative Research, Research Report Writing Criteria for evaluation of a Research study.

2. **Data Collection and Description:**

   Data Vs. Information, Types of Data: Primary Vs. Secondary Data, Time series Vs. Cross sectional Data, Panel Data, Sources of secondary data , Methods of Primary data collection, Editing Coding, Identifying missing observations and outliers, Classification and Tabulation of data, Concepts of a frequency distributions for a discrete and continuous random variable, Data representation: Bar Charts, Pie Charts, Histogram and Ogives, Observation studies , Survey Method, Population Vs. Sample Study , Features of a Good sample, Determination of sample size, Probability sampling methods: SRSWR, SRSWOR, Systematic sampling, Proportionate and disproportionate stratified sampling, Cluster sampling, Area Sampling, Two stage sampling , Multistage sampling , Sequential Sampling, Non–probability sampling methods: Conveyance Sampling, Purposive sampling, Statistical judgment, Quota Sampling, Snowball sampling (Only description of the methods and their applications to practical situations)

**Section – II**

**3. Techniques of Data Analysis:**

Cost Estimation: account classification method(or engineering method), High–low method, Scatter Graph, Linear regression analysis (least square method),correlation and correlation coefficient, coefficient of determination, standard error of fixed and variable costs the conditions suited to the use of linear regression analysis, multiple regression analysis (in theory only).Basics of Statistical Inference: Meaning of Statistical Inference, Parameter and Statistic, Concepts of Point and Interval estimation, Confidence level, Confidence Interval, Level of significance, Statistical Testing of Hypothesis, Power of the test, Type–I and Type–II Errors, Null and Alternate Hypotheses, One Tailed and Two Tailed tests, Properties of Normal Distribution and their applications in hypothesis testing, Large Sample test (Z–test), t–test, chi–square test, F–test, ANOVA.

**4. Business Forecasting:**

Need of Forecasting, History of Forecasting, Types of Forecasts, Forecasting Process, Time–Series Forecasting : Components and models of time series, Methods of determination of Long–term trend: Method of Moving Averages, Simple Exponential Smoothing and Linear Least Squares Trend, exponential Smoothing methods, Forecasting with multiple predictor variables: Multiple Regression model, Interpretation of Computer Output for Multiple Regression Analysis, Co–efficient of Determination and its interpretation, Measuring forecasting error, Choice of an appropriate forecasting technique.

**References:**


| No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Business Research Methods | Donald Cooper & Pamela Schindler | Tata McGraw Hill (9th Edition) |
| 2 | Sampling: Design and Analysis | Sharon Lohr | Duxbury Press |
| 3 | Sampling Techniques | Cochran W. G. | Wiley Eastern |
| 4 | Quantitative Techniques for Management and Economics | PulakChakravarty | Himalaya Publishing House |
| 5 | Statistics for Management | Levin & Rubin | Pearson Education |
| 6 | Business Forecasting | Hankey, Wichern&Reitsch | Pearson Education |
| 7 | Statistics – Decision and Applications | Moshe Ben–horin and Levy | Addison Wesley |
| 8 | Quantitative Techniques for Managerial Decisions | Srivastav, Shenoy and Sharma | Wiley Eastern |
| 9 | Statistics in Research | Bernard Ostle and Mensing R. W. | Ith IOWA State University Press |
| 10 | Business Research Methodology | Sachadeva J. K. | Himalaya Publication |

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE

**Syllabus as per Semester Pattern for M. Com.**
**Semester – 4**
**Subject: Strategic Management**
**(Effective 2015 – 2016)**

| Teaching Scheme (Hr/Week) | | | Exam Schedule (Marks) | | |
|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Total** | **External** | **Sessional** | **Total** |
| **3** | **1** | **4 Hours** | **60 Marks**<br><br>**Theory:**<br>60 Marks ( 3 Hours) | **40 Marks**<br>**Theory:**<br>36 Marks (1.25 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

## Section – I

1. **(A) Formulating Long–TermObjectives and Grand Strategies**: Long–Term objectives: Qualities of Long–Term Objectives, Grand Strategies, Concentration, Market Development, Product Development Innovation, Horizontal Integration, Vertical Integration, Joint Venture Concentric Diversification, Retrenchment/Turnaround, Divestiture, Liquidation, Selection of Long–Term Objectives and Grand Strategy Sets, Sequence of Objectives and Strategy Selection, Summary

   **(B) Strategic Analysis and Choice:** Strategic Analysis at the Corporate Level, TheBCG Growth / Share Matrix, The GE Nine–Cell Planning Grid, Grand Strategy, Selection at the Business Level: SWOT Analysis, Grand Strategy Selection Matrix, Model of Grand Strategy Clusters, Behavioral Considerations Affecting Strategic Choice, Role of past Strategy, Degree of the Firms, External Dependence, Attitudes toward Risk, Internal Political Considerations, Timing Considerations, Competitive Reaction, Contingency Approach to Strategic

2. **Operationalizing the Strategy**: Annual Objectives, Functional Strategies and Business Policies: Annual Objectives: Qualities of Effective Annual Objectives, Contingency in Annual objectives, Benefits of Annual objectives, Developing Functional Strategies, Differences between Business and Functional Strategies, Functional Strategies in the Marketing Area, Functional Strategies in Finance / Accounting, Functional Strategies in Research and Development, Functional Strategies in Production Operators, Functional Strategies in Personnel, Developing and Communicating Concise Policies, The Purpose of Policies,Summary

## Section – II

3. **Institutionalizing the Strategy**: Structure, Leadership and Culture: Structural Considerations: Simple and Functional Organizational Structures, Divisional Organizational Structure, Strategic Business Units, Matrix Organization, The Role of Structure: Linking Structure to Strategy, Organizational Leadership: Role of CEO, Assignment of Key Managers, Organizational Life, the Strategy–Culture Connection

4. **Strategic Control**: Guiding and Evaluating the Strategy: Establishing Strategic Controls, Premise Control, Implementation Control, Strategic Surveillance, SpecialAlert Control, Operational Control Systems: Budgeting Systems, Scheduling. KeySuccess Factors, Using Operational Control Systems: Monitoring Performanceand Evaluating Deviations. Reward Systems: Motivating Execution and Control, Summary

**References:**


| No. | Title | Author |
|---|---|---|
| 1 | Business Policy & Strategic Management | AzharKazmi |
| 2 | Strategic Management, 12th Ed.<br>Concepts and Cases | Arthur A. Thompson Jr.<br>& A. J. Strickland |
| 3 | Management Policy and Strategic<br>Management (Concepts, Skills and Practices) | R. M. Shrivastava |
| 4 | Business Policy and Strategic Management | P. SubbaRao |
| 5 | Strategic Planning Formulation of Corporate Strategy | Ramaswamy |


The question paper to be set in such a manner not a single unit of syllabus should be excluded.

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE
**Syllabus as per Semester Pattern for M. Com.**

**Semester – 4**
**Subject: Business Ethics and Corporate Governance**
**(Effective 2015 – 2016)**

| Teaching Scheme (Hr/Week) | | | Exam Schedule (Marks) | | |
|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Total** | **External** | **Sessional** | **Total** |
| **3** | **1** | **4 Hours** | **60 Marks**<br><br>**Theory:**<br>60 Marks ( 3 Hours) | **40 Marks**<br>**Theory:**<br>36 Marks (1.25 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

**Section – I**

1. **Business Ethics:**
   Introduction to Business Ethics–Ethics, Morals and Values–Conflicts in Decision Making from Business–Legal and Moral Points of View
2. **Managerial Ethics:**
   A Historical Perspectives from Industrial Revolution to social Activism–The Nature of Ethics in Management–Ethical Problem as Managerial Dilemmas–conflict Between Economic & Social Performance–Complexity of Ethical issues–Typical Problems in Business Ethics–Pricing–Advertising–Product Promotion–Working conditions Consumer Service–Downsizing Workforce–Environmental Pollution & Supplier Relations.
   Analyzing Ethical Problems – Economic, Ethical and Legal Aspects – Managerial Ethics and Individual Decisions – Ethical Analysis-Ethical Dilemmas & Personal Career

**Section – II**

3. **Creative Accounting its Role in Business Scandals:**
   Nature and Evaluation of corporate Governance–Global and National Prospective Business Ethics and Corporate Governance, Claims of Various Stake Holders–Owners, Employees, Customers, Creditors, Suppliers, Community, Government Business Standards and Values–Anticipating & Avoiding unethical Consequences Selecting Ethical Goals–Value Orientation of the Firm.
   Administering & Reporting of Corporate Governance in India–SEBI RegulationsModel; report on Corporate Governance in India–Corporate Governance Rating
4. **Business Leaderships:**
   Role of Business in Society–Economic Role and Social Impact of Business–Entrepreneur's Role–Background & Characteristics-Leadership and Self Awareness
   Leadership Styles–Essential Components of Leadership–Understanding Team Work and Leadership–How Culture Constrains or Enhance Leaders–Essential Leadership Skills–Problem Solving and Decision Making–Visionary Leadership–Profile of Leaders

**References:**


| No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Ethics in Business and Corporate Governance | S. K. Mandal | Tata McGraw Hill |
| 2 | Ethical Choices in Business | R. C. Shekhar | Response Books |
| 3 | The Ethics of Management | LaRue Tone Hosmer | Universal Books |
| 4 | Beyond Leadership: Balancing Economics,Ethics & Ecology | Warren Bennis, J.Parikh& R. Lessem | Harper Collins |


The question paper to be set in such a manner not a single unit of syllabus should be excluded.

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE

**Syllabus as per Semester Pattern for M. Com.**
**Semester – 4**
**Subject: Operation Research**
**(Effective 2015 – 2016)**

| Teaching Scheme (Hr/Week) | | | Exam Schedule (Marks) | | |
|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Total** | **External** | **Sessional** | **Total** |
| **3** | **1** | **4 Hours** | **60 Marks**<br><br>**Theory:**<br>60 Marks ( 3 Hours) | **40 Marks**<br>**Theory:**<br>36 Marks (1.25 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

**Section – I**

1. **Introduction to Operations Research:** Definitions of O.R., Nature and Scope of O.R., Phases of O.R., Different types of Models in O.R., Iconic or Physical models, Analogue or Schematic models, Symbolic models, Deterministic models, Probabilistic models, General models, Dynamic models, Heuristic models, Types of Mathematical models, Advantages of Models, Decision theory, Decision making under certainty, Risk and Uncertainty conditions- Introduction, Applications of O.R. in the fields of Marketing, Finance, Planning, Research Development Techniques, Limitations of O.R., O.R. in India.

2. **Linear Programming and its Applications:** Definitions of Linear Programming, Linear Programming as an Optimization Technique, Structure of an L.P. problem, Formulations of L.P. problem, Graphical Method, Simplex method for Maximization problem, Big-M method for Minimization case, Degeneracy, Unbounded, Infeasible and Alternative Solution cases, Advantages and Limitations of Linear Programming, Transportation Problem and Assignment Problem: Transportation Model, Formulation of Transportation Problem as an L.P. model, Vogel's approximation Method, Modified Distribution Method, Optimality Tests, Degeneracy in T.P., Unbalanced T.P., Assignment Problem: Formulation, Hungarian Method, Constrained Assignment Problem, Applications of Transportation and Assignment Problems.

**Section – II**

3. **Theory of Games and Sequencing Problems:** Study of Two Person Zero–sum Game Problems, Games with and without Saddle point, Principles of Dominance, Graphical method, Conversion of Game problem into an L.P. problem, Problem of Sequencing: Sequencing of n jobs on two and three machines, Applications of Game theory and Sequencing problems.
4. **Network Analysis: (CPM & PERT):** Concept of Network, Network Diagram, Concepts connected with a Network, Labelling Method, Critical Path Method, Determination of Floats: Total Float, Free Float and Independent Float, Project Evaluation and Review Technique (PERT), Applications of CPM and PERT.

**References:**


| No. | Title | Author |
|---|---|---|
| 1 | Introduction to Operations Research | Sharma J. K. |
| 2 | Operations Research – An Introduction | Taha H. A. |
| 3 | Operations Research | Hiller and Lieberman |
| 4 | Quantitative Techniques for Management | Vohra N. D. |
| 5 | Optimization Theory and Applications | Rao S. S. |
| 6 | Problems and Solutions in Operations Research | Kapoor V. K. |


The question paper to be set in such a manner not a single unit of syllabus should be excluded.

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE

**Syllabus as per Semester Pattern for M. Com.**
**Semester – 4**
**Subject: Advanced Cost, Financial andManagement Accounting**
**(Effective 2015 – 2016)**

| Teaching Scheme (Hr/Week) | | | Exam Schedule (Marks) | | |
|---|---|---|---|---|---|
| **Lecture** | **Tutorial** | **Total** | **External** | **Sessional** | **Total** |
| **3** | **1** | **4 Hours** | **60 Marks**<br><br>**Theory:**<br>60 Marks ( 3 Hours) | **40 Marks**<br>**Theory:**<br>36 Marks (1.25 Hours)<br>**Assignment:** 02 Marks<br>**Attendance:** 02 Marks | **100 Marks** |

**Section – I**

1. **New Concepts:**
   - **(A) Life Cycle Costing:** Identifying the costs involved at different stages of the life–cycle, Implications of life cycle costing on pricing, performance management and decision making
   - **(B) Target Costing:** Deriving a target cost in manufacturing and service industries, Difficulties of using target costing in service industries; Implications of using target costing on pricing, cost control and performance management; suggestions to close a target cost gap.
   - **(C) KAIZEN Costing**
2. **Capital Budgeting & Decisions under uncertainty:**
   Introduction, techniques of evaluating capital investment projects – Pay Back Period, Accounting Rate of Return, Profitability Index, Net Present Value, Internal Rate of Return (Advanced Problems)
   Meaning of Risk & Uncertainty, Techniques of dealing with risks, risks Risk Adjusted Discount Rate, Certainty Equivalent Coefficient, Sensitivity Analysis, Probability Assignment, Decision Tree

**Section – II**

3. **(A) AS 11: The effect of changes in Foreign Exchange Rates**
   - **(B) Accounting for Foreign Currency Transactions:** Introduction, The need for transaction, Origin of problem, Internal Transactions, Forward Exchange Contracts, Foreign Currency Transactions
4. **Service Costing:**
   Meaning and Definition; Service Cost Units; Service Cost Analysis; Application of Service Costing; Service Organisations; Service Costing v/s Output Costing; Operating Cost Statements; Hotel Costing; Canteen Costing; Power House Costing; Hospital Costing (Excluded Transport Costing)

**Reference Books:**

| No. | Title | Author | Publisher |
|---|---|---|---|
| 1 | Management Accounting & Financial Management | S. N. Maheshwari | Sultanchand& Sons, New Delhi. |
| 2 | Management Accounting | I. M. Pandey | Vikas Publishing House Pvt. Ltd. |
| 3 | International Accounting | ShirinRathore | Prantice Hall Indian |
| 4 | Cost & Management Accounting With Problems & Solution | Ravi M. Kishore | Taxmann |

The question paper to be set in such a manner not a single unit of syllabus should be excluded.

# DHARMSINH DESAI UNIVERSITY, NADIAD
# FACULTY OF COMMERCE
**Syllabus as per Semester Pattern for M. Com.**

**Semester – 4**

**Subject: Project**

**(Effective 2015 – 2016)**

For "Practical Studies" at 4th Semester the candidate should satisfy the following requirements:

To prepare a project report detailed guide lines are provided for project report. Title of the project report & methodology will be decided by the concern Faculty who will guide them.

At the end of the semester there will be Viva–Voce Examination for this subject that will carry 100 marks. (60 Marks for Viva–Voce & 40 Marks for Project Report–Marks will be given.)

For detailed project guidelines: M Com Sem 4 Project Guidelines.docx

# PROSTHODONTICS AND CROWN & BRIDGE

## 1. AIM:

To train the dental graduates so as to ensure higher level of competence in both general and specialty areas of Prosthodontics and prepare candidates with teaching, research and clinical abilities including prevention and after care in Prosthodontics – removable dental prosthodontics, fixed dental prosthodontics (Crown &Bridge), implantology, maxillofacial prosthodontics and esthetic dentistry.

**GENERAL OBJECTIVES OF THE COURSE:**

- Training program for the dental graduates in Prosthetic dentistry– removable dental prosthodontics, fixed dental prosthodontics (Crown & Bridge), implantology, maxillofacial prosthodontics and esthetic dentistry and Crown & Bridge including Implantology is structured to achieve knowledge and skill in theoretical and clinical laboratory, attitude, communicative skills and ability to perform research with a good understanding of social, cultural, educational and environmental background of the society.
- To have adequate acquired knowledge and understanding of applied basic and systemic medical sciences, both in general and in particularly of head and neck region.
- The postgraduates should be able to provide Prosthodontic therapy for patients with competence and working knowledge with understanding of applied medical, behavioral and clinical science, that are beyond the treatment skills of the general BDSgraduates and MDS graduates of other specialties,
- To demonstrate evaluative and judgment skills in making appropriate decisions regarding prevention, treatment, after care and referrals to deliver comprehensive care to patients.

**KNOWLEDGE:**

- The candidate should possess knowledge of applied basic and systemic medical sciences.
- On human anatomy, embryology, histology, applied in general and particularly to head and neck, Physiology & Biochemistry, Pathology Microbiology & virology; health and diseases of various systems of the body (systemic) principles in surgery and medicine, pharmacology, nutrition, behavioral science, age changes, genetics, Immunology, Congenital defects & syndromes and Anthropology, Bioengineering, Bio-medical & Biological Principles
- The student shall acquire knowledge of various Dental Materials used in the specialty and be able to provide appropriate indication, understand the manipulation characteristics, compare with other materials available, be adept with recent advancements of the same.
- Students shall acquire knowledge and practice of history taking, Diagnosis, treatment planning, prognosis, record maintenance of oral, craniofacial and systemic region. Ability for comprehensive rehabilitation concept with pre prosthetic treatment plan including surgical re-evaluation and prosthodontic treatment planning, impressions, jaw relations, utility of face bows, articulators, selection and positioning of teeth, teeth arrangement for retention, stability, esthetics, phonation, psychological comfort, fit and insertion.
- Instructions for patients in after care and preventive Prosthodontics and management of failed restorations shall be possessed by the students.

- Understanding of all the applied aspects of achieving physical, psychological well-being of the patients for control of diseases and / or treatment related syndromes with the patient satisfaction and restoring function of Cranio mandibular system for a quality life of a patient.
- Ability to diagnose and plan treatment for patients requiring Prosthodontic therapy
- Ability to read and interpret radiographs, and other investigations for the purpose of diagnosis and treatment planning.
- The theoretical knowledge and clinical practice shall include principles involved for support, retention, stability, esthetics, phonation, mastication, occlusion, behavioral, psychological, preventive and social aspects of Prosthodontics science of Oral and Maxillofacial Prosthodontics and Implantology
- Tooth and tooth surface restorations, Complete denture Prosthodontics, removable partial denture Prosthodontics, fixed prosthodontics and maxillofacial and Craniofacial Prosthodontics, implants and implant supported Prosthodontics, T.M.J. and occlusion, craniofacial esthetics, and biomaterials, craniofacial disorders, problems of psychogenic origin.
- Should have knowledge of age changes, geriatric psychology, nutritional considerations and prosthodontic therapy in the aged population.
- Should have ability to diagnose failed restoration and provide prosthodontic therapy and after care.
- Should have essential knowledge on ethics, laws, and Jurisprudence and Forensic Odontology in Prosthodontics.
- Should know general health conditions and emergency as related to prosthodontics treatment like allergy of various materials and first line management of aspiration of prosthesis
- Should identify social, cultural, economic, environmental, educational and emotional determinants of the patient and consider them in planning the treatment.
- Should identify cases, which are outside the area of his specialty / competence, refer them to appropriate specialistsand perform interdisciplinary case management.
- To advice regarding case management involving surgical and interim treatment
- Should be competent in specialization of team management in craniofacial prosthesis design.
- To have adequate acquired knowledge, and understanding of applied basic, and systemic medical science knowledge in general and in particular to head and neck regions.
- Should attend continuing education programmes, seminars and conferences related to Prosthodontics, thus updating himself/herself.
- To teach and guide his/her team, colleagues and other students.
- Should be able to use information technology tools and carry out research both in basic and clinical areas, with the aim of publishing his/ her work and presenting his/her work at various scientific forums.
- Should have an essential knowledge of personal hygiene, infection control, prevention of cross infection and safe disposal of waste, keeping in view the risk of transmission of potential communicable and transmissible infections like Hepatitis and HIV.
- Should have an ability to plan and establish Prosthodontics clinic/hospital teaching department and practice management.
- Should have a sound knowledge (of the applications in pharmacology, effects of drugs on oral tissues and systems of body and in medically compromised patients.

**SKILLS:**

- The candidate should be able to examine the patients requiring Prosthodontic therapy, investigate the patient systemically, analyze the investigation results, radiographs, diagnose the ailment, plan the treatment, communicate it with the patient and execute it.

- To understand the prevalence and prevention of diseases of craniomandibular system related to prosthetic dentistry.
- The candidate should be able to restore lost functions of stomatognathic system like mastication, speech, appearance and psychological comforts by understanding biological, biomedical, bioengineering principles and systemic conditions of the patients to provide quality health care in the craniofacial regions.
- The candidate should be able to demonstrate good interpersonal, communication skills ***and*** team approach in interdisciplinary care by interacting with other specialties including medical specialty for planned team management of patients for craniofacial ***&*** oral acquired and congenital defects, temporomandibular joint syndromes, esthetics, Implant supported Prosthetics and problems of Psychogenic origins.
- Should be able to demonstrate the clinical competence necessary to carry out appropriate treatment at higher level of knowledge, training and practice skills currently available in their specialty area with a patient centered approach.
- Should be able to interpret various radiographs like IOPA, OPG, CBCT and CT. Should and be able to plan and modify treatment plan based on radiographic findings
- Should be able to critically appraise articles published and understand various components of different types of articles and be able to gather the weight of evidence from the same
- To identify target diseases and create awareness amongst the population regarding Prosthodontic therapy.
- To perform Clinical and Laboratory procedures with a clear understanding of biomaterials, tissue conditions related to prosthesis and have required dexterity & skill for performing clinical and laboratory all procedures in fixed, removable, implant, maxillofacial, TMJ and esthetics Prosthodontics.
- To carry out necessary adjunctive procedures to prepare the patient before prosthesis like tissue preparation and preprosthetic surgery and to prepare the patient before prosthesis / prosthetic procedures
- To understand demographic distribution and target diseases of Cranio mandibular region related to Prosthodontics.

**ATTITUDES:**

- To adopt ethical principles in Prosthodontic practice, Professional honesty, credibility and integrity are to be fostered. Treatment to be delivered irrespective of social status, caste, creed or religion of patient.
- Should be willing to share the knowledge and clinical experience with professional colleagues.
- Should develop an attitude towards quality, excellence, ***non-compromising*** in treatment.
- Should be able to self-evaluate, reflect and improve on their own.
- Should pursue research in a goal to contribute significant, relevant and useful information, concept or methodology to the scientific fraternity.
- Should be able to demonstrate ***evidence-based*** practice while handling cases
- Should be willing to adopt new methods and techniques in prosthodontics from time to time based on scientific research, which are in patient's best interest.
- Should respect patient's rights and privileges, including patient's right to information and right to seek second opinion.
- To develop the ability to communicate with professional colleagues through various media like Internet, e-mails, videoconferences etc. to render the best possible treatment. Should demonstrate good explanatory and demonstrating ability as a teacher in order to facilitate learning among students

**COURSE CONTENTS:**

The course content has been identified and categorized as essential knowledge given below.

**ESSENTIAL KNOWLEDGE:**

The topics to be considered are Applied Basic Sciences, Oral and Maxillofacial Prosthodontics and Implantology

**APPLIED BASIC SCIENCES:**

Should develop thorough knowledge on the applied aspects of Anatomy, Embryology, Histology particularly head and neck, Physiology, Biochemistry, Pathology, Microbiology, Virology, Pharmacology, Health and systematic diseases principles in surgery medicine and Anesthesia, Nutrition, Behavioral sciences, age changes, genetics, Dental Material Science, congenital defects and Syndromes and Anthropology, Biomaterial Sciences, Bio-engineering and Bio-medical and Research Methodology as related to Masters degree Prosthodontics and Crown & Bridge including Implantology

It is desirable to have adequate knowledge in Bio-statistics, Research Methodology and use of computers to develop necessary teaching skills in the specialty of Prosthodontics including crown and bridge.

**APPLIED ANATOMY OF HEAD AND NECK:**

**General Human Anatomy** –Gross Anatomy, anatomy of Head and Neck in detail:Cranial and facial bones, TMJ and function, muscles of mastication and facial expression, muscles of neck and back including muscles of deglutition and tongue, arterial supply and venous drainage of the head and neck, anatomy of the Para nasal sinuses in relation to the $V^{th}$ cranial nerve. General considerations of the structure and function of the brain, brief considerations of V, VII, XI, XII, cranial nerves andautonomic nervous system of the head and neck. The salivary glands, Pharynx, LarynxTrachea, Oesophagus, Functional Anatomy of masticatory muscles, Deglutition, speech, respiration, and circulation, teeth eruption, morphology, occlusion and function. Anatomy of TMJ, its movements and myofacial pain dysfunction syndrome.

**Embryology** –Development of the face, tongue, jaws, TMJ, Paranasal sinuses,pharynx, larynx, trachea, esophagus, Salivary glands, Development of oral and Para oral tissues including detailed aspects of tooth formation.

**Growth & Development** –Facial form and Facial growth and development overview of Dentofacial growth process and physiology from foetal period to maturity and old age, General physical growth, functional and anatomical aspects of the head, changes in craniofacial skeletal development, relationship between development of the dentition and facial growth.

**Dental Anatomy** –Anatomy of primary and secondary dentition, concept of occlusion,mechanism of articulation, and masticatory function. Detailed structural and functional study of the oral and Para oral tissues, normal occlusion, development of occlusion in deciduous mixed and permanent dentitions, root length, root configuration & tooth-numbering systems.

**Histology** –histology of enamel, dentin, Cementum, periodontal ligament and alveolarbone, pulpal anatomy, histology and biological consideration. Salivary glands and Histology of epithelial tissues including glands.
Histology of general and specific connective tissue including bone, , Salivary glands, Histology of skin, oral mucosa, respiratory mucosa, connective tissue, bone, cartilage,

cellular elements of blood vessels, blood, lymphatics, nerves, muscles, tongue and tooth

**Cell biology** –Brief study of the structure and function of the mammalian cell Components of the cell and functions of various types of cells and their consequences with tissue injury

**APPLIED PHYSIOLOGY AND NUTRITION:**

Introduction, Mastication, deglutition, digestion and assimilation, Homeostasis, fluid and electrolyte balance, blood composition, volume, function, blood groups and hemorrhage, Blood transfusion, circulation, Heart, Pulse, Blood pressure, capillary and lymphatic circulation. Shock, respiration, control, anoxia, hypoxia, asphyxia, artificial respiration. Endocrine glands in particular reference to pituitary, parathyroid and thyroid glands and sex hormones. Role of calcium and Vit D in growth and development of teeth, bone and jaws. Role of Vit. A, C and B complex in oral mucosal and periodontal health. Physiology and function of the masticatory system. Speech mechanism, mastication, swallowing and deglutition mechanism, salivary glands and Saliva

**Endocrines** – General principles of endocrine activity and disorders relating to pituitary, thyroid, pancreas, parathyroid, adrenals, gonads, including pregnancy and lactation. Physiology of saliva, urine formation, normal and abnormal constituents, Physiology of pain, Sympathetic and parasympathetic nervous system, neuromuscular co-ordination of the stomatognathic system.

**Applied Nutrition** – General principles, balanced diet, effect of dietary deficiencies and starvation, Diet, digestion, absorption, transportation and utilization & diet for elderly patients.

**APPLIED BIOCHEMISTRY:**

General principles governing the various biological activities of the body, such as osmotic pressure, electrolytic dissociation, oxidation-reduction Carbohydrates, proteins, liquids and their metabolism, Enzymes, Vitamins, and minerals, Hormones, Blood, Metabolism of inorganic elements, Detoxification in the body & anti metabolites.

**APPLIED PHARMACOLOGY AND THERAPEUTICS:**

Dosage and mode of administration of drugs. Action and fate of drugs in the body, Drug addiction, tolerance and hypersensitive reactions, Drugs acting on the central nervous system, general anesthetics hypnotics, analeptics and tranquilizers. Local anesthetics, Chemotherapeutics and antibiotics, Antitubercular and anti-syphilitic drugs, Analgesics and antipyretics, Antiseptics, styptics, Sialogogues and antisialogogues, Haematinics, Cortisones, ACTH, insulin and other antidiabetics vitamins: A, D, B – complex group C, K etc. Chemotherapy and Radiotherapy. Drug regime for antibiotic prophylaxis and infectious endocarditis and drug therapy following dental surgical treatments like placement of implants, pre and peri prosthetic surgery

**APPLIED PATHOLOGY:**

Inflammation, repair and degeneration, Necrosis and gangrene, Circulatory disturbances, Ischemia, hyperaemia, chronic venous congestion, oedema, thrombosis, embolism and infarction. Infection and infective granulomas, Allergy and hypersensitive reactions, Neoplasms; Classification of tumors, Carcinogenesis, characteristics of benign and malignant tumors, spread of tumors. Applied histo pathology and clinical pathology.

**APPLIED MICROBIOLOGY:**

Immunity, knowledge of organisms commonly associated with diseases of the oral cavity (morphology cultural characteristics etc) of strepto, staphylo, , Clostridia group of organisms, Spirochaetes, organisms of tuberculosis, leprosy, diphtheria, actinomycosis and moniliasis etc. Virology, Cross infection control, sterilization and hospital waste management

**APPLIED ORAL PATHOLOGY:**

Developmental disturbances of oral and Para oral structures, Regressive changes of teeth, Bacterial, viral and mycotic infections of the oral cavity. Dental caries, diseases of pulp and periapical tissues, Physical and chemical injuries of the oral cavity, oral manifestations of metabolic and endocrine disturbances, Diseases of the blood and blood forming organism in relation to the oral cavity, Periodontal diseases, Diseases of the skin, nerves and muscles in relation to the Oral cavity.

**LABORATORY DETERMINATIONS:**

Blood groups, blood matching, R.B.C. and W.B.C. count, Bleeding and clotting time, PT, PTT and INR Smears and cultures – urine analysis and culture. Interpretation of RBS, Glycosylated Hb, GTT

**BIOSTATISTICS:**

Characteristics and limitations of statistics, planning of statistical experiments, sampling, collection, classification and presentation of data (Tables, graphs, pictograms etc) & Analysis of data, parametric and non-parametric tests

**Introduction to Biostatistics -** Scope and need for statistical application to biological data. Definition of selected terms – scale of measurements related to statistics, Methods of collecting data, presentation of the statistical diagrams and graphs.

Frequency curves, mean, mode of median, Standard deviation and co-efficient of variation, Correlation – Co-efficient and its significance, Binominal distributions normal distribution and Poisson's distribution, Tests of significance.

**RESEARCH METHODOLOGY**:

Understanding and evaluating dental research, scientific method and the behavior of scientists, understanding to logic – inductive logic – analogy, models, authority, hypothesis and causation. Measurement and Errors of measurement, presentation of results, Reliability, Sensitivity and specificity diagnosis tests and measurements, Research Strategies, Observation, Correlation, Experimentation and Experimental design. Logic of statistical in(ter)ferences, balance judgements, judgement under uncertainty, clinical vs., scientific judgement, problems with clinical judgement, forming scientific judgements, the problem of contradictory evidence, citation analysis as a Means of literature evaluation, influencing judgement:

Protocol writing for experimental, observational studies, survey including hypothesis, PICO statement, aim objectives, sample size justification, use of control/placebo, standardization techniques, bias and its elimination, blinding, evaluation, inclusion and exclusion criteria.

**APPLIED RADIOLOGY:**

Introduction, radiation, background of radiation, sources, radiation biology, somatic damage, genetic damage, protection from primary and secondary radiation, Principles of X-ray production, Applied principles of radio therapy and after care.

**ROENTGENOGRAPHIC TECHNIQUES:**

Intra oral, extra oral roentgenography, Methods of localization digital radiology and ultra sounds. Normal anatomical landmarks of teeth and jaws in radiograms, temporomandibular joint radiograms, neck radiograms. Use of CT and CBCT in prosthodontics

**APPLIED MEDICINE:**

Systemic diseases and (its) their influence on general health and oral and dental health. Medical emergencies like syncope, hyperventilation, angina, seizure, asthma and allergy/anaphylaxis in the dental offices – Prevention, preparation, medico legal consideration, unconsciousness, respiratory distress, altered consciousness, seizures, drug related emergencies, chest pain, cardiac arrest, premedication, prophylaxis and management of ambulatory patients, resuscitation, applied psychiatry, child, adult and senior citizens.

**APPLIED SURGERY & ANESTHESIA:**

General principles of surgery, wound healing, incision wound care, hospital care, control of hemorrhage, electrolyte balance. Common bandages, sutures, splints, shifting of critically ill patients, prophylactic therapy, bone surgeries, grafts, etc, surgical techniques, nursing assistance, anesthetic assistance.
Principles in speech therapy, surgical and radiological craniofacial oncology, applied surgical ENT and ophthalmology.

**APPLIED PLASTIC SURGERY**:

Applied understanding and assistance in programs of plastic surgery for prosthodontics therapy.

**APPLIED DENTAL MATERIALS:**

- Students should have understanding of all materials used for treatment of craniofacial disorders – Clinical, treatment, and laboratory materials, associated materials, technical considerations, shelf life, storage, manipulations, sterilization, and waste management.
- Students shall acquire knowledge of testing biological, mechanical and other physical properties of all materials used for the clinical and laboratory procedures in prosthodontic therapy.
- Students shall acquire full knowledge and practice of Equipments, instruments, materials, and laboratory procedures at a higher level of competence with accepted methods.

All clinical practices shall involve personal and social obligation of cross infection control, sterilization and waste management.

## ORAL AND MAXILLOFACIAL PROSTHODONTICS AND IMPLANTOLOGY:

### I. NON-SURGICAL AND SURGICAL METHODS OF PROSTHODONTICS AND IMPLANTOLOGY

a. Prosthodontic treatment for completely edentulous patients – Complete dentures, immediate complete dentures, single complete dentures, tooth supported complete dentures & Implant supported Prosthesis for completely edentulous patients for typical and atypical cases

b. Prosthodontic treatment for partially edentulous patients: - Clasp-retained acrylic and cast partial dentures, transitional dentures, immediate dentures, attachments intra coronal and extra coronal precision retained partial dentures & maxillofacial prosthesis for typical and atypical cases.

**Prosthodontic treatment for edentulous patients: -** Complete Dentures and Implant supported Prosthesis.

Complete Denture Prosthesis – Definitions, terminologies, G.P.T., Boucher's clinical dental terminology

Scope of Prosthodontics – The Cranio Mandibular system and its functions, the reasons for loss of teeth, consequences of loss of teeth and treatment modality with various restorations and replacements

a) **Edentulous Predicament**, Biomechanics of the edentulous state, Supportmechanism for the natural dentition and complete dentures, Biological considerations, Functional and Para functional considerations, Esthetic, behavioral and adaptive responses, Temporomandibular joints changes.
b) **Effects of aging of edentulous patients** –aging population, distribution andedentulism in old age, impact of age on edentulous mouth – Mucosa, Bone, saliva, jaw movements in old age, taste and smell, nutrition, aging, skin and teeth, concern for personal appearance in old age
c) **Sequelae caused by wearing complete denture** –the denture in the oralenvironment – Mucosal reactions, altered taste perception, burning mouth syndrome, gagging, residual ridge (reduction) resorption, denture stomatitis, flabby ridge, denture irritation hyperplasia, traumatic Ulcers, Oral cancer in denture wearers, nutritional deficiencies, masticatory ability and performance, nutritional status and masticatory functions.
d) **Temporomandibular disorders in edentulous patients** –Epidemiology,etiology and management, Pharmacotherapy, Physical modalities, and Bio-behavioral modalities
e) **Nutrition Care for the denture wearing patient** –Impact of dental status onfood intake, Gastrointestinal functions, nutritional needs and status of older adults, Calcium and bone health, vitamin and herbal supplementation, dietary counseling and risk factor for malnutrition in patients with dentures and when teeth are extracted.
f) **Preparing patient for complete denture patients** –Diagnosis and treatment planning for edentulous and partially edentulous patients – familiarity with patients, principles of perception, health questionnaires and identification data, problem identification, prognosis and treatment identification data, problem identification, prognosis and treatment planning – contributing history – patient's history, social information, medical status – systemic status with special reference to debilitating diseases, diseases of the joints, cardiovascular disorders, diseases of the skin, neurological disorders, oral malignancies, climacteric, use of drugs, mental health – mental attitude, psychological changes,

adaptability, geriatric changes – physiologic, pathological, pathological and intra oral changes. Intra oral health – mucus membrane, alveolar ridges, palate and vestibular sulcus and dental health.

Data collection and recording, visual observation, radiography, palpation, measurement of sulci or fossae, extra oral measurement, the vertical dimension of occlusion, diagnostic casts.
Specific observations – existing dentures, soft tissue health, hard tissue health – teeth, bone
Biomechanical considerations – jaw relations, border tissues, saliva, muscular development – muscle tone, neuromuscular co-ordination, tongue, cheek and lips.
Interpreting diagnostic findings and treatment planning

g) **Pre prosthetic surgery** –Improving the patients denture bearing areas andridge relations.
h) **Non surgical methods** –rest for the denture supporting tissues, occlusal correction of the old prosthesis, good nutrition, conditioning of the patients musculature,
i) **Surgical methods** –Correction of conditions, that preclude optimal prosthetic function – hyperplastic ridge – epulis fissuratum and papillomatosis, frenular attachments
j) **Immediate Denture** –Advantages, Disadvantages, Contraindications,Diagnosis, treatment planning and Prognosis, Explanation to the patient, Oral examinations, Examination of existing prosthesis, Tooth modification, Prognosis, Referrals/adjunctive care, oral prophylaxis and other treatment needs.

First visit, preliminary impressions and diagnostic casts, management of loose teeth, custom trays, final impressions and master casts, two tray or sectional custom impression tray, location of posterior limit and jaw relation records, setting of the posterior denture teeth / verifying jaw relations and the patient try in.

Laboratory phase, setting of anterior teeth, Wax contouring, flasking and boil out, processing and finishing, surgical templates, surgery and immediate denture insertion, post operative care and patient instructions, subsequent service for the patient on the immediate denture.

k) **Over dentures** (tooth supported complete dentures)–indications andtreatment planning, advantages and disadvantages, selection of abutment teeth, loss of abutment teeth, tooth supported complete dentures. Non-coping abutments, abutment with copings, abutments with attachments, submerged vital roots, preparations of the retained teeth.
l) **Single Dentures:** Single Mandibular denture to oppose natural maxillaryteeth, single complete maxillary denture to oppose natural Mandibular teeth to oppose a partially edentulous Mandibular arch with fixed prosthesis, partially edentulous Mandibular arch with removable partial dentures. Opposing existing complete dentures, preservation of the residual alveolar ridge, necessity for retaining maxillary teeth and preventing mental trauma.
m) **Art of communication in the management of the edentulous predicament** – Communication–scope, a model of communication, why communication is important? What are the elements of effective communication? special significance of doctor / patient communication, doctor behavior, The iatro sedative (doctor & act of making calm) recognizing and acknowledging the problem, exploring and identifying the problem, interpreting and explaining the problem, offering a solution to the problem for mobilizing their resources to operate in a most efficient way, recognizing and acknowledging the problem, interpreting and explaining the problem, offering a solution to the problem.
n) **Materials prescribed in the management of edentulous patients -** Denture base materials, General requirements of biomaterials for edentulous patients, requirement of an ideal denture base, chemical composition of denture base resins, materials used in the fabrication of prosthetic denture teeth, requirement of prosthetic denture teeth, denture lining materials and tissue conditioners, cast metal alloys as denture bases – base metal alloys.
o) **Articulators** – **Evolution of concepts,** Classification, selection, limitations, precision, accuracy andsensitivity, and Functions of the articulator and their uses. Recent advancements including virtual articulator

p) **Fabrication of complete dentures** –complete denture impressions–muscles of facial expressions and anatomical landmarks, support, retention, stability, aims and objectives of preservation, support, stability, aesthetics, and retention. Impression materials and techniques – need of 2 impressions the preliminary impression and final impressions.

Developing an analogue / substitute for the maxillary denture bearing area – anatomy of supporting structures – mucous membrane, hard palate, residual ridge, shape of the supporting structure and factors that influence the form and size of the supporting bones, incisive foramen, maxillary tuberosity, sharp spiny process, torus palatinus, Anatomy of peripheral or limiting structures, labial vestibule, Buccal vestibule, vibrating lines. Preliminary and final impressions, impression making, custom tray and refining the custom tray, preparing the tray to secure the final impression, making the final impression, boxing impression and making the casts

Developing an analogue / substitute for the Mandibular denture bearing area-anatomy of supporting structure, crest of the residual ridge, buccal shelf, shape of supporting structure, mylohyoid ridge, mental foramen, genial tubercles, torus mandibularis, Anatomy of peripheral or limiting structure – labial vestibule, Buccal vestibule, lingual border, mylohyoid muscle, retromylohyoid fossa, sublingual gland region, alveolingual sulcus, Mandibular impressions – preliminary impressions, custom tray, refining, preparing the tray\, final impressions.

q) **Mandibular movements, Maxillo mandibular relations and concepts of occlusion –** Gnathology, identification of shape and location of arch form–Mandibular and maxillary occlusion rims, level of occlusal plane and recording of trail denture base, tests to determine vertical dimension of occlusion, interocclusal & centric relation records. Biological and clinical considerations in making jaw relation records and transferring records from the patients to the articulator, Recording of Mandibular movements – influence of opposing tooth contacts, temporomandibular joint, muscular involvements, neuromuscular regulation of Mandibular motion, the envelope of motion, rest position.

Maxillo – Mandibular relations – the centric, eccentric, physiologic rest position, vertical dimension, occlusion, recording methods – mechanical, physiological, Determining the horizontal jaw relation – Functional graphics, tactile or interocclusal check record method, Orientation / sagittal relation records, Arbitrary

a. Hinge axis and face bow record, significance and requirement, principles and biological considerations and securing on articulators.

**r) Selecting and arranging artificial teeth and occlusion for the edentulous patient –** anterior tooth selection, posterior tooth selection, and principles in

arrangement of teeth, and factors governing the position of teeth – horizontal & vertical relations. The inclinations and arrangement of teeth for aesthetics, phonetics and mechanics – to concept of occlusion.

s) **The Try in** –verifying vertical dimension, centric relation, establishment ofposterior palatal seal, creating a facial and functional harmony with anterior teeth, harmony of spaces of individual teeth position, harmony with sex, personality and age of the patient, co-relating aesthetics and incisal guidance.

t) **Speech considerations with complete dentures & speech production** –structural and functional demands, neuropsychological background, speech production and the roll of teeth and other oral structures – bilabial sounds, labiodental(s) sounds, linguodental sounds, linguoalveolar sound, articulatoric characteristics, acoustic characteristics, auditory characteristics, linguopalatal and linguoalveolar sounds, speech analysis and prosthetic considerations.

u) **Waxing contouring and processing the dentures their fit and insertion and after care** –laboratory procedure–wax contouring, flasking and processing, laboratory remount procedures, ***selective grinding***, finishing and polishing.

Critiquing the finished prosthesis – doctors evaluation, patients evaluation, friends evaluation, elimination of basal surface errors, errors in occlusion,

interocclusal records for remounting procedures – verifying centric relation, eliminating occlusal errors.

Special instructions to the patient – appearance with new denture, mastication with new dentures, speaking with new dentures, oral hygiene with dentures, preservation of residual ridges and educational material for patients, maintaining_the comfort and health of the oral cavity in the rehabilitated edentulous patients. Twenty-four hours oral examination and treatment and (preventive) Prosthodontic

– periodontic recall for oral examination 3 to 4 months intervals and yearly intervals.

v) **Implant supported Prosthesis for partially edentulous patients** –Scienceof Osseo integration, clinical protocol ***(diagnostic,surgical and prosthetic***) for treatment with implant supported over dentures, managing problems and complications. Implant Prosthodontics for edentulous patients: current and future directions.

Implant supported prosthesis for partially edentulous patients – Clinical and laboratory protocol: Implant supported prosthesis, managing problems and complications

- Introduction and Historical Review
- Biological, clinical and surgical aspects of oral implants
- Diagnosis and treatment planning
- Radiological interpretation for selection of fixtures
- Splints for guidance fort surgical placement of fixtures
- ***Surgical and*** Intra oral plastic surgery, if any
- Guided bone and Tissue regeneration consideration for implants fixture.
- Implant supported prosthesis for complete edentulism and partial edentulism
- Occlusion for implant supported prosthesis.
- Peri-implant tissue and Management of peri-implantitis
- Maintenance and after care
- Management of failed restoration.
- Work authorization for implant supported prosthesis – definitive instructions, legal aspects, delineation of responsibility.

**Prosthodontic treatment for partially edentulous patients – Removable partial Prosthodontics –**

a. **Scope, definition** and terminology, Classification of partially edentulous arches - requirements of an acceptable method of classification, Kennedy's classification, Applegate's rules for applying the Kennedy classification

b. **Components of RPD** –

i) major connector–mandibular and maxillary

ii) minor connectors, design, functions & form and location of major and minor connectors, tissue stops, finishing lines, reaction of tissue to metallic coverage

iii) Rest and rest seats – form of the Occlusal rest and rest seat, interproximal Occlusal rest seats, internal Occlusal rests, possible movements of partial

dentures, support for rests, lingual rests on canines and incisor teeth, incisal rest and rest seat.

iv) Direct retainers- Internal attachments & extracoronal direct retainers. Relative uniformity of retention, flexibility of clasp arms, stabilizing reciprocal clasp, criteria for selecting a given clasp design, the basic principles of clasp design, circumferential clasp, bar clasp, combination clasp and other type of retainers.

v) Indirect Retainers – denture rotation about an axis, factors influencing effectiveness of indirect retainers, forms of indirect retainers, auxiliary Occlusal rest, canine extensions from Occlusal rests, canine rests, continuous bar retainers and linguoplates, modification areas, rugae support, direct – indirect retention.

(vi) Teeth and denture bases – types, materials, advantages and dis-advantages, indications and contraindications and clinical use.

Principles of removable partial Denture design – Bio mechanical considerations, and the factors influencing after mouth preparations – Occlusal relationship of remaining teeth, orientation of Occlusal plane, available space for restoration, arch integrity, tooth morphology, response of oral structure to previous stress, periodontal conditions, abutment support, tooth supported and tooth and tissue supported, need for indirect retention, clasp design, need for rebasing, secondary impression, need for abutment tooth modification, type of major connector, type of teeth selection, patients past experience, method of replacing single teeth or missing anterior teeth. Difference between tooth supported and tissue supported partial dentures. Essentials of partial denture design, components of partial denture design, tooth support, tissue support, stabilizing components, guiding planes, use of splint bar for denture support, internal clip attachments, overlay abutment as support for a denture base, use of a component partially to gain support.

**c. Education of patient**

**d. Diagnosis and treatment planning**

**e. Design, treatment sequencing and mouth preparation**

f. **Surveying** –Description of dental surveyor, purposes of surveying, Aims andobjectives in surveying of diagnostic cast and master cast, Final path of insertion, factors that determine path of insertion and removal, Recording relation of cast to surveyor, measuring amount of retentive area Blocking of master cast – paralleled blockout, shaped blockout, arbitrary blockout and relief.

g. **Diagnosis and treatment planning** –Infection control and cross – clinical and laboratory and hospital waste management, Objectives of prosthodontic treatment, Records, systemic evaluation, Oral examination, preparation of diagnostic cast, interpretation of examination data, radiographic interpretation, periodontal considerations, caries activity, prospective surgical preparation, endodontic treatment, analysis of occlusal factors, fixed restorations, orthodontic treatment, need for determining the design of components, impression procedures and occlusion, need for reshaping remaining teeth, reduction of unfavorable tooth contours, differential diagnosis : fixed or removable partial dentures, choice between complete denture and removable partial dentures, choice of materials

h. **Preparation of Mouth for removable partial dentures** –Oral surgical preparation, conditioning of abused and irritated tissues, periodontal preparation – objectives of periodontal therapy, periodontal diagnosis, control therapy, periodontal surgery.

i. **Preparation of Abutment teeth** –Classification of abutment teeth, sequenceof abutment preparations on sound enamel or existing restorations, conservative restorations using crowns, splinting abutment teeth, utilization, temporary crowns to be used as abutment.

j. **Impression Materials and Procedures for Removable Partial Dentures** –Rigid materials, thermoplastic materials, Elastic materials, Impressions of the partially edentulous arch, Tooth supported, tooth tissue supported, Individual impression trays.

k. **Support for the Distal Extension Denture Base** –Distal extensionremovable partial denture, Factors influencing the support of distal extension base, Methods of obtaining functional support for the distal extension base

l. **Laboratory Procedures** –Duplicating a stone cast, Waxing the partialdenture framework, Anatomic replica patterns, Spruing, investing, burnout, casting and finishing of the partial denture framework, making record bases, occlusion rims, making a stone occlusal template from a functional occlusal record, arranging posterior teeth to an opposing cast or template, arrangement of anterior teeth, waxing and investing the partial denture before processing acrylic resin bases, processing the denture, remounting and occlusal correction to an occlusal template, polishing the denture.

m. **Initial placement, adjustment and servicing of the removable partial denture**- adjustments to bearing surfaces of denture framework, adjustmentof occlusion in harmony with natural and artificial dentition, instructions to the patient, follow – up services

n. **Relining and Rebasing the removable partial denture** –Relining toothsupported dentures bases, relining distal extension denture bases, methods of reestablishing occlusion on a relined partial denture.

o. **Repairs and additions to removable partial dentures** –Broken clasp arms,fractured occlusal rests, distortion or breakage of other components – major and minor connectors, loss of a tooth or teeth not involved in the support or retention of the restoration, loss of an abutment tooth necessitating its replacement and making a new direct retainer, Other types of repairs & repair by soldering.

p. **Removable partial denture considerations in maxillofacial prosthetics** – Maxillofacial prosthetics, intra oral prosthesis, design considerations,maxillary prosthesis, Obturators, speech aids, palatal lifts, palatal augmentations, mandibular prosthesis, treatment planning, framework design, class I resection, Class II resection, mandibular flange prosthesis, jaw relation records.

q. **Management of failed restorations and work authorization details.**

## II. MAXILLOFACIAL REHABILITATION:

Scope, terminology, definitions, cross infection control and hospital waste management, work authorization. Behavioral and psychological issues in Head and neck cancer, Psychodynamic interactions between clinician and patient. **Cancer Chemotherapy:** Oral Manifestations, Complications, and management, **Radiation therapy of head and neck tumors:** Oral effects, Dental manifestations and dental treatment: Etiology, treatment and rehabilitation (restoration).

Acquired defects of the mandible, acquired defects of hard palate, soft palate, clinical management of edentulous and partially edentulous maxillectomy patients, Facial defects, Restoration of speech, Velopharyngeal function, cleft lip and palate, cranial implants, maxillofacial trauma, Lip and cheek support prosthesis, Laryngectomy aids, Obstructive sleep apnoea, Tongue prosthesis, Oesophageal prosthesis, radiation carriers, Burn stents, Nasal stents, Vaginal and anal stents, Auditory inserts, Trismus appliances, mouth controlled devices for assisting the handicapped, custom prosthesis, conformers, and orbital prosthesis for ocular and orbital defects. Osseo integrated supported facial and maxillofacial prosthesis. Resin bonding for maxillofacial prosthesis, cranial prosthesis Implant rehabilitation of the mandible compromise by radiotherapy, Prosthodontic treatment, Material and laboratory procedures for maxillofacial prosthesis.

## III. OCCLUSION

### EVALUATION, DIAGNOSIS AND TREATMENT OF OCCLUSAL PROBLEMS:

Scope, definition, terminology, optimum oral health, anatomic harmony, functional harmony, occlusal stability, causes of deterioration of dental and oral health. Anatomical, physiological, neuro – muscular, psychological considerations of teeth; muscles of mastication; temporomandibular joint; intra oral and extra oral and facial musculatures and the functions of Cranio mandibular system.

Occlusal therapy, the stomatognathic system, centric relation, vertical dimension, the neutral zone, the occlusal plane, differential diagnosis of temporomandibular disorders, understanding and diagnosing intra articular problems, relating treatment to diagnosis of internal derangements of TMJ, Occlusal splints. Selecting instruments for occlusal diagnosis and treatment, mounting casts, Pankey-Mann-Schuyler philosophy of complete occlusal rehabilitation, long centric, anterior guidance, restoring lower anterior teeth, restoring upper anterior teeth, determining the type of posterior occlusal contours, methods for determining the plane of occlusion, restoring lower posterior teeth, restoring upper posterior teeth, functionally generated path techniques for recording border movements intra orally, occlusal equilibration.

Bruxism, Procedural steps in restoring occlusion, requirements for occlusal stability, solving occlusal problems through programmed treatment planning, splinting, solving – occlusal wear problems, deep overbite problems, anterior overjet problems, anterior open bite problems. Treating – end to end occlusion, splaed anterior teeth, cross bite problems, Crowded, irregular, or interlocking anterior bite. Using Cephalometric for occlusal analysis, solving severe arch malrelationship problems, transcranial radiography, postoperative care of occlusal therapy.

## I. FIXED PROSTHODONTICS

Scope, definitions and terminology, classification and principles, design, mechanical and biological considerations of components – Retainers, connectors, pontics, work authorization.

- **Diagnosis and treatment planning** –patients history and interview, patientsdesires and expectations and needs, systemic and emotional health, clinical examinations – head and neck, oral – teeth, occlusal and periodontal, Preparation of diagnostic cast, radiographic interpretation, Aesthetics, endodontics considerations, abutment selection – bone support, root proximities and inclinations, selection of abutments for cantilever, pier abutments, splinting, available tooth structures and crown morphology, TMJ and muscles of mastication and comprehensive planning and prognosis.
- **Management of Carious teeth** –caries in aged population, caries control,removal caries, protection of pulp, reconstruction measure for compromised teeth – retentive pins, horizontal slots, retentive grooves, prevention of caries, diet, prevention of root caries and vaccine for caries.
- **Periodontal considerations** –attachment units, ligaments, prevention ofgingivitis, periodontitis. Microbiological aspect of periodontal diseases, marginal lesion, occlusal trauma, periodontal pockets in attached gingiva, interdental papilla, gingival embrasures, gingival/periodontal prosthesis, radiographic interpretations of Periodontia, intraoral, periodontal splinting –Fixed prosthodontics with periodontially compromised dentitions, placement of margin restorations.
- **Biomechanical principles of tooth preparation** –individual tooth preparations - Complete metal Crowns – P.F.C., All porcelain – Cerestore crowns, dicor crowns, incer**a**m etc. porcelain jacket crowns; partial 3/4, 7/8, telescopic, pin–ledge, laminates, inlays, onlays. Preparations for restoration of teeth–amalgam, glass Ionomer and composite resins. Resin bond retainers, Gingival marginal preparations – Design, material selection, and biological and mechanical considerations – intracoronal retainer and precision attachments – custom made and prefabricated.
- **Isolation and fluid control –** Rubber dam application(s), tissue dilation–softtissue management for cast restoration, impression materials and techniques, provisional restorations, interocclusal records, laboratory support for fixed Prosthodontics, Occlusion, Occlusal equilibration, articulators, recording and transferring of occlusal relations, cementing of restorations.
- **Resins, Gold and gold alloys, glass Ionomer, restorations.**
- **Restoration of endodontically treated teeth, Stomatognathic Dysfunction and management**
- **Management of failed restorations**

  **Osseo integrated supported fixed Prosthodontics** –Osseo integratedsupported and tooth supported fixed Prosthodontics
- **CAD – CAM Prosthodontics**

## V. TMJ – Temporomandibular joint dysfunction – Scope, definitions, and terminology

- Temporomandibular joint and its function, Orofacial pain, and pain from the temporomandibular joint region, temporomandibular joint dysfunction, temporomandibular joint sounds, temporomandibular joint disorders, Anatomy related, trauma, disc displacement, Osteoarthrosis/Osteoarthritis, Hyper mobility and dislocation, infectious arthritis, inflammatory diseases, Eagle's syndrome (Styloid – stylohyoid syndrome), Synovial chondromatosis, Osteochondrosis disease, Ostonecrosis, Nerve entrapment process, Growth changes, Tumors, Radiographic imaging

- Etiology, diagnosis and cranio mandibular pain, differential diagnosis and management of orofacial pain – pain from teeth, pulp, dentin, muscle pain, TMJ pain
  – psychologic, physiologic – endogenous control, acupuncture analgesia, Placebo effects on analgesia, Trigeminal neuralgia, Temporal arteritis
- Occlusal splint therapy – construction and fitting of occlusal splints, management of occlusal splints, therapeutic effects of occlusal splints, occlusal splints and general muscles performance, TMJ joint uploading and anterior repositioning appliances, use and care of occlusal splints.

  Occlusal adjustment procedures – Reversible – occlusal stabilization splints and physical therapies, jaw exercises, jaw manipulation and other physiotherapy or irreversible therapy – occlusal repositioning appliances, orthodontic treatment, Orthognathic surgery, fixed and removable prosthodontic treatment and occlusal adjustment, removable prosthodontic treatment and occlusal adjustment. Indication for occlusal adjustment, special nature of orofacial pain, Psychopathological considerations, occlusal adjustment philosophies, mandibular position, excursive guidance, occlusal contact scheme, goals of occlusal adjustment, significance of a slide in centric, Preclinical procedures, clinical procedures for occlusal adjustment.

## II. ESTHETICS SCOPE.

**DEFINITIONS:**

**Morpho psychology and esthetics, structural esthetic rules** –facial components, dental components, gingival components and physical components. Esthetics and its relationship to function – Crown morphology, physiology of occlusion, mastication, occlusal loading and clinical aspect in bio esthetic aspects, Physical and physiologic characteristic and muscular activities of facial muscle, perioral anatomy and muscle retaining exercises Smile – classification and smile components, smile design, esthetic restoration of smile, Esthetic management of the dentogingival unit, intraoral materials for management of gingival contours, and ridge contours, Periodontal esthetics, Restorations – Tooth colored restorative materials, the clinical and laboratory aspects, marginal fit, anatomy, inclinations, form, size, shape, color, embrasures & contact point.

Prosthodontic treatment should be practiced by developing skills, by treating various and more number of patients to establish skill to diagnose and treatment and after care with bio-mechanical, biological, bio-esthetics, bio-phonetics. All treatments should be carried out in more numbers for developing clinical skills.

- Infection control, cross infection barrier – clinical & lab ; hospital & lab waste management

**Teaching / Learning Activities:**

**The post graduate is expected to complete the following at the**

**end of: I YEAR M.D.S.**

- Theoretical exposure of all applied sciences
- *Pre-clinical* exercises involved in prosthodontic therapy for assessment.
- *E*xercises involved in prosthodontic therapy for demonstrating skills on suturing technique for
  1. For single implant

2. For two or more implant placement
3. For full arch implant placement

- All clinical steps involved in implant prosthodontics
  1. Impression making for single implant
  2. Impression making for full arch implant
  3. Jig trails

4. Pouring of final master cast for single and full arch implant

- Didactic lecture, demonstration and hands-on suturing technique.
- Didactic lecture, demonstration and hands-on all clinical steps involved in implant prosthodontics
- Commencement of library assignment within six months
- To carry out short epidemiological study relevant to prosthodontics.
- Acquaintance with books, journals and referrals.
- To differentiate various types of articles published in and critically appraise based on standard reference guidelines.
- To develop the ability to gather evidence from published articles.
- To acquire knowledge of published books, journals and websites for the purpose of gaining knowledge and reference – in the field of ***Oral and Maxillofacial Prosthodontics and Implantology***
- Acquire knowledge of instruments, equipment, and research tools in Prosthodontics.
- To acquire knowledge of Dental Material Science – Biological and biomechanical
- bio-esthetics, knowledge of using material in laboratory and clinics including testing methods for dental materials.
- Submit a protocol for their dissertation before Institutional Review Board and Institutional Ethics Committee.
- Participation and presentation in seminars, didactic lectures.

Course revision for first year M.D.S.

- Introduction to tilted dental implants concepts.
- Didactic lectures & discussion on pterygoid and zygomatic implants and their restorative techniques

**II YEAR M.D.S.**

- Acquiring confidence in obtaining various phases and techniques in removable and fixed prosthodontics therapy
- Acquiring confidence by clinical practice with sufficient number of patients requiring tooth and tooth surface restorations
- Fabrication of adequate number of complete denture prosthesis following, higher clinical approach by utilizing semi-adjustable articulators, face bow and graphic tracing.
- Understanding the use of dental surveyor and its application in diagnosis and treatment plan in R.P.D.
- Adequate number of R.P.D's covering all partially edentulous situations.
- Adequate number of Crowns, Inlays, laminates, ***FDP fixed dental prosthesis)*** covering all clinical situations.
- Selection of cases and following principles in treatment of partially or complete edentulous patients by implant supported prosthesis.
- Treating single edentulous arch situations by implant supported prosthesis.
- Diagnosis and treatment planning for implant prosthesis.

- I$^{st}$ stage and II$^{nd}$ stage implant surgery
- Understanding the maxillofacial ***Prosthodontics, treating craniofacial and management of orofacial defects***
- Prosthetic management of TMJ syndrome
- Occlusal rehabilitation
- Management of failed restorations.
- Prosthodontic management of patient with psychogenic disorder.
- Practice of child and geriatric prosthodontics.
- Participation and presentation in seminars, didactic and non didactic Teaching and Training students.
- Didactic lecture to introduce advance grafting procedure in the P.G. curriculum.

- Live demonstration on patients and post graduate students to performed grafting procedure independently in iii MDS

**III YEAR M.D.S**

- Clinical and laboratory practice continued from II$^{nd}$ year.
- Occlusion equilibration procedures – fabrication of stabilizing splint for parafunctional disorders, occlusal disorders and TMJ functions.
- Practice of dental, oral and facial esthetics
- The clinical practice of all aspects of Prosthodontic therapy for elderly patients.
- Implants Prosthodontics – Rehabilitation of Partial Edentulism, Complete edentulism and craniofacial rehabilitation.
- Failures in all aspects of Prosthodontics and their management and after care.
- Team management for esthetics, TMJ syndrome and Maxillofacial & Craniofacial Prosthodontics
- Management of Prosthodontic emergencies, resuscitation.
- Candidate should complete the course by attending a large number and variety of patients to master the prosthodontic therapy. This includes the practice management, examinations, treatment planning, communication with patients, clinical and laboratory techniques materials and instrumentation required in different aspects of prosthodontic therapy, Tooth and Tooth surfacerestoration, Restoration of root treated teeth, splints for periodontal rehabilitations and fractured jaws, complete dentures, R.P. D's, F.P.D's,
  Immediate dentures, over dentures, implant supported prosthesis, maxillofacial and body prosthesis, occlusal rehabilitation.
- Prosthetic management of TMJ syndrome
- Management of failed restorations
- Should complete and submit Main Dissertation assignment 6 months prior to examination.
- Candidates should acquire complete theoretical and clinical knowledge through seminars, symposium, workshops and reading.
- Participation and presentation in seminars, didactic lectures
- Didective lectures in third year for management of prosthodontics complication and failures.

**PROSTHODONTIC TREATMENT MODALITIES**

**1)** Diagnosis and treatment planning prosthodontics
**2)** Tooth and tooth surface restorations
- Fillings

- Veneers – composites and ceramics
- Inlays- composite, ceramic and alloys
- Onlay – composite, ceramic and alloys
- Partial crowns – ¾ th, 4/5th, 7/8th, Mesial ½ crowns
- Pin-ledge
- Radicular crowns
- Full crowns

- Precision attachments
  - Intra coronal attachments
  - Extra coronal attachments
  - Bar – slide attachments
  - Joints and hinge joint attachments

**3)** Tooth replacements

| | **Partial** | **Complete** |
|---|---|---|
| • Tooth supported | Fixed partial denture | Overdenture |
| • Tissue supported | Interim partial denture<br>Intermediate partial denture | Complete denture<br>Immediate denture<br>Immediate complete denture |
| • Tooth and tissue Supported | Cast partial denture<br>Precision attachment | Overdenture |
| • Implant supported | Cement retained<br>Screw retained<br>Clip attachment | Bar attachment<br>Ball attachment |
| • Tooth and implant Supported | Screw retained<br>Cement retained | Screw retained<br>Cement retained |
| • **Root supported** | Dowel and core<br>Pin retained | Over denture |

**4)** Tooth and tissue defects (Maxillo- facial and Cranio-facial prosthesis)

**A. Congenital Defects**

a. Cleft lip and palate
b. Pierre Robin Syndrome
c. Ectodermal dysplasia
d. Hemifacial microstomia
e. Anodontia
f. Oligodontia
g. Malformed teeth

} cast partial dentures
implant supported prosthesis
complete dentures
fixed partial dentures

**B. Acquired defects**

a. Head and neck cancer patients – prosthodontic splints and stents
b. Restoration of facial defects
   – Auricular prosthesis
   – Nasal prosthesis
   – Orbital prosthesis
   – Craniofacial implants

c. Midfacial defects
d. Restoration of maxillofacial trauma
e. Hemimandibulectomy
f. Maxillectomy
   Dentures
g. Lip and cheek support prosthesis

} cast partial denture / implant supported

complete dentures

h. Ocular prosthesis
i. Speech and Velopharyngeal prosthesis
j. Laryngectomy aids
k. Esophageal prosthesis
l. Nasal stents
m. Tongue prosthesis
n. Burn stents
o. Auditory inserts
p. Trismus appliances

**5) T.M.J and Occlusal disturbances**

a. Occlusal equilibration
b. Splints - Diagnostic
   - Repositioners / Deprogrammers
c. Anterior bite planes
d. Posterior bite planes
e. Bite raising appliances
f. Occlusal rehabilitation

**6) Esthetic/Smile designing**

a. Laminates / Veneers
b. Tooth contouring (peg laterals, malformed teeth)
c. Tooth replacements
d. Team management

**7) Psychological therapy**

a. Questionnaires
b. Charts, papers, photographs
c. Models
d. Case reports
e. Patient counseling
f. Behavioral modifications

g. Referrals

**8) Geriatric Prosthodontics**

a. Prosthodontics for the elderly
b. Behavioral and psychological counseling
c. Removable Prosthodontics
d. Fixed Prosthodontics
e. Implant supported Prosthodontics
f. Maxillofacial Prosthodontics
g. Psychological and physiological considerations

**9) Preventive measures**

a. Diet and nutrition modulation and counseling
b. Referrals

**The bench work should be completed before the start of clinical work during the first year of the MDS Course**

**I. Complete dentures**

1. Arrangements on adjustable articulator for
   - Class I
   - Class II
   - Class III
2. Various face bow transfers to adjustable articulators
3. Processing of characterized anatomical dentures

***II.* Removable partial dentures**

1. Design for Kennedy's Classification
   (Survey, block out and design)
   a. Class I
   b. Class II
   c. Class III
   d. Class IV
2. Designing of various components of RPD
3. Wax pattern on refractory cast
   a. Class I
   b. Class II
   c. Class III
   d. Class IV
4. Casting and finishing of metal frameworks
5. Acrylisation on metal frameworks
   for Class I
   Class III with modification

**III. Fixed Partial Denture**

1. Preparations on ivory teeth / natural teeth
   - FVC for metal
   - FVC for ceramic
   - Porcelain jacket crown
   - Acrylic jacket crown
   - PFM crown
   - 3/4$^{th}$ (canine, premolar and central)
   - 7/8$^{th}$ posterior

        - Proximal half crown

    - Inlay – Class I, II, V
    - Onlay – Pin ledged, pinhole
    - Laminates

2. Preparation of different die systems

3. Fabrication of wax patterns by drop wax build up technique
    - Wax in increments to produce wax coping over dies of tooth preparations on substructures
    - Wax additive technique
    - 3-unit wax pattern (maxillary and Mandibular)
    - Full mouth

4. Pontic designs in wax pattern
    - Ridge lap
    - Sanitary
    - Modified ridge lap
    - Modified sanitary
    - Spheroidal or conical

5. Fabrication of metal frameworks
    - Full metal bridge for posterior (3 units)
    - Coping for anterior (3 unit)
    - Full metal with acrylic facing
    - Full metal with ceramic facing
    - Adhesive bridge for anteriors
    - Coping for metal margin ceramic crown
    - Pin ledge crown

6. Fabrication of crowns
    - All ceramic crowns with characterisation
    - Metal ceramic crowns with characterisation
    - Full metal crown
    - Precious metal crown
    - Post and core

7. Laminates
    - Composites with characterisation
    - Ceramic with characterisation
    - Acrylic

8. Preparation for composites
    - Laminates
    - Crown
    - Inlay
    - Onlay
    - Class I
    - Class II
    - Class III
    - Class IV
    - Fractured anterior tooth

**IV. Maxillofacial prosthesis**

- Eye
- Ear
- Nose
- Face
- Body defects

  - Cranial
  - Maxillectomy
  - Hemimandibulectomy
  - Finger prosthesis
  - Guiding flange
  - Obturator

**V. Implant supported prosthesis**

1. Step by step procedures –***Surgical and*** laboratory phase

**VI. Other exercises**

1. TMJ splints – stabilization appliances, maxillary and Mandibular repositioning appliances
2. Anterior disocclusion appliances
3. Chrome cobalt and acrylic resin stabilization appliances
4. Modification in accommodation of irregularities in dentures
5. Occlusal splints
6. splints
7. Precision attachments – custom made
8. Over denture coping
9. Full mouth rehabilitation (by drop wax technique, ceramic build up)
10. TMJ appliances – stabilization appliances

**<u>ESSENTIAL SKILLS:</u>**

*Key
O – Washes up and observes
A – Assists a senior
PA – Performs procedure under the direct supervision of a senior specialist PI – Performs independently

The following list of procedures are expected of the post graduate to complete in the post graduate programme under faculty guidance [PA] or independently [PI] . Each of the following procedures should be evaluated for the competencies like critical thinking, patient centered approach, use of evidence based approach, professionalism, systems based practice approach and communication skills of the student. The mentioned numbers denote minimal requirement. However, the head of the department has the discretion to fix the quota and assess them systematically. There may be procedures which the student has observed [O] or assisted [A]. The student can however make his entry into his log book or portfolio wherein he/she can make his comments with remarks of the facilitator in the form of a feedback which would reinforce his learning.

| PROCEDURE | CATEGORY | | | |
|---|---|---|---|---|
| | O | A | PA | PI |
| Tooth and tooth surface restoration<br>a) Composites – fillings, laminates, inlay, onlay<br>b) Ceramics – laminates, inlays, onlays<br>c) Glass Ionomer | | | | <br>5<br>5<br>5 |

| | | | | |
|---|---|---|---|---|
| **CROWNS** | | | | |
| FVC for metal | | | | 10 |
| FVC for ceramic | | | | 10 |
| Precious metal crown or Galvanoformed crown | 1 | - | 1 | 5 |
| Intraradicular crowns (central, lateral, canine, premolar,<br>and molar) | | - | - | 5 |
| Crown as implant supported prosthesis | As many | 5 | 5 | 5 |
| **FIXED PARTIAL DENTURES** | | | | |
| Porcelain fused to metal (anterior and posterior) | | | | 10 |
| Multiple abutments – maxillary and Mandibular full arch | | | | 5 |

| | | | |
|---|---|---|---|
| Complete dentures for patients with | | | |
| TMJsyndromes | - | - | |
| Complete dentures for medically compromised | | | |
| and | - | - | |
| handicapped patients | | | |
| **GERIATRIC PATIENTS** | | | |
| Handling geriatric patients requiring nutritional | | | |
| counseling, psychological management and | | | |
| management of co-morbitity including xerostomia | | | |
| and systemic problems. Palliative care to elderly. | | | |
| **IMPLANT SUPPORTED COMPLETE** | | | |
| **PROSTHESIS** | | | |
| Implant supported complete prosthesis (maxillary | | | |
| And Mandibular) | - | - | |
| | | | |
| **MAXILLOFACIAL PROSTHESIS** | | | |
| | e.g. Guiding flange/ obturators/ Speech and palatal lift prosthesis/ Eye/ Ear/ Nose/ Face/Finger/Hand/Foot | | 5 different types as PI |
| | **TMJ SYNDROME MANAGEMENT** | | |
| Splints – periodontal, teeth, jaws | - | - | 1 |

| | | | | |
|---|---|---|---|---|
| TMJ supportive and treatment prosthesis | - | - | 1 | 1 |
| Stabilization appliances for maxilla and mandible with freedom to move from IP to CRCP | - | - | - | 1 |
| In IP without the freedom to move to CRCP | - | - | - | 1 |
| Disocclusion repositioning appliances for anterior | - | - | - | 1 |
| Chrome cobalt and acrylic resin stabilization appliances for modification to accommodate for the irregularities in the dentition | - | - | - | 1 |
| Occlusal adjustment and occlusal equilibrium appliances | - | - | 1 | 4 |
| **FULL MOUTH REHABILITATION** | | | | |
| Full mouth rehabilitation – restoration of esthetics and function of stomatognathic system | - | - | 1 | 2 |
| INTER-DISCIPLINARY TREATMENT MODALITIES | - | - | 1 | 2 |
| Inter-disciplinary management – restoration of Oro | - | - | - | 5 |

| | | | | |
|---|---|---|---|---|
| craniofacial defects for esthetics, phonation, mastication and psychological comforts | | | | |
| **MANAGEMENT OF FAILED RESTORATION** | | | | |
| Tooth and tooth surface restorations | - | - | - | 5 |
| Removable prosthesis | | | | 5 |
| Crowns and fixed prosthesis | | | | 2 |
| Maxillofacial prosthesis | | | | 2 |
| Implant supported prosthesis | | | | 1 |
| Occlusal rehabilitation and TMJ syndrome | | | | 2 |
| Restoration failures of psychogenic origin | | | | 2 |
| Restoration failures to age changes | | | | 2 |

SCHEME OF EXAMINATION

A. **Theory** Part I Basic Sciences Paper 100 Marks

Part II Paper 1, Paper 2, Paper 3 300 Marks

(100 for each paper)

Written examination shall consist of Basic Sciences Paper (Part-I) of three hours duration and should be conducted at the end of First year of ***MDS course. Part 1 examination consists of two essays of 25 marks each and 10 short answers of 5 marks each. Part-II Examination will be conducted at the end of Third year of MDS course. Part-II Examination will consist of Paper-I, Paper-II & Paper-III, each of three hours duration. Paper-I , Paper-II and Paper III shall consist of two long answer questions carrying 25 marks each and five***

***questions carrying 10 marks each. Distribution of topics for each paper will be as follows:***

**Part-I** : ***Applied Basic Sciences: Applied Anatomy***
Nutrition & Biochemistry, Pathology & Microbiology, virology, Applied Dental anatomy & histology, Oral pathology & oral Microbiology, Adult and geriatric psychology. Applied dental materials.

**Part-II**

***Paper-I : Removable Prosthodontics and Implant supported prosthesis (Implantology), Geriatric dentistry and Cranio facial Prosthodontics***

***Paper-II : Fixed Prosthodontics, Occlusion, TMJ and esthetics.***
***Paper-III :*** Essays (descriptive and analyzing type questions)

**The topics assigned to the different papers are generally evaluated under those sections. However a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.*

**A. Practical / Clinical Examination : 200 Marks**

**1. Presentation of treated patients and records during their 3 years Training period** 35 Marks

a. C.D. 1 mark
b. R. P.D. 2 marks
c. F.P.D. including single tooth and surface restoration 2 marks
d. I.S.P. 5 marks
e. Occlusal rehabilitation 5 marks
f. T.M.J. 5 marks
g. Maxillofacial Prosthesis 5 marks
h. Pre Clinic Exercises 10 marks

**2. Presentation of Clinical Exam CD patient's prosthesis including insertion 75 Marks**

| | | |
|---|---|---|
| 1. | Discussion on treatment plan and patient review | 10 marks |
| 2. | Tentative jaw relation records | 5 marks |
| 3. | Face Bow – transfer | 5 marks |
| 4. | Transferring it on articulators | 5 marks |
| 5. | Extra oral tracing and securing centric and protrusive/lateral, record | 15 marks |
| 6. | Transferring records on articulator and programming. | 5 marks |
| 7. | Selection of teeth | 5 marks |
| 8. | Arrangement of teeth | 10 marks |
| 9. | Waxed up denture trial | 10 marks |

| | | |
|---|---|---|
| 10. | Check of Fit, insertion and instruction of previously processed characterized, anatomic complete denture Prosthesis | 5 marks |

**ALL STEPS WILL INCLUDE CHAIRSIDE, LAB AND VIVA VOCE**

**Fixed Partial Denture** **35 Marks**

Case discussion including treatment planning and selection of patient for F.P.D. 5 Marks

Abutment preparation isolation and fluid control 15 marks

Gingival retraction and impressions (conventional/ CAD CAM impressions 10 marks

d. Cementation of provisional restoration 5 marks

**4. Removable Partial Denture** **25 Marks**

a. Surveying and designing of partial dentate cast. *5 marks*

Discussion on components and material selection including occulsal schemes. *10 marks*

***5. Implant supported prosthesis (2nd stage- protocol)*** ***30 marks***

***a. Case discussion including treatment planning and selection of patient for ISP*** *10 marks*

***b. II stage preparation, Abutment selection, placement, evaluation*** *10 marks*

***c. Implant impression and making of cast*** *10 marks*

**B. Viva Voce :** **100 Marks**

***I. Viva-Voce examination:*** *80 marks*

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expressions, interpretation of data and communication skills. It includes all components of course contents. It includes presentation and discussion on dissertation also.

**II. Pedagogy** *20 marks*

- **List of textbooks**

| Sr. No. | Title |
|---|---|
| 1 | Boucher's prosthodontic treatment for edentulous patients BY ZARB, G A 12th Ed. Elsevier |
| 2 | Clinical removable partial prosthodontics BY STEWART K L PUB: DELHI: AIPD 2nd Ed. IEA |
| 3 | Essentials of complete denture prosthodontics BY WINKLER, S PUB: NEW DELHI: 2nd edi AITBS |
| 4 | Kawabe's complete dentures BY KAWABE, S PUB: CHENNAI: AIPD 1st Ed. MDMI |
| 5 | Mccracken's removable partial prosthodonticsBY MCGIVNEY GLEN P PUB: NEW DELHI HARCOURT 11th edition |
| 6 | Textbook of complete dentures BY RAHN A O 5th Ed. B.C. DECKER |
| 7 | Tylman's theory and practice of fixed prosthodonticsBY MALONE, W F PUB: CHENNAI :AIPD 8th Ed. Medico dental media internation inc |
| 8 | Mc Cracken's Removable Partial Prosthodontics BY CARR, A B 11th Ed. Mosby |
| 9 | Syllabus of Complete Dentures BY HEARTWELL,C M : VERGHESE 4th edition Varghese |
| 10 | Fundamentals of Fixed Prosthodontics BY SHILLINGBURG,H T :QUINTESENCE :London 3rd Ed. |
| 11 | Dental Implants:The Art & Sc. BY BABBUSH, 1st Ed. W B SAUNDERS |
| 12 | Contemporary Implant Dentistry, BY MISCH, C E 2nd Ed. MOSBY PUB. |
| 13 | Fenn Clinical Dental Prosthetics BY MACGREGOR A R PUB:VARGHESE:Bombay 3rd Ed |
| 14 | Prosthodontics Treatment for Edentulous Patients 11th edi ELSEVIER:New Delhi |
| 15 | Essentials of pathology for dental students By Mohan,H 3rd edi jaypee |
| 16 | Restorative Dental Materials By Powers,J M 12 th Ed. Elsevier:New Delhi |
| 17 | Textbook of Pathology By Mohan, H 5th edi Jaypee |
| 18 | Medicine for Dental students By Alagapan, R.1st edi Jaypee brothers |
| 19 | Robins Basic Pathology By Kumar,V 7th edi Saunders |
| 20 | Fundamental of tooth Preparation By Shillingburg 1st Ed. Quintessence |
| 21 | Textbook of Microbiology By Panikar, A 7th edi Orient longman |
| 22 | Clinical Maxillofacial Prosthetics By Taylor 1ST EDI quintessence |
| 23 | Dental Implant Prosthetics By Misch 1st edi elsevier |
| 25 | Pharmacology and Pharmacotherapeutics By Satoskar, R S 19th edi Popular prakashan |
| 26 | Consice Pharmacology Basic and Applied By Bhagwat, A W 1st edi Paras publication |
| 27 | MCQs forPGs in Prosthodontics By Bhat Pub.Jaypee:New Delhi 1st Ed. |
| 28 | MCQs in Prosthodontics for PG By Chandra . 1st Ed. Jaypee:New Delhi |
| 29 | Contemporary fixed Prosthodontics By Rosentell 4th edition Elsevier |
| 30 | Clinical Pharmacology By Bennett P N and Brown 9th edi Churchill livingston |
| 31 | Clinical problem Solving in Prosthodontics By Bartlett 1st edi Churchill livingstrone |
| 32 | Essentials of Pharmacology for Dentistry By Tripathy K D 1st edi Jaypee |
| 33 | Essentials of Medical Pharmacology for Dentistry By Tripathy K 5th edi Jaypee |
| 34 | Human Physiology Vol I By Chatterjee C C 10th edi Medical allied agency |
| 35 | Human Physiology Vol II By Chatterjee C C 10th edi Medical allied agency |
| 36 | Essentials of Medical Physiology By Sembulingum, K 3rd edi Jaypee |
| 37 | Consice Medical Physiology By Chaudhri S K 5th edi New central book agency |
| 38 | Textbook of Human Histology With Color Atlas By Singh Inderbir 4th edi Jaypee |
| 39 | Introduction of Metal Ceramic Technology By Naylor 2nd edi Quintenssence |
| 40 | Partial Dentures 4th Ed By Osborne 4th edi CBS |
| 41 | B. D. Chaurasia's Human Anatomy Vol I By Chaurasia 3rd edi CBS |
| 42 | B. D. Chaurasia's Human Anatomy Vol II By Chaurasia 3rd edi CBS |
| 43 | B. D. Chaurasia's Human Anatomy Vol III By Chaurasia 3rd edi CBS |
| 44 | Pathology Quick review And MCQs By Mohan H 5th edi Jaypee |
| 45 | Fundamentals of Esthetic impnat Dentistry By Salama 2nd edition Blackwell |
| 46 | Multiple Choice Questions in Surgery By Tondon, V and Sood S 1st Elsevier |
| 47 | Multiple Choice Questions in Anatomy By Bhatnagar S N 3rd edi Elsevier |
| 48 | MCQs in Pharmacology For Dental Students by Chandra S 1st edi Jaypee |
| 49 | MCQs in Physiology by Chandra S 1st edi Jaypee |
| 50 | MCQs in head And Neck ANatomy by Chandra S 1st edi jaypee |

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|---|---|
| 51 | Short Cases in Surgery by Bhattacharya S K 5th edi CBS publishers |
| 52 | Human Embryology by Singh I 7th edi McMillan |
| 53 | Bhatia's Dentogist MCQs By Shaini S 6th edi Jaypee |
| 54 | Dentest Clinical Science Shankar S G 4th edi Paras publishing |
| 55 | Dentest Basic Science Shankar S G 4th edi Paras publishing |
| 56 | Dental Pulse Vol I Basic Science By StaishKumar K 3rd edi Swapna medical publishers |
| 57 | Dental Pulse Vol II ClinicalScience By Redd 3rd edi Swapna medical publishers |
| 58 | Multiple Choice Questions in Dentistry Including Applied Medical Subjects By Yadav N S 2nd edi AITBS |
| 59 | Multiple Choice Questions in Dentistry Basic Science By Singh V P 1st di AITBS |
| 60 | MCQs in Dentistry Clinical Science By Singh V P 1ST AITBS |
| 61 | Bhatia's Dentogist MCQs with Explanatory Answers By Shaini H 6th edi Jaypee |
| 62 | MCQs in Dentistry Key To Success By Bal C S 2nd edi AITBS |
| 63 | MCQs in Dental Science By Shrivastva D 2nd edi Jaypee |
| 64 | MCQs in Dental Material With Explanation For PG By Chandra S 1st Jaypee |

## M.D.S

## SUBJECT: PROSTHODONTICS AND CROWN & BRIDGE

| Teaching Scheme (Hours) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | External | | Internal | | Total |
| Lec(L) | Prac(P) | Clinical(C) | Total | | Theory | Pract | Theory | Pract | |
| 936 | 936 | 4860 | 6732 | | 2 | 1 | 2 | 1 | 6 |

## A. COURSE OVERVIEW

Training program for the dental post graduates in Prosthetic dentistry– removable dental prosthodontics, fixed dental prosthodontics (Crown & Bridge), implantology, maxillofacial prosthodontics and esthetic dentistry and Crown & Bridge including Implantology is structured to achieve knowledge and skill in theoretical and clinical laboratory, attitude, communicative skills and ability to perform research with a good understanding of social, cultural, educational and environmental background of the society

## B. COURSE CONTENT

| NO | TOPIC | L+P+C(hrs) | CLs |
|---|---|---|---|
| 1 | APPLIED ANATOMY OF HEAD AND NECK | 15+10+10 | CL1,2,3,6 |
| 2 | APPLIED PHYSIOLOGY AND NUTRITION | 15+10+10 | CL1,2,3,6 |
| 3 | APPLIED BIOCHEMISTRY | 10+10+10 | CL1,2,3,6 |
| 4 | APPLIED PHARMACOLOGY AND THERAPEUTICS | 10+10+10 | CL1,2,3,6 |
| 5 | APPLIED PATHOLOGY | 10+10+10 | CL1,2,3,4,5,6 |
| 6 | APPLIED MICROBIOLOGY: | 10+10+10 | CL1,2,3,4,5,6 |
| 7 | APPLIED ORAL PATHOLOGY | 10+10+10 | CL1,2,3,4,5,6 |
| 8 | LABORATORY DETERMINATIONS | 10+10+10 | CL1,2,3,4,5,6 |
| 9 | BIOSTATISTICS | 10+10+10 | CL1,3,6 |
| 10 | RESEARCH METHODOLOGY | 20+10+10 | CL1,6 |
| 11 | APPLIED RADIOLOGY | 10+10+10 | CL1,2,3,4,5,6 |
| 12 | APPLIED MEDICINE | 10+10+10 | CL1,2,3,4,5,6 |
| 13 | APPLIED SURGERY & ANESTHESIA | 10+10+10 | CL1,2,3,4,5,6 |
| 14 | APPLIED PLASTIC SURGERY | 10+10+10 | CL1,2,3,4,5,6 |
| 15 | APPLIED DENTAL MATERIALS | 20+30+50 | CL1,6 |
| 16 | NON-SURGICAL AND SURGICAL METHODS OF PROSTHODONTICS AND IMPLANTOLOGY | 344+371+1990 | CL1,2,3,4,5,6 |
| 17 | ADVANCED GRAFTING PROCEDURES | 6+5+10 | CL1,4,5,6 |
| 18 | MAXILLOFACIAL REHABILITATION | 50+40+200 | CL1,2,3,4,5,6 |
| 19 | OCCLUSION | 30+20+200 | CL1,2,3,4,5 |
| 20 | FIXED PROSTHODONTICS | 266+250+1570 | CL1,2,3,4,5 |
| 21 | ESTHETICS | 30+20+200 | CL1,2,3,4,5,6 |
| 22 | Teaching / Learning Activities | 30+60+500 | CL1,2,3,4,5,6 |

## C. TEXT BOOKS

NIL

## D. REFERENCE BOOKS

1. Charles M. Heartwell Jr. and Arthur O. Rahn; Syllabus of Complete denture,4th edition, Lea & Febiger,1992.
2.Zarb, Bolender; Boucher's "Prosthodontic treatment for edentulous patients" , 13th edition, Mosby Publicatons, 2012.3. Sheldon Winkler; Essentials of complete denture prosthodontics , 3rd edition, AITBS Publishers, 2015.
4. Willam R.Laney; Maxillofacial prosthetics, 1st edition, Psg Pub.Co., 1979.
5. McCraken's Removable partial prosthodontics, 12th edition,Elsevier Publications,2012.
6. Ernest L. Miller and Joseph E. Grasso; Removable partial prosthdontics, 3rd edition,Mosby publications,1990.

## E. COMPETENCY LEVEL

| CL Number | Skill | Statement |
|---|---|---|
| **CL1** | Knowledge | ● Possess knowledge of applied basic and systemic medical sciences.<br>● Knowledge of various Dental Materials used in the specialty.<br>● Principles involved for support, retention, stability, esthetics, phonation, mastication, occlusion, behavioral, psychological, preventive and social aspects of Prosthodontics science of Oral and Maxillofacial Prosthodontics and Implantology<br>● Well-rounded knowledge about different fields and their application with respect to Prosthodontics, eg. Periodontal (grafting procedures), oral surgical and orthodontic procedures. |
| **CL2** | Patient Care: Diagnosis | ● Students shall acquire knowledge and practice of history taking, Diagnosis, treatment planning, prognosis, record maintenance of oral, craniofacial and systemic region |
| **CL3** | Investigations | ● Should be able to interpret various radiographs like IOPA, OPG, CBCT and CT. Should and be able to plan and modify treatment plan based on radiographic findings<br>● adequate knowledge about common laboratory investigations and interpretation of their results |

| | | |
|---|---|---|
| **CL4** | Patient Care: Treatment planning | ● Ethically Integrate multiple disciplines into an individual comprehensive sequence treatment plan using diagnostic and prognostic information<br>● Ability for comprehensive rehabilitation concept with pre prosthetic treatment plan including surgical re-evaluation and prosthodontic treatment planning, impressions, jaw relations, utility of face bows, articulators, selection and positioning of teeth, teeth arrangement for retention, stability, esthetics, phonation, psychological comfort, fit and insertion |
| **CL5** | Patient Care: Treatment | ● To perform Clinical and Laboratory procedures with a clear understanding of biomaterials (grafting procedures), tissue conditions related to prosthesis and have required dexterity & skill for performing clinical and laboratory all procedures in fixed, removable, implant, maxillofacial, TMJ and esthetics Prosthodontics.<br>● To carry out necessary adjunctive procedures to prepare the patient before prosthesis like tissue preparation and preprosthetic surgery and to prepare the patient before prosthesis / prosthetic procedures |
| **CL6** | Research and Innovation | ● Upgradation of knowledge and skill from time to time, familiarize with new concepts (advanced grafting procedures) and equipment in prosthodontics and crown & bridge. |

**PROGRAM SPECIFIC OUTCOME (PSO)**

| | | |
|---|---|---|
| PSO1 | DIAGNOSIS | ● Possess knowledge of applied basic and systemic medical sciences.<br>● Knowledge of various Dental Materials used in the specialty and be able to provide appropriate indication, understand the manipulation characteristics, compare with other materials available, be adept with recent advancements of the same<br>● The theoretical knowledge and clinical practice shall include principles involved for support, retention, stability, esthetics, |

| | | |
|---|---|---|
| | | phonation, mastication, occlusion, behavioral, psychological, preventive and social aspects of Prosthodontics science of Oral and Maxillofacial Prosthodontics and Implantology |
| PSO2 | INVESTIGATIONS | ● Should be able to interpret various radiographs like IOPA, OPG, CBCT and CT. Should and be able to plan and modify treatment plan based on radiographic findings<br>● adequate knowledge about common laboratory investigations and interpretation of their results |
| PSO3 | TREATMENT | ● To ethically and morally carry out necessary adjunctive procedures to prepare the patient before prosthesis like tissue preparation and preprosthetic surgery and to prepare the patient before prosthesis / prosthetic procedures. Didactic lectures and live demonstrations for adjuctive implant procedures like grafting, immediate placement etc. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CL1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CL2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| **CL3** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CL4** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CL5** | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CL6** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **Avg** | **3** | **3** | **3** | **3** | **3** | **2.8** | **2.5** | **2.8** | **2.8** | **2.8** | **3** | **3** | **3** | **3** | **3** | **3** | **2.5** | **2.3** |

# MASTER OF DENTAL SURGERY COURSE
# RULES & REGULATIONS

## 1. SHORT TITLE AND COMMENCEMENT:

**1.1 These Regulations shall be called**

**"THE REGULATIONS FOR THE MASTER OF DENTAL SURGERY PROGRAMS OF THE FACULTY OF DENTAL SCIENCE- NADIAD".**

**1.2 The Regulations and the Syllabus are as prescribed in these Regulations and are subject to modifications by the Academic Council of Faculty of Dental Science Nadiad**

## 2. ELIGIBILITY:

**To be Eligible for Admission for the Degree of Master of Dental Surgery, the Candidate shall –**

**2.1 Hold a Degree of Bachelor of Dental Surgery (B.D.S.) of University duly recognized by the Dental Council of India.**

**2.2 Be registered with the State Dental Council and must have obtained provisional or permanent registration.**

**2.3 Have undergone compulsory rotatory internship of a year in an approved/recognised dental college.**

**2.4 Qualify in Merit the NEET Qualifying examination for the said academic year and be granted admission by the common counselling procedure.**

**2.5 In the case of a foreign national who has qualified the said NEET examination, the candidate shall obtain on payment of the prescribed fee for registration to the Dental Council of India, a temporary registration for the duration of the post-graduate training restricted to the dental college/institution to which he or she is admitted for the time being exclusively for postgraduate studies, provided further that temporary registration to such foreign national shall be subject to the condition that such person is duly registered as medical practitioner in his/her own country from which he/she has obtained his/her basics dental qualification and that his/her degree is recognized by the corresponding state dental council or concerned authority.**

**2.6 NEET eligibility percentile**

**SELECTION OF CANDIDATE FOR POST-GRADUATE COURSES**

**2.6.1 The candidate has to secure the following category wise minimum percentile* in NEET for admission to postgraduate courses held in a particular academic year.**

| | |
|---|---|
| **General** | **50th Percentile** |
| **Person with locomotory disability of lower limbs** | **45th Percentile** |
| **Scheduled castes, Scheduled Tribes, Other Backward Classes** | **40th Percentile** |

***It can vary as declared by National Board of Examination for THAT particular year.**

**2.6.2 A candidate who has failed to secure the minimum percentile as prescribed in these regulations, shall not be admitted to any post-graduate courses in any academic year.**

**2.6.3 Minimum 5% seats of the annual sanctioned intake capacity shall be filled up by candidates with locomotory disability of lower limbs between 50% to 70%:**

**A. Provided that in case any seat in this quota remains unfilled on account of unavailability of candidates with locomotory disability of lower limbs between 50% to 70% then any such unfilled seat shall be filled up by persons with locomotory disability of lower limbs between 40% to 50% – before they are included in the annual sanctioned seats for general category candidates:**

**B. Provided further that this entire exercise shall be completed by each dental college/institution as per the statutory time schedule for admissions.**

## 3. AGE LIMIT:

**There is No Upper Age Limit.**

## 4. PHYSICAL FITNESS CERTIFICATE:

**4.1 Every candidate before admission to the course shall submit to the Principal of the Institution a Certificate of Medical Fitness from an authorized Medical Officer that**

**the Candidate is physically fit to undergo the M.D.S course and does not suffer from any contagious disease or Psychiatric problems.**

**4.2 Students with locomotory disability of lower limbs between 50% to 70% should produce the Disability Certificate issued by the duly constituted District Medical Board.**

**4.3 Disabled students should also produce FITNESS CERTIFICATE as described in 4.1.**

## 5. ELIGIBILITY CERTIFICATE:

**The candidate who has passed the NEET qualifying examination conducted by the National Board of Examinations, before seeking admission to Faculty of Dental Science, shall obtain an Eligibility Certificate from the Dharmsinh Desai University by remitting the prescribed fees along with the filled application form and required documents.**

## 6. CUT OFF DATES FOR ADMISSION:

**The academic session shall commence from as per the counselling dates and shall be worked on further with accordance of it.**

## 7. ENROLLMENT:

**A candidate admitted to the Master of Dental Surgery Course (M.D.S.) in Faculty of Dental Science, shall submit the prescribed application form for Enrollment, duly filled along with prescribed fee and filled in Declaration Form to the Registrar of Dharmsinh Desai University through the Principal of the affiliated institution within 15 days from the joining to the Master of Dental Surgery course. The candidate who fails to submit the Enrollment form in stipulated time period will get an Extension of One term i.e. Six months.**

## 8. DURATION OF THE COURSE:

**8.1 The Period of certified study & training of the Master of Dental Surgery Postgraduate Degree Course shall be three complete years including period of examination.**

**8.2 Time period required for passing out MDS course shall be a maximum of six years from the date of admission in the said course.**

**8.3 No exemption shall be given from this period of study and training for any other experience gained prior to the admission to the MDS course, except PG diploma holders in the same specialty**

**8.4 Provided further that the duration of the post-graduate course for the post-graduate Diploma holders shall be of two years in the respective specialty. The syllabus and curriculum shall be the same as MDS Course in the concerned specialty except that they are not required (i) to undergo study and training in Basic Sciences and (ii) pass the PART – I examination of MDS Course. However, they have to submit the dissertation work, as part of the post-graduate programme.**

**8.5 A candidate who wishes to study in a second specialty shall have to undergo the full course of three years duration in that specialty.**

## 9. COMMENCEMENT OF THE COURSE:

**Academic year for the Master of Dental Surgery course shall commence as per the dates of counselling of each year.**

## 10. POST GRADUATE GUIDE:

**10.1 The qualifications required to be a postgraduate teacher are as laid down by the Dental council of India.**

**10.2 The postgraduate teacher will be a registered post graduate teacher of Dharmsinh Desai University.**

**10.3 A Professor who is a recognized postgraduate teacher can register maximum two post graduate students in each academic year of MDS course.**

**10.4 A Reader who is a recognized postgraduate teacher can register maximum of one post graduate students in each academic year of MDS course.**

**10.5 Not more than 3 active postgraduate students should be registered under each Reader who is a post graduate Teacher during the 3 years MDS course.**

**10.6 The post graduate teacher will register the post graduate student in the same specialty in which he/she is trained.**

**10.7 The postgraduate teacher shall always certify the clinical/ practical work, library and main Dissertation, research project and any other activities conducted by post graduate student under them.**

**10.8 No postgraduate teacher shall enroll candidates for a discipline other than the subject of his/her Specialty for the post-graduate programme and no teacher shall be recognized as Postgraduate teacher for more than one specialty.**

**10.9 Part-time professor who can put in at least four hours a day or eighty hours in a month are eligible to enroll only one post-graduate student under them.**

## 11. CURRICULUM:

**The Curriculum and the Syllabus for the course shall be as prescribed in the Regulations according to Dental Council of India and are subject to modifications by the Academic Council of Dharmsinh Desai University from time to time.**

## 12. MEDIUM OF INSTRUCTION:

**English shall be the medium of instruction for all the subjects of the M.D.S. course.**

**13. WORKING DAYS IN THE ACADEMIC YEAR:**

**13.1 No candidate shall be permitted to appear in the M.D.S. Examination, unless he / she has attended the course in the concerned specialty for the prescribed period in an affiliated Institution recognized by this University and has produced the necessary certificate of Study, Attendance, Satisfactory Conduct and Progress from the Head of the Department and Principal/Dean of the Institution.**

**13.2 A candidate is required to put in minimum of 80% of attendance the first academic year for Part I examination and in every academic year before admission to the Part II examination.**

**14. PERIOD OF TRAINING.**

**14. (1) The period of training for the award of the MDS course shall be of three years duration for three academic years as full-time candidates in an institution including the period of examination:**

**14.(2) During the period, each student shall take part actively in learning and teaching activities design of training, by the institution or the university. The teaching and learning activities in each speciality, shall be as under: -**

**(a) LECTURES:**

**There shall be some didactic lectures in the speciality and in the allied fields. The departments shall encourage guest lectures in the required areas and integrated lectures by multi-disciplinary teams on selected topics, to strengthen the training programmes.**

**(b) JOURNAL REVIEW:**

**The journal review meetings shall be held at least once a week. All trainees, associate and staff associated with the post-graduate programme are expected to participate actively and enter relevant details in the logbook. The trainee shall make presentations from the allotted journals of selected articles. A model check list for the evaluation of journal review presentation is annexed at Schedule-I of these regulations.**

**(c) SEMINARS:**

**The seminars shall be held at least twice a week in each department. All trainees are expected to participate actively and enter relevant details in logbook. A model check list for the evaluation of seminar presentation is annexed at Schedule-II of these regulations.**

**(d) SYMPOSIUM:**

**It is recommended to hold symposium on topics covering multiple disciplines.**

**(e) CLINICAL POSTINGS:**

**Each trainee shall work in the clinics on regular basis to acquire adequate professional skills and competency in managing various cases.**

**(f) CLINICO- PATHOLOGICAL CONFERENCE:**

**The clinico-pathological conference shall be held once a month involving the faculties of Oral Medicine and Radiology, Oral Pathology and allied clinical departments. The trainees shall be encouraged to present the clinical details, radiological and histo-pathological interpretations and participation in the discussions.**

**(g) INTER-DEPARTMENTAL MEETINGS:**

**To encourage integration among various specialities, there shall be inter-departmental meeting chaired by the Dean with all heads of post-graduate departments at least once a month.**

**(h) TEACHING SKILLS:**

**All the trainees shall be encouraged to take part in undergraduate teaching programmes either in the form of lectures or group discussions. A model check list for evaluation of teaching skills is annexed at Schedule-IV of these regulations.**

**(i) DENTAL EDUCATION PROGRAMMES:**

**Each department shall organise dental education programmes on regular basis involving other institutions. The trainees shall also be encouraged to attend such programmes conducted outside their university or institute.**

**(j) CONFERENCES / WORKSHOPS / ADVANCED COURSES:**

**The trainees shall be encouraged to attend conference/workshops/advanced courses and also to present at least two scientific papers and two posters at State / national level speciality and allied conferences / conventions during the training period.**

## 15. MAINTENANCE OF LOG BOOK

**15.1** Every post graduate candidate shall maintain a record of skills (Log Book), he/ she has acquired during the three years training period, certified by the Guide, Head of Department, where he / she has undergone training.

**15.2** The candidate is also required to participate in the teaching and training programme for the under graduate student.

**15.3** In addition, the Head of the Department shall involve their Post-Graduate students in seminars, journal clubs, group discussions and Participation in conferences.

**15.4** At the end of the course, the candidate should summarize the contents and get the Log Book certified by the guide, Head of the Department.

**15.5** Every Post-Graduate candidate should be encouraged to present scientific papers in conferences and improve on it and submit them for publication in indexed journals, motivation by the Heads of Departments shall be essential in this area to sharpen the research skills of the Post-Graduate candidates.

## 16. DISSERTATION:

**16.1** Every candidate appearing for the MDS degree examination for the first time shall submit with his/her application for the admission to the examination, four type written copies of a dissertation of a research topic undertaken by the candidate and prepared under the direction and guidance and to the satisfaction of his/her university Teacher / Guide.

**16.2** The dissertation should be submitted to the University six months prior to the commencement of MDS theory examination.

**16.3** The dissertation shall be referred to FOUR external examiners approved by SVU for the MDS examination and acceptance of it by 75% of the examiners shall be a precondition for the candidate to appear in the final university examination.

**16.4** A candidate whose dissertation has been accepted by the examiners, but who is declared to have failed at the examination will be permitted to reappear at the subsequent MDS examination without having to prepare a new dissertation, if, however, the dissertation is rejected, the authorities shall give reasons thereof and suggestion for the improvement of the same and the dissertation thus improved will have to be resubmitted to the examiners and accepted before appearing in MDS theory examination.

**16.5** Acceptance of dissertation:

**16.5.1** The dissertation submitted by the candidate must be accepted at least by 75% of the examiners.

**16.5.2 In case, the dissertation submitted by the candidate is not accepted by the examiners, the concerned candidates shall not be allowed to appear for the theory & practical examination and he/she shall be required to resubmit a fresh dissertation complying with the observations/remarks made by the examiners for not accepting the dissertation previously.**

**16.5.3 An unsuccessful examinee whose dissertation has already been accepted by the examiners shall not be required to submit a fresh dissertation while appearing at the subsequent examination. However, the examinee, on submission of fresh application and payment of fresh examination fee, producing a certificate to that effect by the Head of the Department is allowed to appear for the subsequent examinations.**

## 17. EXAMINATIONS

### 17.1 MOCK EXAMINATIONS:

**17.1.1 The mock examinations shall be conducted by internal and external examiners similar to that of University exam scheme.**

### 17.2 PART -I EXAMINATIONS

**17.2.1 Eligibility to appear –**

**17.2.1.1 Attendance: Every candidate should have fulfilled the minimum attendance i.e. 80% of the attendance during the first academic year of the Postgraduate MDS course as prescribed by the dental council of India and the University.**

**17.2.1.2 Progress and conduct: Every candidate should have presented seminars, journal club meetings, clinical case presentations, attended clinics and didactic lectures. Attended symposia and specialty conferences.**

**17.2.1.3 All the students of the speciality departments shall complete the minimum quota for teaching and learning activities as follows.**

| | | |
|---|---|---|
| 1. | Journal Clubs | 5 in a year |
| 2. | Seminars | 5 in a year |
| 3. | Clinical case presentation | 4 in a year |
| 4. | Lectures taken for undergraduates | 1 in a year |
| 5. | Scientific Paper / Poster Presentations In State / National Level Conferences / | 4 papers / posters during three years of training workshop period |
| 6. | Clinico Pathological Conferences | Clinico Pathological Conferences |
| 7. | Scientific Publications (optional) | One publication in any indexed scientific journal |

| | | |
|---|---|---|
| 8. | Submission of Synopsis | One synopsis within six months from the date of commencement of the course |
| 9. | Submission of Dissertation | One dissertation within six months before appearing for university examination |
| 10. | Submission of Library Dissertation | One dissertation within eighteen months from the commencement of the course |

**17.3 PART – II EXAMINATIONS**

**17.3.1 Eligibility to Appear – The following requirements should be fulfilled by every candidate to become Eligible to appear for the University examination:**

**17.3.1.1 Attendance: Every candidate appearing for the Degree of Master of Dental Surgery (M.D.S.) examination must have completed atleast three academic years of study after registration as a Post-graduate student under a recognized Postgraduate Teacher of Faculty of Dental Science-Dharmsinh Desai University. Every candidate should have fulfilled the minimum attendance i.e. 80% of the attendance during each academic year of the Postgraduate MDS course as prescribed by the Dental Council of India and the University.**

**17.3.1.2 Progress and Conduct:**

**17.3.1.2.1 Every candidate should have presented seminars, journal club meetings, clinical case presentations, attended clinics and didactic lectures, attended symposia and specialty conferences during each year.**

**17.3.1.2.2 Every candidate should have conducted at least TWO Research projects as Principal Investigator other than the main dissertation, during the course.**

**17.3.1.2.3 Every candidate must have published at least one scientific article in an Indexed journal.**

**17.3.1.2.4 Work diary and Log book: Every candidate shall maintain a work diary and log book for recording his or her participation in the training program conducted by the department. The work done diary and log book shall be verified and certified by the Guide, Head of the Department and Head of the Institution. The certification of satisfactory progress is based on the work diary and log book.**

**17.3.1.3 Dissertation:**

**17.3.1.3.1 Every candidate should have submitted one library dissertation within eighteen months from the date of commencement of the course.**

**17.3.1.3.2** Every candidate should have submitted one main dissertation 6 months before the end of third academic year.

**17.3.1.3.3** The dissertation work should be accepted and certified as per the university guidelines prior to appearing in the Part II Theory examinations.

**17.3.1.4** University Examination:

The changes in University examination pattern shall be as following:

The candidates shall have to secure a minimum of 50% in the Basic Sciences and shall have to pass the Part-I examination at least six months prior to the final (Part-II) examination. Part II University Examination for the MDS Course shall consist of theory, practical and clinical examination and viva-voce and pedagogy

**17.3.1.4.1** Theory: Part-II: Shall consist of three papers, namely: Paper I, Paper II and Paper III.

**17.3.1.4.1.1** Distribution of Marks in Theory: Part II University Examination: (300 Marks) (3 papers of 100 Marks each):-

a. Paper-I: 2 long essay questions of 25 marks each and 5 short essays of 10 marks each (Total of 100 Marks)
b. Paper-II: 2 long essay questions of 25 marks each and 5 short essays of 10 marks each (Total of 100 Marks)
c. Paper III: 2 out of 3 essay questions (50 x 2 = 100 Marks)

17.3.1.4.1.2 Each paper shall be of three hours duration.

17.3.1.4.1.3 Title of Papers: For written examination, following shall be the Titles of Papers in which the students will be examined in his/ her respective specialization:

a. PROSTHODONTICS AND CROWN & BRIDGE

Part-I Paper-I: Applied Basic Sciences: Applied anatomy, embryology, growth and development Genetics, Immunology, anthropology, Physiology, nutrition and Biochemistry, Pathology and Microbiology, virology, Applied pharmacology, Research Methodology and bio statistics, Applied Dental anatomy and histology, Oral pathology & oral Microbiology, Adult and geriatric psychology. Applied dental materials.

**Part-II Paper-I: Removable Prosthodontics and Implant supported prosthesis (Implantology), Geriatric dentistry and Cranio facial Prosthodontics**

**Paper-II: Fixed Prosthodontics, occlusion, TMJ and esthetics.**

**Paper-III: Descriptive and analyzing type question**

**b. PERIODONTOLOGY**

**Part- I Paper-I: Applied Basic Sciences: Applied Anatomy, Physiology, and Biochemistry, Pathology, Microbiology, Pharmacology, Research Methodology and Biostatistics.**

**Part-II Paper I: Normal Periodontal structure, Etiology and Pathogenesis of Periodontal diseases epidemiology as related to Periodontics**

**Paper II: Periodontal diagnosis, therapy and Oral implantology**

**Paper III: Descriptive and analyzing type question**

**c. ORAL & MAXILLOFACIAL SURGERY**

**Part-I Paper-I: Applied Basic Sciences: Applied Anatomy, Physiology, & Biochemistry, Pathology, Microbiology, Pharmacology, Research Methodology and Biostatistics.**

**Part- II: Paper-I: Minor Oral Surgery and Trauma**

**Paper-II: Maxillo-facial Surgery**

**Paper-III: Descriptive and analyzing type question**

**d. CONSERVATIVE DENTISTRY AND ENDODONTICS**

**Part-I Paper-I: Applied Basic Sciences: Applied Anatomy, Physiology, Pathology including Oral Microbiology, Pharmacology, Biostatistics and Research Methodology and Applied Dental Materials.**

**Part-II Paper-I: Conservative Dentistry**

**Paper-II: Endodontics**

**Paper-III: Descriptive and analyzing type question**

**e. ORTHODONTICS AND DENTOFACIAL ORTHOPEDICS**

**Part-I Paper-I: Applied Basic Sciences: Applied anatomy, Physiology, Dental Materials, Genetics, Pathology, Physical Anthropology, Applied Research methodology, Biostatistics and Applied Pharmacology.**

**Part-II Paper-I: Orthodontic history, Concepts of occlusion and esthetics, Child and Adult Psychology, Etiology and classification of malocclusion, Dentofacial Anomalies, Diagnostic procedures and treatment planning in Orthodontics, Practice management in Orthodontic**

**Paper II: Clinical Orthodontics**
**Paper III: Descriptive and analyzing type question**

**f. ORAL AND MAXILLOFACIAL PATHOLOGY AND ORAL MICROBIOLOGY:**

**Part-I Paper-I: Applied Basic Sciences: Applied anatomy, Physiology (General and oral), Cell Biology, General Histology, Biochemistry, General Pathology, General and Systemic Microbiology, Virology, Mycology, Basic Immunology, Oral Biology (oral and dental histology), Biostatistics and Research Methodology**

**Part-II: Paper-I: Oral pathology, Oral Microbiology and Immunology and Forensic Odontology**
**Paper-II: Laboratory techniques and Diagnosis and Oral Oncology**
**Paper-III: Descriptive and analyzing type question**

**17.3.1.4.2 Practical and Clinical Examination: Clinical/practical examination is designed to test the clinical skill, performance and competence of the candidate in skills such as communication, clinical examination, medical/dental procedures or prescription, exercise prescription, latest techniques, evaluation and interpretation of results so as to undertake independent work as a specialist. The department shall ensure that the candidate has been given ample opportunity to perform various clinical procedures. The practical/clinical examination in all the specialties shall be conducted for six candidates in two days. The practical/clinical examination may be extended for one day, if it is not completed in two days.**

**17.3.1.4.3 Viva-voce: Viva voce examination aims at assessing the depth of knowledge, logical reasoning, confidence and communication skill of the students. The Viva voce shall be conducted by two pairs (one external and one internal examiner in each pair). Each pair shall conduct viva for 20 minutes per candidate and award marks out of 40 (Pair**

**A-40 marks + Pair B-40 Marks=Total 80 Marks).**

**17.3.1.4.4 Pedagogy: The student needs to make Presentation to demonstrate the teaching skills on a topic assigned by the examiners. Pedagogy exercise is reviewed jointly by all 4**

**examiners. 20 Marks for Pedagogy exercise shall be awarded individually by each examiner.**

**17.3.1.4.5 The practical & clinical Examination shall be of 200 marks and viva + pedagogy for (80+20) 100 marks.**

**17.3.1.4.6 The clinical or practical exams shall be reviewed jointly by all 4 examiners, but marks shall be awarded separately and average shall be computed for final result by the University.**

**17.5 COMMENCEMENT OF EXAMINATION:**

**17.5.1 Examination leading to the Degree of Master of Dental Surgery (M.D.S.) in various branches shall be held twice a year in the month of May/ October at such place and on such dates as may be declared by the University.**

**17.5.2 The Theory and/or Practical Examination will not be held on Sundays and public holidays.**

**17.5.3 There shall be a gap of minimum 1 day in between each theory papers.**

**17.6 EXAMINATION CENTRE:**

**When the PG university examination is being conducted in the same city / town having more than one PG institution under the same university, one central examination center shall be fixed by the concerned university and all the PG students from all the PG institutions of the city will take the examination in that center only.**

**Centers can be rotated as per the direction of the university.**

**17.7 EXAMINERS:**

**17.7.1 Part I: There shall be one internal and one external examiner for three students appointed by the affiliating university for evaluating the answer scripts of the same specialty. However, the number of examiner/s may be increased with the corresponding increase in number of students.**

**17.7.2 Part II: There shall be four examiners in each subject. Out of them, two shall be external examiners and two shall be internal examiners. Both external examiners shall be from a university other than the affiliating university of which one external examiner shall be from a university of different State.**

**17.7.3 Qualification and experience for examiners: The qualification and experience for appointment of an examiner shall be as under: -**

**i. Possess qualification and experience of a professor in a post-graduate degree program.**

**ii. A person who is not a regular post-graduate teacher in the subject shall not be appointed as an examiner;**

**iii. The internal examiner in a subject shall not accept reciprocal external examinership in a college for the same academic year;**

iv. **No person shall be appointed as an external examiner for the same institution for more than two consecutive years. However, if there is a break of one year, the person can be re-appointed.**

**17.8 EVALUATION OF ANSWER BOOKS:**

**17.8.1 Part-I: Answer book/s shall be evaluated by the internal and external examiner/s**

**17.8.2 Part II: The Answer books of the theory question papers shall be evaluated individually by the Four Examiners during the Practical / Clinical examination. Average of commuted marks should be awarded for final result.**

**17.9 RE-EVALUATION/ RE-TOTALING OF ANSWER BOOKS:**

**There is a provision for re-evaluation of answer papers. However, re-totaling is allowed in the failed subjects.**

**17.10 NUMBER OF ATTEMPTS:**

**A candidate registered for three years M.D.S. Course must qualify in the examinations within six years from the date of his / her admission. The candidate will not be permitted to appear for more than six attempts in the final examinations and shall be discharged from the course if he / she fails to pass the examination in the said number of attempts.**

**17.11 CRITERIA FOR DECLARING AS PASS:**

**17.11.1 To pass the university examination, a candidate shall secure in both theory examination and in practical/clinical including viva voce independently with an aggregate of 50% of total marks allotted (50 out of 100 marks in Part I theory examination and 150 marks out of 300 in Part II theory examination and 150 out of 300 in Part - II clinical plus viva voce together).**

**17.11.2 A candidate securing marks below 50% as mentioned above shall be declared to have failed in the examination.**

**17.11.3 A postgraduate student who fails in the university examination will have to attend the department/clinical duties as scheduled during the period till the next examination. They will have to gain 80% attendance, and obtain applicable NOC to be eligible for the next examination.**

**17.11.4 All the PG students who have failed shall have to pay the applicable examination fees according to the university guidelines for re-appearing.**

**17.11.5 A candidate who is declared successful in the MDS examination shall be granted a Degree of Master of Dental Surgery in the respective specialty.**

**17.12 Award of Distinction and University Ranks:**

**Distinction will be awarded to successful candidates who secure 75% marks or more as a course aggregate in the concerned subject without any failure.**

**18. ACTIVE STUDENTS**

**18.1 The postgraduate student who is actively pursuing the MDS course and regularly attending the day to day various activities, and whose dissertation is yet to be completed as well as completed three years shall be considered as Active student for the purpose of calculating Active student under a postgraduate teacher.**

**18.2 However, students having completed the attendance and dissertation, but not having appeared or failed in the examination or, candidates having discontinued the course (absent for more than six months) and students not completing the dissertation within 1 year after the regular duration of course, shall not be considered as Active student for this purpose.**

**19. RE-ADMISSION AFTER BREAK OF STUDY: As per the University norms, the re-admission of a candidate can be done after break of study.**

**20. MIGRATION/TRANSFER OF CANDIDATES:**

**Request for Migration/Transfer of candidates during the course of study from one recognized college to another recognized college of this University or from another University shall not be granted under any circumstances. No inter-change of the specialty in the same institution or in any other institution shall be permitted after the last date of the commencement of session.**

**21. VACATION:**

**The Head of Institution shall declare 2 week vacation in an academic year to the students. The period(s) of vacation can be decided by the Head of the Department and Head of the Institution.**

## SECTION II

## GOALS & OBJECTIVES OF MDS COURSE

**Goals: The goals of postgraduate training in various specialties are to train M.D.S. graduates who will, after successful completion of the course:**

- **Practice respective specialty efficiently and effectively, backed by scientific knowledge and skill.**
- **Exercise empathy and a caring attitude and maintain high ethical standards.**
- **Continue to evince keen interest in continuing professional education in the specialty and allied specialties irrespective of whether in teaching or practice.**
- **Willing to share the knowledge and skills with any learner, junior or a colleague.**
- **Develop the faculty for critical analysis and evolution of various concepts and views, to adopt the most rational approach.**

**Objectives:**

- **The objective is to train a candidate so as to ensure higher competence in both general and special area of interest and prepare him for a Career in Teaching, Research and Specialty Practice.**
- **A candidate must achieve a high degree of clinical proficiency in the subject matter and develop competence in research and its methodology as related to the field concerned.**

**These objectives are to be achieved by the time the candidate completes the course and the objectives may be considered as under:**

1. **Knowledge (Cognitive domain)**
2. **Skills (Psycho motor domain)**
3. **Human values, ethical practice and communication abilities.**

**Programme Outcomes (PO's) (MDS)**

**Post graduates should be able to:**

**PO 1. Understand basic sciences relevant to specialty.**

**PO 2. Describe etiology, patho-physiology and principles of diagnosis and management of common problems within the specialty in adults in children.**

**PO 3. Identify social economic, environmental and emotional determinants in a given case and take them into account for planning treatment.**

**PO 4. Recognize conditions that may be outside the area of specialty/competence and to refer them to an appropriate specialist.**
**PO 5. Update knowledge by self-study and by attending courses, conferences and seminars relevant to specialty.**

**PO 6. Undertake audit, use information technology and carryout research both basic and clinical with the aim of publishing or presenting the work at various scientific gatherings.**

**Knowledge :**

- **Demonstrate understanding of basic sciences relevant to specialty.**
- **Describe etiology, patho-physiology and principles of diagnosis and management of common problems within the specialty in adults & children.**
- **Identify social economic, environmental and emotional determinants in a given case and take them into account for planning treatment.**
- **Recognize conditions that may be outside the area of specialty/competence and to refer them to an appropriate specialist.**
- **Update knowledge by self-study and by attending courses, conferences and seminars relevant to specialty.**
- **Undertake audit, use information technology and carryout research both basic and clinical with the aim of publishing or presenting the work at various scientific gatherings.**

**Skills:**

- **Take a proper clinical history, examine the patient, perform essential diagnostic procedures and other relevant tests and interpret them to come to a reasonable diagnosis about the condition.**
- **Acquire adequate skills and competence in performing various procedures as required in the specialty.**

**Human values, ethical practice and communication abilities:**

- **Adopt ethical principles in all aspects of practice.**
- **Professional honesty and integrity are to be fostered.**
- **Patient care is to be delivered irrespective of social status, caste, creed or religion of the patient.**
- **Develop communication skills, in particular and skill to explain various options available in management and to obtain a true informed consent from the patient.**
- **Develop communication skills, in particular and skill to explain various options available in management and to obtain a true informed consent from the patient.**
- **Provide leadership and get the best out of his team in a congenial working atmosphere.**
- **Apply high moral and ethical standards while carrying out human or animal research.**
- **Be humble and accept the limitations in his knowledge and skill and to ask for help from colleagues when needed.**
- **Respect patient's rights and privileges including patient's right to information and right to seek a second opinion.**

**GENERAL OBJECTIVES OF POST-GRADUATE TRAINING EXPECTED FROM STUDENTS AT THE END OF POST-GRADUATE TRAINING:**

**At the End of the Postgraduate training in the discipline concerned, the student shall be able to:**

1. **Recognize the importance to the concerned specialty in the context of the health needs of the community and the national priorities in the health section.**

2. **Practice the specialty concerned ethically and in step with the principles of primary health care.**

3. **Demonstrate sufficient understanding of the basic sciences relevant to the concerned specialty.**

4. **Identify social, economic, environmental, biological and emotional determinants of health in a given case, and take them into account while planning therapeutic, rehabilitative, preventive and primitive measure/strategies.**

5. **Diagnose and manage majority of the conditions in the specialty concerned on the basis of clinical assessment, and appropriately selected and conducted investigations.**

6. **Plan and advice measures for the prevention and rehabilitation of patients suffering from disease and disability related to the specialty.**

7. **Demonstrate skills in documentation of individual case details as well as morbidity and mortality rate relevant to the assigned situation.**
8. **Demonstrate empathy and humane approach towards patients and their families and exhibit interpersonal behavior in accordance with the societal norms and expectations.**
9. **Play the assigned role in the implementation of National Health Programme, effectively and responsibly.**
10. **Organize and supervise the chosen/assigned health care services demonstrating adequate managerial skills in the clinic/hospital or the field situation.**
11. **Develop skills as a self-directed learner, recognize continuing education needs; select and use appropriate learning resources.**
12. **Demonstrate competence in basic concepts of research methodology and epidemiology, and be able to critically analyze relevant published research literature.**
13. **Develop skills in using educational methods and techniques as applicable to the teaching of medical/nursing students, general physicians and paramedical health workers.**
14. **Function as an effective leader of a health team engaged in health care, research or training.**

## SECTION III

## TEACHING AND LEARNING ACTIVITIES

**All the candidates registered for MDS course in various specialties shall pursue the course for a period of three years as fulltime students. During this period each student shall take part actively in learning & teaching activities designed by the institution/ university. Dharmsinh Desai University desires the following Teaching & Learning activities in each specialty.**

### 1. LECTURES

**There shall be Didactic lectures in the specialty and in the allied fields. The postgraduate departments should encourage guest lectures in the required areas to strengthen the training programmes. It is desirable to have certain integrated lectures by multidisciplinary teams on selected topics.**

### 2. JOURNAL CLUB

**The Journal review meetings shall be held at least once a week. Critical appraisal of article should be presented as per the principles of Evidence Based Decision Making in journal clubs. All trainees, associates and staff associated with the post-graduate program are expected to participate actively and enter relevant details in logbook. The trainee should make the journal article presentations from the allotted journals based on clinical/community relevant question. The article should be appraised on the basis of critical appraisal tool kit for the study design as applicable. The journal review presentation should be evaluated according to the model checklist (Annexure I).**

### 3. SEMINARS

**The Seminars shall be held at least twice a week in each post graduate department. Seminars shall be evidence based with incorporation of most recent evidences as per the hierarchy of evidences. All trainees are expected to participate actively and enter relevant details in Logbook. Each trainee shall make presentations as per the desired requirement of the respective department. The seminar presentation should be evaluated according to the model checklist (Annexure II).**

### 4. SYMPOSIUM

**It is recommended to hold symposiums on topics covering multiple disciplines. The post graduate students of respective specialty should actively participate in these symposia.**

**5. CLINICAL POSTINGS**

**Each trainee shall work in the clinics on regular basis to acquire adequate professional skills and competency in managing various cases to be treated by the specialist. The performance in the clinical postings should be evaluated according to the model checklist (Annexure III-a).**

**6. CLINICAL CASE PRESENTATION**

**The clinical case presentation shall be a presentation of interesting/special cases with a detailed history, evidence based diagnosis and treatment plan. The performance in the clinical case presentation should be evaluated according to the model checklist (Annexure III-b).**

**6. CLINICO- PATHOLOGICAL CONFERENCES/ INTERDISCIPLINARY PRESENTATIONS**

**The Clinico-Pathological conference / interdisciplinary presentation should be held once in a month involving the faculties of Oral Medicine and Radiology, Oral Pathology and allied clinical department. The trainees should be encouraged to present the clinical details, radiological and histopathological interpretations and participation in the discussions. (Annexure IV)**

**7. INTERDEPARTMENTAL MEETINGS**

**To bring in more integration among various specialties, there shall be interdepartmental meetings chaired by the Principal / Dean with all Heads of Postgraduate Department at least once a month.**

**8. TEACHING SKILLS**

**All the trainees shall be encouraged to take part in undergraduate teaching programs either in the form of lectures or group discussions. The teaching skills should be evaluated according to the model checklist (Annexure V).**

**9. CONTINUING DENTAL EDUCATION PROGRAMMES (CDE)**

**Each postgraduate department of the Institute shall organize CDE programmes on regular basis involving the other institutions. The trainees shall also be encouraged to attend such programmes conducted outside their institute and university**

**10. CONFERENCES/ WORKSHOPS/ ADVANCED COURSES**

**The trainees shall be encouraged not only to attend conference/ workshops/ advanced courses but also to present at least two papers and two posters, or one poster and one table clinic at State / National Speciality and allied conferences/ conventions during their training period.**

## 11. ROTATIONAL POSTINGS IN OTHER DEPARTMENTS AND RELATED FIELDS

**To bring in more integration between the speciality and allied fields, each postgraduate department shall workout a programme to rotate the trainees in related disciplines. The postgraduate students may interact with these centers for specialized learning of clinical skills in handling these patients. The performance in these postings should be evaluated according to the model checklist (Annexure III-a).**

## 12. DISSERTATION / THESIS/ RESEARCH

**The Sumandeep Vidyapeeth appreciates the importance of Research activities for the growth of the profession. Trainees shall prepare a dissertation based on the clinical or experimental work or any other study conducted by them under the supervision of the Postgraduate guide. The dissertation should be continuously evaluated by the guide/coguide according to the model checklist (Annexure VI a & b).**

## 13. WORK DIARY/LOG BOOK

**Every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any conducted by the candidate.**

**The trainee undergoing the postgraduate course shall be evaluated using the overall assessment sheet. (Annexure VII)**

| | | |
|---|---|---|
| 1 | Journal clubs | 05 in a year |
| 2 | Seminars | 05 in a year |
| 3 | Clinical Case Presentations | 04 in a year |
| 4 | Lectures taken for undergraduates | 01 in a year |
| 5 | Submission of Synopsis | Dissertation synopsis submission within 6 months from the date of commencement of course |
| 6 | Scientific Paper / Poster Presentation in State/ National Conferences | Four scientific presentations during three years of training period |
| 7 | Clinico Pathological Conferences/ Interdisciplinary Presentation | Two presentations during three years of training period |
| 8 | Scientific Publications | One publication in any indexed scientific journal |
| 9 | Submission of Main Dissertation | One Main Dissertation within six before appearing for the university examination |
| 10 | Submission of Library Dissertation | One Library dissertation within eighteen months from the date of commencement of the course. Systematic review shall be considered as one of the form for library dissertation. |
| | Short Research | Two Short Researches with the candidate being the principal investigator in minimum one |
| | Training Workshop for | Should attend minimum one workshop each during the course |
| | A. Basic Life Support | |
| | B. Dental Photography And Adobe Photoshop | |
| | C. Corel Draw | |

**SCHEDULE – I**
**(See clause (b) of sub-regulation (2) of regulation 11)**

**MODEL CHECKLIST FOR EVALUATION OF JOURNAL REVIEW PRESENTATIONS.**

Name of the Trainee : Date :
Name of the Faculty / Observer :

| Sl. No. | Items for observation during presentation | Poor 0 | Below Average 1 | Average 2 | Good 3 | Very Good 4 |
|---|---|---|---|---|---|---|
| 1. | Article chosen was | | | | | |
| 2. | Extent of understanding of scope and objectives of the paper by the candidate. | | | | | |
| 3. | Whether cross-references have been consulted. | | | | | |
| 4. | Whether other relevant publications consulted. | | | | | |
| 5. | Ability to respond to questions on the paper / subject. | | | | | |
| 6. | Audio – Visual aids used. | | | | | |
| 7. | Ability to defend the paper. | | | | | |
| 8. | Clarity of presentation. | | | | | |
| 9. | Any other observation. | | | | | |
| | **Total Score** | | | | | |

**CHEDULE-II**
**(See clause (c) of sub-regulation (2) of regulation 11)**

**MODEL CHECK LIST FOR EVALUATION OF SEMINAR PRESENTATIONS**

Name of the Trainee : Date :
Name of the Faculty / Observer :

| Sl. No. | Items for observation during presentation | Poor 0 | Below Average 1 | Average 2 | Good 3 | Very Good 4 |
|---|---|---|---|---|---|---|
| 1. | Completeness & Preparation. | | | | | |
| 2. | Clarity of presentation. | | | | | |
| 3. | Understanding of subject. | | | | | |
| 4. | Whether other relevant publications consulted. | | | | | |
| 5. | Whether cross-references have been consulted. | | | | | |
| 6. | Ability to answer the questions. | | | | | |
| 7. | Time scheduling. | | | | | |
| 8. | Appropriate use of audio – visual aids. | | | | | |
| 9. | Overall performance. | | | | | |
| 10. | Any other observation. | | | | | |
| | **Total Score** | | | | | |

## SCHEDULE-III

**(See clause (e) of sub-regulation (2) of regulation 11)**

**(a) MODEL CHECK LIST FOR EVALUATION OF CLINICAL WORK IN Outpatient Department**

*(To be completed once a month by respective unit heads including posting in other department)*

Name of the Trainee : Date :
Name of the Unit Head :

| Sl. No. | Items for observation during presentation | Poor 0 | Below Average 1 | Average 2 | Good 3 | Very Good 4 |
|---|---|---|---|---|---|---|
| 1. | Regularity of attendance. | | | | | |
| 2. | Punctuality. | | | | | |
| 3. | Interaction with colleagues and supportive staff. | | | | | |
| 4. | Maintenance of case records. | | | | | |
| 5. | Presentation of cases. | | | | | |
| 6. | Investigations work up. | | | | | |
| 7. | Chair-side manners. | | | | | |
| 8. | Rapport with patients. | | | | | |
| 9. | Over all quality of clinical work. | | | | | |
| | **Total Score** | | | | | |

**(b) Evaluation of clinical presentation**

Name of the Trainee : Date :
Name of the Faculty / Observer :

| Sl. No. | Items for observation during presentation | Poor 0 | Below Average 1 | Average 2 | Good 3 | Very Good 4 |
|---|---|---|---|---|---|---|
| 1. | Completeness of history. | | | | | |
| 2. | Whether all relevant points elicited. | | | | | |
| 3. | Clarity of presentation. | | | | | |
| 4. | Logical order. | | | | | |
| 5. | Mentioned all positive and negative points | | | | | |
| 6. | Accuracy of general physical examination. | | | | | |
| 7. | Diagnosis: Whether it follows logically from history and findings. | | | | | |
| 8. | Investigations required. | | | | | |
| | Complete list. | | | | | |
| | Relevant order. | | | | | |
| | Interpretation of investigations. | | | | | |
| 9. | Ability to react to questioning Whether it follows logically from history and findings. | | | | | |
| 10. | Ability to defend diagnosis. | | | | | |
| 11. | Ability to justify differential diagnosis. | | | | | |
| 12. | Others. | | | | | |
| | **Grand Total** | | | | | |

**Note: Please use a separate sheet for each faculty member.**

**SCHEDULE-IV**

**(See clause (h) of sub-regulation (2) of regulation 11)**

**MODEL CHECKLIST FOR EVALUATION OF TEACHING SKILL**

Name of the Trainee : Date :

Name of the Faculty / Observer :

| Sl. No | Items for observation | Poor 0 | Below Average 1 | Average 2 | Good 3 | Very Good 4 |
|---|---|---|---|---|---|---|
| 1. | Communication of the purpose of the talk | | | | | |
| 2. | Evokes audience interest in the subject. | | | | | |
| 3. | The introduction. | | | | | |
| 4. | The sequence of ideas. | | | | | |
| 5. | The use of practical examples and / or illustrations. | | | | | |
| 6. | Specking style (enjoyable, monotonous, etc. specify) | | | | | |
| 7. | Attempts audience participation. | | | | | |
| 8. | Summary of the main points at the end. | | | | | |
| 9. | Asks questions. | | | | | |
| 10. | Answers questions asked by the audience. | | | | | |
| 11. | Rapport of speaker with his audience. | | | | | |
| 12. | Effectiveness of the talk. | | | | | |
| 13. | Uses audio-visual aids appropriately. | | | | | |

## SCHEDULE-V
**(See clause (l) of sub-regulation (2) of regulation 11)**

### (a) MODEL CHECKLIST FOR DISSERTATION PRESENTATION

Name of the Trainee : Date :
Name of the Faculty / Observer :

| Sl. No. | Prints to be considered. | Poor 0 | Below Average 1 | Average 2 | Good 3 | Very Good 4 |
|---|---|---|---|---|---|---|
| 1 | Interest shown in selecting topic. | | | | | |
| 2 | Appropriate review. | | | | | |
| 3 | Discussion with guide and other faculty. | | | | | |
| 4 | Quality of protocol. | | | | | |
| 5 | Preparation of proforma | | | | | |
| | **Total Score** | | | | | |

### (b) CONTINUOUS EVALUATION OF DISSERTATION WORK BY GUIDE / CO-GUIDE

Name of the Trainee : Date :
Name of the Faculty / Observer :

| Sl. No. | Items for observation during presentation | Poor 0 | Below Average 1 | Average 2 | Good 3 | Very Good 4 |
|---|---|---|---|---|---|---|
| 1 | Periodic consultation with guide / co-guide. | | | | | |
| 2 | Regular collection of case material | | | | | |
| 3 | Depth of analysis / discussion. | | | | | |
| 4 | Quality of final output. | | | | | |
| 5 | Others | | | | | |
| | **Total Score** | | | | | |

## SCHEDULE-VI
**(See clause (l) of sub-regulation (2) of regulation 11)**

### OVERALL ASSESSMENT SHEET

Date :

| Sl. No. | Faculty Member | Name of Trainee and Mean Score | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E | F | G | H | I | J |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |

Signature of Head of the Department Signature of Principal

# ORTHODONTICS & DENTOFACIAL ORTHOPEDICS

Orthodontics and Dentofacial Orthopaedics deals with prevention and correction of oral anomalies and malocclusion and the harmonising of the structures involved, so that the dental mechanisms function in a normal way.

**1. Definition**:

a. To train dental graduates to ensure higher competence in both general and special areas of Orthodontics

b. To prepare a candidate for teaching, research and clinical abilities, including fixed orthodontics, removable orthodontics, orthopaedic appliances, lingual orthodontics, mini – implants and surgical orthodontics.

c. To prepare the candidate to practice Evidence Evidence-based decision making.

- The dynamic interaction of biological processes and mechanical forces acting on the stomatognathic system during orthodontic treatment.
- The aetiology, pathophysiology, diagnosis and treatment planning of various common orthodontic problems.
- Various treatment modalities in preventive, interceptive and corrective Basic sciences relevant to the practice of Orthodontics.
- Interaction of social, cultural economic, genetic and environmental factors and their relevance to management of cranio – facial deformities.
- Factors affecting the long-term stability of orthodontic correction
- Personal hygiene and infection control, prevention of cross infection and safe disposal of hospital waste, keeping in view the high prevalence of Hepatitis B, HIV and other highly contagious diseases.

**2. SKILLS:**

- To obtain proper clinical history, methodical examination of the patient, perform essential diagnostic procedures, and interpret them and arrive at reasonable diagnosis about the Dentofacial deformities.
- To identify clinical problem and acquire most suitable evidence for critical appraisal of the literature to formulate appropriate evidence-based treatment protocol.
- To be competent to fabricate and manage the most appropriate appliance – intra or extra oral, removable or fixed, mechanical or functional, and active or passive – for the treatment of any orthodontic problem to be treated singly or as a part of

multidisciplinary treatment of orofacial deformities as per the patient's need and preference.

- Develop an attitude to adopt ethical principles in all aspects of Professional honesty and integrity are to be fostered.
- Treatment care is to be delivered irrespective of the social status, cast, Willingness to share the knowledge and clinical experience with Willingness to adopt, after a critical assessment, new methods and techniques of orthodontic management developed from time to time based on scientific research, which are in the best interest of the patient.
- Respect patient's rights and privileges, including patient's right to information and right to seek a second opinion.
- Develop attitude to seek opinion from allied medical and dental
- Develop communication skills, in particular, to explain treatment option available in management and to make patient partner in evidence based decision making to manage a particular Dentofacial problem and to obtain a true informed consent from them for the most appropriate treatment available at that point of time.
- Develop the ability to communicate with the professional colleagues, in orthodontics or other specialities through various media like correspondence, internet, e-video, conference etc. to render the best possible treatment.

**Outcomes:**

At the end of the course the postgraduate student should be able to obtain

- Proper clinical history, methodical examination of the patient, perform essential diagnostic procedures, and interpret them and arrive at reasonable diagnosis about the Dentofacial deformities,
- competent to fabricate and manage the most appropriate appliance – intra or extra oral, removable or fixed, mechanical or functional, and active or passive – for the treatment of any orthodontic problem to be treated singly or as a part of multidisciplinary treatment of oro-facial deformities.
- The program outlined, addresses both the knowledge needed in orthodontics and allied medical specialities in its scope.
- A minimum of three years of formal training through a graded system of education as specialities, will equip the trainee with skill and knowledge at its completion to be able to practise basic orthodontics and have the ability to intelligently pursue further apprenticeship towards advanced orthodontics Six months for completion of pre – clinical exercises.
- Two and a half years for coverage of all the relevant topics in Orthodontics, clinical training.

PART I: PAPER I: APPLIED BASIC SCIENCES

**i. Prenatal growth of head**

Stages of embryonic development

- Origin of head
- Origin of face
- Origin of teeth

**ii. Post-natal growth of head:**

- Bones of skull
- The oral cavity
- Development of chin
- The hyoid bone
- General growth of head- Face growth.

**iii. Bone growth**

- Origin of bone
- Composition of bone
- Units of bone structure
- Schedule of ossification
- Mechanical properties of bone
- Roentgenographic appearance of bone.

**IV. Assessment of growth and development:**

- -Growth Prediction
- -Growth spurts
- -The concept of normality and growth increments

  -Differential growth

  -Gradient of growth

  - Methods of gathering growth data

  -Theories of growth and recent advances-

  -Factors affecting physical growth.

**v. Muscles of mastication**

- Development of muscles
- Muscle change during growth
- Muscle function and facial development-Muscle function and malocclusion

**vi. Development of dentition and occlusion**

- Dental development periods
- Order of tooth eruption
- Chronology of permanent tooth formation
- Periods of occlusal development
- Pattern of occlusion

**vii. Assessment of skeletal age**

- The carpal bones x-rays and carpal index
- Cervical vertebrae in cephalogram and CVMI index
- Maturation status of developing permanent teeth and CCS index

**B. APPLIED PHYSIOLOGY**

I. Endocrinology and its disorders

- Pituitary gland hormones
- Thyroid gland hormones,
- Parathyroid gland hormones

ii. Calcium and its metabolism

iii. Nutrition metabolism and their disorders

-protein

-Carbohydrates

- Fats

- Vitamins

-Minerals

**v. Craniofacial biology**

Cell adhesion molecules and mechanism of adhesion

**vi. Bleeding disorders in orthodontics**

Haemophilia

**C. Dental materials**

Gypsum products

- Dental plaster
- Dental stone

**Impression material**

- Impression material in general and particularly of alginate impression material

**Acrylics**

- Chemistry and composition and physical properties

**Composites**

- Type's properties setting reaction

**Banding and bonding cements**

- Zinc phosphate
- Zinc silicophosphate
- Zinc polycarboxylate

**Resin Cements**

Glass ionomer cement

**Wrought metal alloys**

- Deformation, strain hardening
- Annealing recovery
- Recrystallization
- Grain growth properties of metal alloys

**Elastics**

- Latex and non-latex elastics
- Applied Physics bioengineering and metallurgy
- Specification and test method used for materials used in orthodontics
- Survey of all contemporary literature
- Recent advances in above-mentioned materials

**D. Genetics**

- Cell structure DNA, RNA, Protein synthesis cell division
- Chromosomal abnormalities
- Principle of orofacial genetics
- Genetics in malocclusion
- Molecular basis of genetics
- Studies related to malocclusion, genetic counselling, bioethics

**E. Physical anthropology**

- Evolution development of dentition
- Evolution development of Jaws

**F. Pathology**

- Inflammation
- Necrosis

**G. Biostatistics**

- Critical principles
- Data collection
- Methods of summarising
- Methods of analysis different test error Sampling and sampling technique
- Experimental models design and interpretation
- Development of skills for preparing clear scientific abstracts and Publication

**Applied research methodology in orthodontics**

- Experimental design animal experimental protocol principles in the development execution and interpretation methodologies in orthodontics
- Critical scientific appraisal of literature
- Addition of mini-implants as a clinical adjuvant in various clinical treatment.
- Detail understanding of CBCT derived data for diagnosis and better treatment planning.
- Addition of clear aligners as a completely invisible treatment modalities.

**Part 2 paper 1**

A. orthodontic history

- Historical perspective
- Evolution of orthodontic appliances

B. History of orthodontics in India

**C. Concept of occlusion and aesthetics**

- Structure and function of all anatomic components of occlusion mechanics of articulation
- Recording of masticatory function diagnosis of occlusal dysfunction relationship of TMJ anatomy and Pathology and related neuromuscular physiology

**D. Aetiology and classification of malocclusion**

- A comprehensive review of the local and systemic factors in the causes and of malocclusion
- Various classification of malocclusion

**E. Dental anomalies**

- Anatomical
- Physiological, pathological development defect of the orofacial structures and characteristics of major groups

**F. Child and adult psychology**

- Stages of child development
- Theories of psychological development management of child in orthodontic treatment
- Management of handicapped child
- Motivation and psychological problems related to malocclusion adolescence psychology, behaviour psychology and communication

**G. Diagnostic procedures and treatment planning in orthodontics**

- Emphasis on the process of data gathering synthesis and translating it into treatment plan
- Analysis of cases and its management

- Adult cases
- Handicapped and mentally retarded cases and their special problems critic of treated cases

**H. CEPHALOMETRICS**

- Instrumentation
- Image processing
- Tracing and analysis of errors and applications
- Advanced cephalometric techniques
- Comprehensive review of literature
- Video imaging principles and application

**I. Practice management in orthodontics**

- Economics and dynamics of solo and group practices
- Personnel management
- Materials management
- Professional relationship
- dental aesthetics and jurisprudence
- Office sterilization procedures
- Community based orthodontics

**Part 2 paper 2 clinical orthodontics**

(Including review of current literature of all the topics)

**J. Myofunctional orthodontics**

- Basic principles
- Contemporary appliances their design and manipulation
- Case selection and evaluation of the treatment result
- Review of current literature

**K. Dentofacial Orthopedics**

- Principles
- Biomechanics
- Appliance design and manipulation
- Case selection and evaluation of the treatment results.
- Review of the current literature.

**L . Cleft lip and palate rehabilitation**

- Diagnosis and treatment planning
- Mechanotherapy
- Special growth problems of cleft cases
- Speech physiology, pathology and elements of therapy as applied to orthodontics
- Team rehabilitation procedures

**M. BIOLOGY OF TOOTH MOVEMENT:**

- Principles of tooth movement-review
- Review of contemporary literature
- Applied histophysiology of bone, periodontal ligament
- Molecular and ultra-cellular consideration in tooth movement

**N. ORTHODONTIC / ORTHOGNATHIC SURGERY:**

- Orthodontist's role in conjoint diagnosis and treatment planning
- Pre and post-surgical Orthodontics
- Participation in actual clinical cases, progress evaluation and post retention study
- Implementation of Surgery- first concept in skeletal malocclusion cases
- Review of current literature

**O. Ortho/ perio/ prostho/ Interrelationship**

- Principles of inter disciplinary patient treatment.
- Common problems and their management

**P. Basic Principles of Mechanotherapy Includes**

- Design
- Construction
- Fabrication
- Management
- Review of current literature on treatment methods and results.

## Q. Applied preventive aspect in orthodontics

- Caries and periodontal disease prevention
- Oral hygiene measures
- Clinical

## R. Interceptive preventive aspects in orthodontics

- Principles
- Growth guidance
- Diagnosis and treatment planning
- Therapy emphasis on
    - Dentofacial problems
    - Tooth material discrepancies
    - Minor surgery for orthodontics

## S. Retention and relapse

- Mechanotherapy special reference to stability of result with various procedures
- Post retention analysis
- Review of contemporary literature

## T. Recent advances

- Use of implants (TADs) (Addition of advance applications of mini implant in the form of Anterior Ramus Screw, MARPE,Mini implant supported distalization)
- Lasers
- Application of F.E.M.
- Distraction Osteogenesis
- Invisible Orthodontics (Clear Aligners, etc)
- 3D imaging Digital Orthodontics, (Integration of intra oral scanning and CBCT data for increasing the treatment efficacies)
- Virtual Treatment Planning
- CAD-CAM bracket Customization
- Robotic Wire Bending
- Accelerated Orthodontics
    - Surgical
    - Device assisted or mechanical stimulation
    - Biochemical Mediators
- Lingual Orthodontic

**Part II** **Paper-III:** Essays (descriptive and analysing type questions

## PRE – CLINICAL EXERCISES

(Should be completed within 3 months)

A general outline of the type of exercises is given here:

1. General Wire bending exercises to develop the manual dexterity.
2. Clasps, Bows and springs used in the removable appliances.
3. Soldering and welding exercises.
4. Fabrication of removable, habit breaking, mechanical and functional appliances, also all types of space maintainers and space regainers.
5. Bonwill Hawley Ideal arch preparation.
6. Construction of orthodontic models trimmed and polished.
7. Cephalometric tracing and various Analyses, also superimposition methods –
8. Fixed appliance typodont exercises.
   a) Training shall be imparted in one basic technique i.e. Standard Edgewise / Begg technique or its derivative / Straight wire etc., with adequate exposure to other techniques.

   b) Typodont exercise

      - Band making
      - Bracket positioning and placement
      - Different stages in treatment appropriate to technique taught
9. Clinical photography
10. Computerized imaging
11. Preparation of surgical splints, and splints for TMJ problems.
12. Handling of equipment like vacuum forming appliances and hydro solder etc.

**Basic Pre-Clinical Exercise Work for the MDS Students:**

**1. Clasps:**

| Sr. No | Exercise | No. |
|---|---|---|
| 1 | ¾ Clasps | 1 |
| 2. | Triangular Clasps | 1 |
| 3. | Adam's clasp | 2 |
| 4. | Modification of Adam's – With Helix | 2 |
| 5. | Southend Clasp | 1 |

**2. Labial Bows:**

| Sr. No. | Exercise | No. |
|---|---|---|
| 1 | Short labial bow (upper & lower) | 1 |
| 2 | Long labial bow (upper & lower) | 1 |
| 3. | Split high labial bow | 1 |

**3. Springs:**

| Sr. No. | Exercise | No. |
|---|---|---|
| 1 | Double cantilever spring | 1 |
| 2 | Coffin spring | 1 |
| 3 | T spring | 1 |

**4. Appliances**

| Sr. No. | Exercise | No. |
|---|---|---|
| 1. | Hawley's retention appliance with anterior bite plane | 1 |
| 2. | Upper Hawley's appliance with posterior bite plane | 1 |
| 3. | Upper expansion appliance with expansion screw | 1 |
| 4. | Habit breaking appliance with tongue crib | 1 |
| 5. | Oral screen and double oral screen | 1 |
| 6. | Lip bumper | 1 |
| 7. | Splint for Bruxism | 1 |
| 8. | Catalans appliance | 1 |
| 9. | Activator | 1 |
| 10. | Bionator | 1 |
| 11. | Frankel-FR 1& 2 appliance | 2 |
| 12. | Twin block | 1 |

| | | |
|---|---|---|
| 13. | Lingual arch | 1 |
| 14. | TPA | 1 |
| 15. | Quad helix | 1 |
| 16. | Utility arches | 1 |
| 17. | Pendulum appliance | 1 |
| 18. | Canine Retractor**(Marcotte & PG Spring)** | 1 |

**5. Soldering exercises:**

| Sl.No. | Exercise | No. |
|---|---|---|
| 1. | Star/ Combo/Christmas Tree | 1. |

**6. Study model preparation:**

**7. Model analysis – Mixed and permanent Dentition:**

**8. Cephalometrics:**

| **Sl.No.** | **Exercise** |
|---|---|
| 1 | Lateral cephalogram to be traced in different colors and super imposed to see the accuracy of tracing |
| 2 | Vertical and Anterio-Posterior Cephalometric analysis |
| 3 | Soft tissue analysis – Holdaway and Burstone |
| 4 | Various superimposition methods |

**9. Basics of Clinical Photography including Digital Photography:**

**10. Typodont exercises: Begg or P.E.A. method/Basic Edgewise:**

| Sl.No | Exercise |
|---|---|
| 1. | Teeth setting in Class-II division I malocclusion with maxillary anterior Proclination and mandibular anterior crowding |
| 2 | Band pinching, welding brackets and buccal tubes to the bands |
| 3 | Different Stages dependent on the applied technique |

**CLINICAL WORK:**

Once the basic pre-clinical work is completed in three months, the students can take up clinical cases and the clinical training.

**Each postgraduate student should start with a minimum of 50 fixed orthodontics cases and 20 removable including myofunctional cases of his/her own. Additionally, he/she should handle a minimum of 25 transferred cases.**

The type of cases can be as follows:

- Removable active appliances
- Class-I malocclusion with Crowding
- Class-I malocclusion with bi-maxillary protrusion
- Class-II division – 1
- Class-II division – 2
- Class-III (Orthopedic, Surgical, Orthodontic camouflage cases)
- Inter disciplinary cases
- Removable functional appliance cases like activator, Bionator, functional regulator, twin block and new developments
- Fixed functional appliances – Herbst appliance, jasper jumper etc
- Dento-facial orthopedic appliances like head gears, rapid maxillary expansion, NiTi expander etc.
- Appliance for arch development such as molar distalization
- Fixed mechano therapy cases (Begg, PEA, Tip edge, Edgewise, lingual)
- Retention procedures of above treated cases.

Curriculum Enrichment

- Multidisciplinary approaches in congenital craniofacial deformities like cleft-lip and palate, etc.

**Scheme of examination**:

| | | | |
|---|---|---|---|
| **A. Theory:** Part-I: | Basic Sciences Paper | - | **100 Marks** |
| Part-II: | Paper-I, Paper-II & Paper-III | - | **300 Marks** |
| ` | | | (100 Marks for each Paper) |

Written examination shall consist of Basic Sciences Paper (Part-I) of three hours duration and should be conducted at the end of First year of MDS course. Part-II Examination will be conducted at the end of Third year of MDS course. Part-II Examination will consist of Paper-I, Paper-II & Paper-III, each of three hours duration. Paper-I & Paper-II shall consist of two long answer questions carrying 25 marks each and five questions carrying 10 marks each. Paper III will be on Essays. In Paper-III three Questions will be given and student has to answer any two questions. Each question carries 50 marks. Questions on recent advances may be asked in any or all the papers. Distribution of topics for each paper will be as follows*:

**PART-I:** Applied Basic Sciences: Applied anatomy, Physiology, Dental Materials, Genetics, Pathology, Physical Anthropology, Applied Research methodology, Bio-Statistics and Applied Pharmacology.

**PART-II**

**Paper I:** Orthodontic history, Concepts of occlusion and esthetics, Child and Adult Psychology, Etiology and classification of maloclusion, Dentofacial Anomalies, Diagnostic procedures and treatment planning in Orthodontics, Practice management in Orthodontics

**Paper II:** Clinical Orthodontics

**Paper III :** Essays (descriptive and analyzing type questions)

** The topics assigned to the different papers are generally evaluated under those sections. However a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics*.

**B. Practical / Clinical Examination : 200 Marks**

**Exercise No: 1** **50 Marks**
**Functional Case:**
Selection of case for functional appliance and recording of construction bite.
Fabrication and delivery of the appliance the next day.

**Exercise No: 2 : 50 Marks**

1. III stage with auxiliary springs/Wire bending of any stage of fixed orthodontics (OR)
2. Bonding of SWA brackets and construction of suitable arch wire.

**Exercise No. 3** **75 Marks**
**Display of records of the treated cases**
**(Minimum of 5 cases)**

**Exercise No: 4** **25 Marks**
**Long case discussions**

**Time allotted for each exercise:**

| No | Exercise | Marks allotted | Approximate Time |
|---|---|---|---|
| 1 | Functional appliance | 50 | 1 hour (each day) |
| 2 | III stage mechanics /Bonding and arch wire fabrication | 50 | 1 hr 30 min |
| 3 | Display of case record (a minimum of 5 cases to be presented along with all the patients and records) | 75 | 1 hour |
| 4 | Long cases | 25 | 2 hours |

**Note: The complete records of all the cases should be displayed (including transferred cases)**

**C. Viva Voce**

***i. Viva-Voce examination:*** **100 Marks**

*80 marks*

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression, interpretation of data and communication skills. It includes all components of course contents. It includes presentation and discussion on dissertation also.

***ii. Pedagogy Exercise:*** *20 marks*

A topic be given to each candidate in the beginning of clinical examination.

He/she is asked to make a presentation on the topic for 8-10 minutes.

- **List of Text Books**

| Sr.No. | Textbooks |
|---|---|
| 1 | Orthodontics Princ. And Pract.Bailoor JAYPEE-NEW DELHI 1ST Ed. |
| 2 | Master Of Functional Orthodontics LevrineQuintessence 1st Ed. |
| 3 | T.B Of Orthodontics Bishara Elsevier1st Ed. |
| 4 | Contemporary Orthodontics Proffit Elsevier4th Ed. |
| 5 | Synopsis Of Orthodontics Rani, M.S AIPD2ND ED |
| 6 | Current Principles And Techniques In Orthodontics Graber Mosby4t Ed. |
| 7 | Contemporary Treatment Of Dentofacial Deformity Proffit Mosby1sEd. |
| 8 | Dentofacial Orthopedics With Functional Appliances Graber :Mosby2nd Ed |
| 9 | Biomechanics And Esthetics Strategies In Orthodontics NandaSaunders1st Ed. |
| 10 | Systemised Orthodontics Treatment Mechanics Mclaughlin;Mosby1st Ed. |
| 11 | Occlusion: Principles And Concept Santos J;Quintessence1st Ed. |
| 12 | Orthodontics Mgt. Of Class 2 Non Complaint Patient Papadopaulous :Elsevier1st Ed. |
| 13 | W & H Orthodontics Notes By. Jones M L: Varghase6th Ed |
| 14 | Innovative Anchorage-Mini Implants Ludwig:Quintessence1st Ed. |
| 15 | Orthodontics: Current Pric, & Techniques GrabberMosby 4th Ed. |
| 16 | Aesthetic Orthodontics And Orthognathic Surgery Sarver Elsvair1st ed |
| 17 | Dentofacial Orthopaedics With Functional Appliances Graber, RakosyMosbey4th ed |
| 18 | Contemporary Treatment Of Dentofacial Deformity ProffitMosbey 5th ed |
| 19 | Orthodontic Management Of Uncrowded Class 2 Div 1 Malocclusion In Children Bennetmosbey4th ed |
| 20 | Removable Orthodontics Appliances Issacson Mosbey3rd ed |
| 21 | Orthodontics, Diagnosis And Management Of Dentofacial Deformities Kharbanda, O PElsvair 1st ed |
| 22 | Craniofacial Development SperberJP1st ed |
| 23 | Cleft Lip And Palate Lesion, Pathophysiology & Primary Treatment Malek, ReneINFORMA 1st ed |
| 24 | Dentofacial Deformities Epker, Stell, Fish ELSVIER 2nd ed |
| 25 | Dentofacial Deformities Epker, Stell, Fish ELSVIER 2nd ed |
| 26 | Dentofacial Deformities Epker, Stell, FishELSVIER 2nd ed |
| 27 | Dentofacial Deformities BY Epker, Stell, FishELSVIER 2nd ed |
| 28 | Occlusion :Principles And Treatment Santos J: Quintessence 2nd Ed. |
| 29 | Orthodontics: Current Princ. & Techniques. Graber Mosby 4th Ed |
| 30 | Textbook Of Pathology By Mohan H Jaypee 3st ed |
| 31 | Pathology Quick Review And Mcqs By Mohan H Jaypee 5st ed |
| 32 | Robins Basics Pathology Kumar V |
| 33 | Essentials Of Medical Pharmacology By Tripathy K DJaypee 1st ed |
| 34 | Essentials Of Pathology For Dental Students By Mohan HJaypee 3st ed |
| 35 | Essentials Of Pharmacology For Dentistry By Tripathy K D Jaypee1st ed |
| 36 | Consice Pharmacology ; Basics And Applied By Bhagwat, A W Jaypee 1st ed |
| 37 | Essentials Of Medical Physiology By Sembulingm K Jaypee 3st ed |
| 38 | Consice Medical Physiology ByChaudhri S KCentral1st ed |
| 39 | Pharmacology And Pharmacotherapeutics By Satoskar, R SPopular prakashan19th ed |
| 40 | Mcqs On Physiology For Dental Students With Explanations By Chandra SCentral 1st ed |
| 41 | Mcqs On Head And Neck Anatomy For Dental Students By Chandra SJaypee1st ed |
| 42 | Mcqs On Pharmacology For Dental Students By Chandra SJaypee 1st ed |
| 43 | Medicine For Dental Students By Alayaappan R Jaypee 1st ed |
| 44 | Multiple Choice Questions In Surgery By Tondon V And Sood S Jaypee 3st ed |
| 45 | Multiple Choice Questions In Anatomy By Bhatnagar S M And Roychaudhry S Elseveir 3rd ed |
| 46 | Clinical Pharmacolgy By Bennett, P N And Brown M Jmosbey 1sted |
| 47 | Human Embryology By Singh Inderbir And Pal Jaypee 4th ed |
| 48 | Textbook Of Human Histology By Singh Inderbir Jaypee 4th ed |

## M.D.S
## SUBJECT: ORTHODONTICS & DENTOFACIAL ORTHOPAEDICS

| Teaching Scheme (Hours) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | External | | Internal | | Total |
| Lec(L) | Prac(P) | Clinical(C) | Total | | Theory | Pract | Theory | Pract | |
| 936 | 936 | 4860 | 6732 | | 2 | 1 | 2 | 1 | 6 |

### A. COURSE OVERVIEW

Orthodontics and Dentofacial Orthopaedics deals with prevention and correction of oral anomalies and malocclusion and the harmonising of the structures involved, so that the dental mechanisms function in a normal way. The postgraduate student should have knowledge about etiology, pathophysiology, diagnosis and treatment planning of various common Orthodontic problem

### B. COURSE CONTENT

| NO | TOPIC | L+P+C (hrs) | CLs |
|---|---|---|---|
| 1 | Applied Anatomy | 36+0+0 | CL 1 |
| 2 | Physiology | 38+0+0 | CL 1 |
| 3 | Dental Materials | 34+0+0 | CL 1 |
| 4 | Genetics | 30+0+0 | CL 1 |
| 5 | Physical Anthropology | 33+0+0 | CL 1 |
| 6 | Pathology | 34+0+0 | CL 1 |
| 7 | Biostatistics | 38+0+0 | CL 1 |
| 8 | Applied Research Methodology In Orthodontics | 30+0+0 | CL 1 |
| 9 | Applied Pharmacology | 30+0+0 | CL 1 |
| 10 | Basic Orthodontics | 30+0+0 | CL 1 |
| 11 | Orthodontic History | 20+0+114 | CL 1 |
| 12 | Concepts of Occlusion and Esthetics | 30+0+246 | CL 1 |
| 13 | Concepts of Occlusion and Esthetics | 16+0+115 | CL 1 |
| 14 | Dentofacial Anomalies: | 39+0+245 | CL1,2,3 |
| 15 | Diagnostic Procedures and Treatment Planning in Orthodontics | 30+0+243 | CL1,2,3 |
| 15 | Practice Management in Orthodontics | 18+0+114 | CL,12,3 |
| 16 | Addition of mini-implant as a clinical adjuvant in various clinical treatment | 20+0+115 | CL1,2,3,4 |
| 17 | Detail understanding of CBCT derived data for diagnosis and better treatment planning | 16+0+115 | CL1,2,3,4 |
| 18 | Addition of clear aligner as a completely invisible treatment modalities | 18+0+107 | CL1,2,3,4 |
| 19 | Cephalometrics | 36+0+244 | CL1,2 |

| | **Paper-II:Clinical Orthodontics** | | |
|---|---|---|---|
| **20** | Myofunctional Orthodontics | 25+0+240 | CL1,2,3,4 |
| **21** | Dentofacial Orthopedics | 25+0+241 | CL2,3,4,5 |
| **22** | Cleft lip and palate rehabilitation | 25+0+246 | CL2,3,4,5,6 |
| **23** | Biology of tooth movement: | 25+0+245 | CL2,3,4,6 |
| **24** | Orthodontic / Orthognathic surgery: | 23+0+242 | CL2,3,4,5,6 |
| **25** | Ortho / Perio / Prostho/Endo inter relationship: | 27+0+243 | CL2,3,4,5 |
| **26** | Ortho / Perio / Prostho/Endo inter relationship: | 24+0+244 | CL2,3,4,5 |
| **27** | Applied preventive aspects in Orthodontics | 26+0+240 | CL2,3,4,5,6 |
| **28** | Interceptive Orthodontics: | 22+0+246 | CL2,3,4,5 |
| **29** | Evidence Based Orthodontic | 12+0+114 | CL3,4,5,6 |
| **30** | Different types of fixed Mechanotherapy: | 28+0+209 | CL2,3,4,5 |
| **31** | Orthodontic Management of TMJ problems, sleep-apnoea etc. | 25+0+244 | CL2,3,4,5,6 |
| **32** | Retention and relapse: | 25+0+242 | CL2,3,4,5 |
| **33** | Recent Advances | 18+0+45 | CL2,3,4,5,6 |
| **34** | Advance applications of Mini-implants in the form of Anterior Ramus screw, MARPE, Mini-implant supported distalization | 12+0+115 | CL2,3,4,5,6 |
| **35** | Integration of intra-oral scanning and CBCT data for increasing the treatment efficacies | 18+0+45 | CL2,3,4,5,6 |
| **36** | PRE – CLINICAL EXERCISES | 0+936+0 | CL3,4,5 |

## C. TEXT BOOKS

NIL

## D. REFERENCE BOOKS


1. William R. Proffit ;Contemporary Orthodontics, 6th edition,Mosby,2018.
2. White And Gardiner ;Orthodontics For Dental Students, 2nd edition, OUP India,1999.
3. Moyers; Handbook Of Orthodontics, 4th revised edition, Mosby, 1988.
4. Graber; Orthodontics - Principles And Practice, 4th edition, Elsevier,2009.
5. Philip Adams; Design, Construction And Use Of Removable Orthodontic Appliances, 5th edition, Butterworth-Heinemann Ltd., 1984.
6. Salzmann ; Clinical Orthodontics: Vol1 & 2, Lippincott Williams and Wilkins, 1974.


## E. COMPETENCY LEVEL

| CL Number | Skill | Statement |
|---|---|---|
| **CL1** | Knowledge | • Should have knowledge to diagnose the various malocclusion categories and the dynamic interaction of biologic processes and mechanical forces acting on the stomatognathic system during orthodontic treatment<br>• Understand about normal growth and development of facial skeleton and dentition |
| **CL2** | Investigations | • Competent to take intra-oral radiographs and interpret the |

| | | |
|---|---|---|
| | | radiographic findings and adequate knowledge about common laboratory investigations and interpretation of their results |
| **CL3** | Patient Care: Diagnosis | ● To obtain proper clinical history, methodical examination of the patient, perform essential diagnostic procedures, and interpret them and arrive at a reasonable diagnosis about the Dento-facial deformities.) |
| **CL4** | Patient Care: Treatment planning | ● Pinpoint operations in growth process both dental and skeletal and plan necessary treatment (preventive, interceptive and corrective) |
| **CL5** | Patient Care: Treatment | ● Ethically fabricate and manage the most appropriate appliance – intra or extra oral, removable or fixed, mechanical or functional, and active or passive – for the treatment of any orthodontic problem to be treated singly or as a part of multidisciplinary treatment of oro-facial deformities |
| **CL6** | Research and Innovation | ● Upgradation of knowledge and skill from time to time, familiarize with new concept and equipment in. orthodontics & dental orthopaedics. |

**PROGRAM SPECIFIC OUTCOME (PSO)**

| | | |
|---|---|---|
| PSO1 | DIAGNOSIS | ● To obtain proper clinical history, methodical examination of the patient, perform essential diagnostic procedures, and interpret them and arrive at a reasonable diagnosis about the Dento-facial deformities.) |
| PSO2 | INVESTIGATIONS | ● Competent to take intra-oral radiographs and interpret the radiographic findings and adequate knowledge about common laboratory investigations and interpretation of their results |
| PSO3 | TREATMENT | ● Develop adequate |

| | | |
|---|---|---|
| | | communication skills particularly with the patients giving them the various options available to manage a particular Dento-facial problem and to obtain a true informed consent from them for the most appropriate treatment available at that point of time and perform the treatment |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CL1** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 |
| **CL2** | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 |
| **CL3** | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CL4** | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CL5** | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| **CL6** | 1 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | 3 | 2 | 2 |
| **Avg** | **2.3** | **2.3** | **2.1** | **2.3** | **2.5** | **2** | **2.4** | **2.5** | **2.5** | **2.6** | **2.5** | **2.5** | **2.5** | **2.3** | **2.1** | **3** | **2.5** | **2.3** |

# ORAL & MAXILLOFACIAL PATHOLOGY AND ORAL MICROBIOLOGY

Oral and Maxillofacial Pathology and Oral Microbiology branch deals with the nature of oral diseases, their causes, processes and effects. It relates the clinical manifestation of oral disease to the physiologic and anatomic changes associated with these diseases.

**AIM :**To prepare and train dental graduates for teaching and to ensure higher competence in both general and special areas of Oral Pathology and Microbiology. They are trained to prepare their presentations by searching and incorporating related highest level of evidences.

To prepare a candidate for research and clinical abilities including prevention of various oral and maxillofacial lesions. This is undertaken through problem based learning. The students are trained to search for gaps in research, formulate a research hypothesis and conduct research. They are also formulate a clinical problem and search for related high level of evidences and come to diagnosis.

**Objectives:**

- To train a post graduate dental surgeon so as to ensure higher competence in both general and special pathology dealing with the nature of oral diseases, their causes, processes and effects.
- An oral pathologist is expected to perform routine histopathological evaluation of specimens relating to oral and perioral tissues, to carry out routine diagnostic procedures including hematological, cytological, microbiological, Immunological and ultra structural investigations.
- He/she is expected to have an understanding of current research methodology, collection and interpretation of data, ability to carry out research projects on clinical and or epidemiological aspects, a working knowledge on current databases, automated data retrieval systems, referencing and skill in writing scientific papers.
- He/she is expected to present scientific data pertaining to the field, in conferences both as poster and verbal presentations and totake part in group discussions.

**Teaching / Learning Activities:**

**Broad Outline of Theoretical, Clinical and Practical Courses**

**I MDS:**

***1. Biostatistics and Research Methodology*:**

- Basic principles of biostatistics and study as applied to dentistry and research

- Collection/ organization of data/ measurement scales / presentation of data and analysis
- Measures of central tendency
- Measures of variability
- Sampling and planning of health survey
- Probability, normal distribution & indicative statistics
- Estimating population values
- Tests of significance(parametric/non-parametric qualitative methods)
- Analysis of variance
- Association, correlation and regression

**Approach:**

- Didactic Lectures

2. **Applied Gross Anatomy of head and neck, histology and genetics :**

- Temporo-mandibular joint
- Trigeminal nerve and facial nerve
- Muscles of mastication
- Tongue
- Salivary glands
- Nerve supply, blood supply, lymphatic drainage & venous drainage of oro-dental tissues
- Development of face, palate, mandible, maxilla, tongue and applied aspects of the same
- Development of teeth & dental tissues and developmental defects of oral and maxilla-facial region & abnormalities of teeth
- Maxillary sinus
- Jaw muscles and facial muscles

- Introduction to genetics
- Modes of inheritance
- Chromosomal anomalies of oral tissues & single gene disorders

**Approach:**

- Didactic Lectures
- Postings in the Department of Anatomy for dissection of Head, Face and Neck

3. ***Physiology (General & Oral)*** **:**

- Saliva
- Pain
- Mastication
- Taste
- Deglutition
- Wound healing
- Vitamins ( influence on growth, development and structure of oral soft and hard tissues & paraoral tissues )
- Calcium metabolism
- Theories of mineralization
- Tooth eruption and shedding
- Blood and its constituents

- Hormones (influence on growth, development and structure of oral soft and hard tissues & paraoral tissues)

**Approach:**

- Didactic Lectures

4. ***Cell Biology*** **:**

- Cell structure and function (ultra structural & molecular aspects)
- Intercellular junctions
- Cell cycle and division
- Cell cycle regulators
- Cell–cell & cell-extracellular matrix interactions
- Detailed molecular aspects of DNA,RNA and intracellular organelles, transcription and translation and molecular biology techniques

**Approach:**

- Seminars & Didactic Lectures

5. ***General Histology*** **:**

- Light & electron microscopy considerations of epithelial tissues and glands,bone.
- Light & electron microscopy considerations of hemopoetic system, lymphatic system, muscle, neural tissue, endocrinal system ( thyroid, pituitary, parathyroid)

**Approach:**

- Didactic Lectures
- Postings in the Department of Anatomy & Histology for slide discussion
- Record book to be maintained

6. **Biochemistry :**

- Chemistry of carbohydrates, lipids and proteins
- Methods of identification and purification
- Metabolism of carbohydrates, lipids and proteins
- Biological oxidation
- Various techniques-cell fractionation and ultra filtration, centrifugation, electrophoresis, spectrophotometry and radioactive techniques

**Approach:**

- Didactic Lectures
- Postings in the Department of Biochemistry to familiarize with various techniques
- Record book to be maintained

7. ***General Pathology :***

- Inflammation and chemical mediator
- Thrombosis
- Embolism
- Necrosis
- Repair

- Degeneration
- Shock
- Hemorrhage
- Pathogenic mechanisms at molecular level
- Blood dyscrasias
- Carcinogenesis and neoplasia

**Approach:**

- Didactic Lectures & Seminars

8. ***General Microbiology*** *:*

- Definitions of various types of infections
- Routes of infection and spread
- Sterilization ,disinfection and antiseptics
- Bacterial genetics
- Physiology, growth of microorganisms

**Approach:**

- Didactic Lectures & Seminars

9. ***Basic Immunology :***

- Basic principles of immunity, antigen and antibody reaction
- Cell mediated and humoral immunity
- Immunology of hypersensitivity
- Immunological basis of auto immune phenomena
- Immunodeficiency with relevance to opportunistic infections
- Basic principles of transplantation and tumor immunity

**Approach:**

- Didactic Lectures & Seminars

10. ***Systemic Microbiology / Applied Microbiology :***

Morphology, classification, pathogenicity, mode of transmission, methods of prevention, collection and transport of specimen for laboratory diagnosis, staining methods, common culture media, interpretation of laboratory reports and antibiotic sensitivity tests.

- Staphylococci
- Streptococci
- Corynebacterium diphtheria
- Mycobacteria
- Clostridia, bacteroids & fusobacteria
- Actinomycetales
- Spirochetes
- General structure, broad classification of viruses, pathogenesis, pathology of viral infections
- Herpes virus
- Hepatitis virus
- HIV
- General properties of fungi
- Superficial, subcutaneous, deep opportunistic infections

- General principles of fungal infections, method of collection of samples, diagnosis and examination of fungi

**Approach:**

- Didactic Lectures & Seminars
- Postings in the Department of Microbiology to familiarize with relevant diagnostic methods
- Record book to be maintained

***11.* Oral biology (Oral and Dental Histology) :**

- Study of morphology of permanent and deciduous teeth
- Structure and function of oral, dental and paraoral tissues including their ultra structure, molecular and biochemical aspects

**Approach:**

- Didactic Lectures & Seminars
- Slide discussion on histological appearance of normal oral tissues
- Record book to be maintained

***12.* Basic Histo-Techniques and Microscopy :**

- Routine hematological tests and clinical significance of the same
- Biopsy procedures for oral lesions
- Tissue processing
- Microtome and principles of microtomy
- Various stains used in histopathology and their applications
- Microscope, principles and theories of microscopy
- Light microscopy and various other types including electron microscopy
- Fixation and fixatives
- Ground sections and decalcified sections
- Cytological smears

**Approach:**

- Didactic Lectures & Seminars
- Postings in Clinical Pathology and Microbiology for relevant training
- Preparation of Ground and decalcified sections, tissue processing, sectioning and staining
- Tooth Carving (Permanent Dentition)
- Record book to be maintained

**II MDS:**

***1. Oral and Dental Pathology:***

- Developmental disorders of oral and paraoral structures
- Potentially malignant disorders
- Benign and malignant tumors of the oral cavity
- Odontogenic cysts and tumors
- Pathology of salivary glands
- Regressive alterations of teeth
- Bacterial, fungal, viral and protozoal infections of the oral cavity
- Dental caries

- Diseases of pulp and periapical region
- Spread of oral infection
- Healing of oral wounds
- Physical and chemical injuries of oral cavity
- Oral aspects of metabolic diseases
- Diseases of bones and joints
- Diseases of skin and mucous membrane
- Diseases of periodontia
- Diseases of blood and blood forming organs
- Diseases of nerves and muscles
- Oro-facial pain
- Immunological diseases of oral cavity including tumor immunology
- Molecular pathology
- Oral Microbiology

**Approach:**

- Didactic Lectures & Seminars
- Postings in the Department of Dermatology of a Medical College
- Postings in a Cancer Centre

2. ***Basic histo-techniques and microscopy:***

- Enzyme histochemistry
- Principles, techniques and applications of immunofluorescence
- Principles, techniques and applications of immunohistochemistry
- Preparation of frozen sections
- Museum set up
- Quality control
- Animal models

**Approach:**

- Didactic Lectures & Seminars
- Training to be imparted in the Department or in other institutions having the facility
- Visit to the centre of animal experimentation to be familiarize with laboratory techniques, upkeep and care of animals
- Record book to be maintained

3. **Recent Molecular Techniques:**

- Basic principles, techniques and applications of –
  - PCR
  - BLOTS
  - Hybridization
  - Recombinant DNA technology
  - Micro array
  - DNA sequencing
  - Cell culture and cloning

**Approach:**

- Didactic Lectures & Seminars
- Training to be imparted in the Department or in other institutions having the facility
- Record book to be maintained

***4.*** **Recording of Case History and Clinico-Pathological Discussions: Approach:**

- Postings in the Department of Oral Medicine, Diagnosis & Radiology
- Record of minimum 10 case histories to be maintained

***5.*** **Histopathology – Slide discussion:**

- Record book to be maintained

**III MDS:**

- Molecular biology
- Oncology
- Forensic odontology
- Giant cell lesions
- Clear cell lesions
- Round cell lesions
- Spindle cell lesions
- Pigmented lesions
- Fibro-osseous lesions
- Mechanism of formation and expansion of cysts of orofacial region
- Mechanism of growth and metastasis of tumors
- Lab diagnosis of bacterial infections
- Lab diagnosis of viral infections
- Lab diagnosis of fungal infections
- Hamartomas
- Phakomatoses
- Vascular tumors of oro-facial region
- Genodermatoses
- Tumor markers
- Histogenesis of salivary gland tumors
- Tumor angiogenesis
- Concept of premalignancy
- Blue cell lesions
- Molecular basics of oral squamous cell carcinoma
- Matrix remodelling in pathological condition
- Etiopathogenesis of developmental defects of teeth
- Viral oncogenesis
- Lesions associated with impacted and missing teeth
- Syndromes affecting oro-facial region
- Hereditary oral defects
- Techniques to assess the prognosis of neoplastic lesions
- Vesiculo-bullous lesions
- Lymphoreticular malignancy

- Haemopoietic malignancy
- Micronutrients
- Oral aspects of metabolic disorders
- Hormones and oro-maxillofacial lesions
- Matrix metalloproteinases
- Current concepts in HIV related oral diseases
- Current concepts in OSMF
- Epithelial –connective tissue interaction
- Stem cell research
- Dental Photography

**Approach:**

- Didactic Lectures & Seminars
- Postings in the Department of Forensic Medicine / Sciences
- Record book to be maintained

**Monitoring Learning Progress:**

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only helps teachers to evaluate students, but also students to evaluate themselves. The monitoring should be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment is done using checklists that assess various aspects. Checklists are given in Section IV.

**Scheme of Examination:**

**A. Theory:**

| | | |
|---|---|---|
| Part-I: Basic Sciences Paper | - | **100 Marks** |
| Part-II: Paper-I, Paper-II & Paper-III | - | **300 Marks** |
| | | (100 Marks for each Paper) |

Written examination shall consist of Basic Sciences Paper (Part-I) of three hours duration and should be conducted at the end of First year of MDS course. Part-II Examination will be conducted at the end of Third year of MDS course. Part-II Examination will consist of Paper-I, Paper-II & Paper-III, each of three hours duration. Paper-I & Paper-II shall consist of two long answer questions carrying 25 marks each and five questions carrying 10 marks each. Paper-III will be on Essays. Three Questions will be given and student has to answer any two questions. Each question carries 50 marks. Questions on recent advances may be asked in any or all the papers. Distribution of topics for each paper will be as follows: *

**PART-I** : Applied Basic Sciences: Applied Anatomy, Physiology (General and oral), Cell Biology, General Histology, Biochemistry, General Pathology, General Pharmacology specially related to drug induced oral mucosal lesions, General and systemic Microbiology, Virology, Mycology, Basic Immunology, Oral Biology (Oral and Dental Histology), Biostatistics and Research Methodology

**PART-II**

**Paper-I** : Oral pathology, Oral Microbiology & Immunology and Forensic Odontology
**Paper-II** : Laboratory techniques & Diagnosis and Oral Oncology

**Paper-III** : Essays (descriptive and analyzing type questions)

** The topics assigned to the different papers are generally evaluated under those sections. However a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.*

**B. Practical/Clinical Examination – 200 Marks**

1. **Case Presentation**
   a) Long case – 20 marks
   b) Short case – 10 marks
2. **Clinical Hematology** (any two investigations) – 20 Marks
   Hb%, bleeding time, clotting time, Total WBC count, Differential WBC count and ESR
3. **Smear Presentation** – 20 marks
   Cytology or microbial smear and staining
4. **Paraffin sectioning and H & E Staining** – 30 Marks
5. **Histopathology slide discussion** – 100 Marks

**C. Viva Voce – 100 Marks**

i. **Viva-Voce examination** – 80 marks
   All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression, interpretation of data and communication skills. It includes all components of course contents.

ii. **Pedagogy Exercise** – 20 marks
   A topic be given to each candidate in the beginning of clinical examination. He/she is asked to make a presentation on the topic for 8-10 minutes.

| Sr. No. | Particulars | I MDS | II MDS | III MDS |
|---|---|---|---|---|
| | **Hematologic Posting**<br><br>**a. Blood Sugar** | **20** | | |

| | | | | |
|---|---|---|---|---|
| 1. | estimation<br>b. Bleeding time,<br>clotting time | 20 | | |
| | c. DLC, TLC, Hb | 20 | | |
| 2. | Cytology | 30 | 30 | 30 |
| 3. | Carvings | 14 | - | - |
| 4. | Ground sections | 5 | - | - |
| 5. | Decalcified sections | 5 | - | - |
| 6. | Grossing of tissues | 20 | 20 | 20 |
| 7. | Histopathology examination with slide Diagrams | | | |
| | a. General Histology | 50 | - | - |
| | b. Oral Histology | 25 | - | - |
| | c. Oral Pathology | - | 50 | - |
| | d. PG Slides | - | 50 | 150 |
| | e. Histopathology diagnosis | - | 50 | 50 |
| 8. | Microbiology | | | |
| | a. Culturing | 5 | 10 | - |
| | b. ZN staining | 5 | 10 | - |
| | c. Gram staining | 10 | 20 | - |
| 9. | Carving Demonstrations to first Year BDS Students & Slides Discusions | Entire Year | - | - |
| 10. | Slides Discusions 2nd and 3rd Year BDS Students | - | Entire Year | Entire Year |

| | | | | |
|---|---|---|---|---|
| **11.** | **Lectures for BDS Students** | **-** | **3** | **3** |
| **12.** | **Special Staining including** | **-** | **5** | **5** |
| | **IHC (Other than Thesis)** | | | |
| **13.** | **Screening/ Camps** | **1** | **1** | **-** |

- **List of Text Books**

| Sr.No. | Title |
|---|---|
| 1 | Textbook of oral pathology BY SHAFER,W G PUB: NEW DELHI:ELSEVIER 5th ed. |
| 2 | Oral & Maxillofacial Pathology By Neville Pub:Elsevier:New Delhi 2nd ed. |
| 3 | Oral Patho. Clinical Patho. Correlation By Regezi Pub:Saunders 5th ed. |
| 4 | MCQs in Oral & Max.Pathology By Chandra: JAYPEE 1st ed. |
| 5 | MCQs in oral pathology by Kalra JAYPEE-NEW DELHI 1st Ed. |
| 6 | MCQs in oral pathology by Karunakaran JAYPEE-NEW DELHI 1st Ed. |
| 7 | MCQs in oral pathology with Expla.Ans.by Rooban :JAYPEE 1st Ed. |
| 8 | MCQs in Pharmacology For Dental Students By Chandra S |
| 9 | Textbook of Medical Laboratory Technology By Godkar |
| 10 | Diagnostic Surgical pathology of the head and neck By Snepp,D |
| 11 | Odontogenic Tumours and Allied lesions By Reichart |
| 12 | Colour Atlas of Oral Clinical & Pathology By Neville |
| 13 | Salivary Diagnostics By Wong |
| 14 | Essential of Oral Pathology & Oral Medicine By Cawson |
| 15 | Cellular & Molecular Immunology By Abbas |
| 16 | MCQs in Head And Neck Anatomy By Chandra S |
| 17 | MCQs in Physiology For Dental Students By Chandra S |
| 18 | MCQs in Biochemistry By Sharma D C |
| 19 | MCQs in Surgery By Tondon V |
| 20 | Atlas of Oral & Maxillofacial Pathology By Regezi |
| 21 | Contemporary Oral & Maxillofacial Pathology By Sapp |
| 22 | Molecular Biology of Cells By Alberts |
| 23 | Comprehensive Cytopathology By Bibbo |
| 24 | MCQs in Anatomy By Bhatnagar S N |
| 25 | Human Anatomy Vol I By B D Chaurasia |
| 26 | Human Anatomy Vol II By B D Chaurasia |
| 27 | Human Anatomy Vol III By B D Chaurasia |
| 28 | Human Physiology Vol I By Chatterjee C C |
| 29 | Oral Anatomy Histology and Embryology By Berkowitz |
| 30 | Human Physiology Vol II By Chatterjee C C |
| 31 | Fine Needle aspiration Cytology By Orell |
| 32 | Differential Diagnosis of Diseases of Oral Mucosa By Bengel |
| 33 | Essentials of Microbiology for Dental Students By Begg |
| 34 | Essentials of Oral Histolgy and Embryology By Avery |
| 35 | Human Embryology BY Inderbir Singh |
| 36 | Textbook of Human Histology By Inderbir Singh |

| | |
|---|---|
| 37 | Consice Medical Physiology By Chaudhri S K |
| 38 | Essentials of Medical Physiology By Sembulingum |
| 39 | Medicine For Dental Students BY Algappan |
| 40 | Short Cases in Surgery By Bhattacharya S K |
| 41 | Davidsons Principle and Practice of Medicine By Boon |
| 42 | Consice TB of Surgery By Das |
| 43 | Essentials of Medical Pharmacology By K D Tripathy |
| 44 | Essentials of Pharmacology for Dental Students By K D Tripathy |
| 45 | Clinical Pharmacology By Bennett P N |
| 46 | onsice Pharmacology By Bhagwat K W |
| 47 | Pharmacology And Pharmacotherapeutics By Satoskar R S |
| 48 | Textbook Of Microbiology By Panikar and Ananthnarayan |
| 49 | Pathology Quick Review and MCQs By Mohan H |
| 50 | Robin's Basic Pathology By Kumar V |
| 51 | Textbook of Pathology For Dental Students BY Mohan H |
| 52 | Essentials of Pathology for Dental Students By Mohan H |
| 53 | Theory & Pract.of Historical Techniques By Bancroft J D:Charchill 6th Ed. |
| 54 | Burkett's Oral Medicine By Greeneberg M S |
| 55 | Bloom and Faucet Consice Histology |
| 56 | Dental Anatomy, Histology and Development By Bhalaji |
| 57 | Orban's Oral Histology and Embryology By Bhaskar S N |
| 58 | Tencate's Oral Histology By Nancy , A |
| 59 | Wheeler's Dental Anatomy Physiology and Occlusion By Ash Nelson |
| 60 | Cysts of the Oral & Maxillofacial Regions |

## MDS

## SUBJECT: ORAL PATHOLOGY & ORAL MICROBIOLOGY

| Teaching Scheme (Hours) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | External | | Internal | | Total |
| Lec(L) | Prac(P) | Clinical(C) | Total | | Theory | Pract | Theory | Pract | |
| 936 | 936 | 4860 | 6732 | | 2 | 1 | 2 | 1 | 6 |

## A. COURSE OVERVIEW

Oral & Maxillofacial Pathology and Oral Microbiology deals with the nature of oral diseases, their causes, processes and effects. It relates the clinical manifestation of oral diseases to the physiologic and anatomic changes associated with these diseases. The course aims to train a postgraduate dental surgeon to ensure higher competence in both general and special pathology dealing with the nature of oral diseases, their causes, processes and effects.

## B. COURSE CONTENT

| NO | TOPIC | L+P+C (hrs) | CLs |
|---|---|---|---|
| 1 | Biostatistics and Research Methodology | 45+10+80 | CL1,6 |
| 2 | Applied Gross Anatomy of head and neck, histology and genetics | 15+20+80 | CL1,2,3 |
| 3 | Physiology (General & Oral) | 20+15+80 | CL1,2,3 |
| 4 | Cell Biology | 10+5+25 | CL1,2,6 |
| 5 | General Histology | 40+20+80 | CL1,2,3 |
| 6 | Biochemistry | 25+65+0 | CL1,2,3 |
| 7 | General Pathology | 40+25+80 | CL1,2,3,4 |
| 8 | General Microbiology | 25+10+60 | CL1,2,3 |
| 9 | Basic Immunology | 10+10+40 | CL1,2,3,6 |
| 10 | Systemic Microbiology / Applied Microbiology | 25+10+50 | CL2,3,4 |
| 11 | Dental Histology | 60+20+80 | CL1,2,3 |
| 12 | Oral Anatomy (carving of permanent teeth) | 20+30+40 | CL2,3 |
| 13 | Histopathology Staining Technique | 10+30+820 | CL2,3 |
| 14 | Cytology Staining Technique | 20+30+800 | CL2,3 |
| 15 | Decalcified Section | 5+20+60 | CL2,3 |
| 16 | Ground Section | 5+20+60 | CL2,3 |
| 17 | Recent Molecular Techniques: | 20+20+60 | CL2,3,6 |
| 18 | Histopathology – Slide discussion | 97+144+888 | CL2,3,4,5,6 |
| 19 | Recording of Case History | 10+30+80 | CL2,3,4,5,6 |
| 20 | Clinico Pathological Discussion | 10+30+80 | CL2,3,4,5 |
| 21 | Forensic odontology | 30+20+50 | CL2,3,4,6 |
| 22 | Giant cell lesions | 5+10+30 | CL2,3,6 |
| 23 | Clear cell lesions | 3+10+30 | CL2,3,4,5 |
| 24 | Round cell lesions | 3+10+30 | CL2,3,4,5 |
| 25 | Spindle cell lesions | 3+10+30 | CL2,3,4,5 |
| 26 | Pigmented lesions | 8+10+20 | CL2,3,4,5 |
| 27 | Fibro-osseous lesions | 10+10+20 | CL2,3,4,5 |

| | | | |
|---|---|---|---|
| **28** | Mechanism of formation and expansion of odontogenic cysts | 20+20+60 | CL2,3,4,5 |
| **29** | Mechanism of formation and expansion of developmental cysts | 10+20+60 | CL2,3,4,5 |
| **30** | Odontogenic Tumors | 20+20+60 | CL2,3,4,5 |
| **31** | Lab diagnosis of bacterial infections | 10+20+40 | CL2,3,4 |
| **32** | Lab diagnosis of viral infections | 15+20+40 | CL2,3,4 |
| **33** | Lab diagnosis of fungal infections | 10+20+40 | CL2,3,4 |
| **34** | Hamartomas | 5+5+20 | CL2,3,4,5 |
| **35** | Phakomatoses | 5+5+10 | CL2,3,4,5 |
| **36** | Vascular tumors of oro-facial region | 10+10+30 | CL2,3,4,5 |
| **37** | Genodermatoses | 10+10+20 | CL2,3,4,5 |
| **38** | Histogenesis of salivary gland tumors | 15+10+40 | CL2,3,4,5 |
| **39** | Blue cell lesions | 10+10+20 | CL2,3,4,5 |
| **40** | Tumor markers | 10+10+40 | CL2,3,4,6 |
| **41** | Concept of premalignancy | 10+10+40 | CL2,3,4,5,6 |
| **42** | Mechanism of Growth and metastasis of tumor | 10+10+30 | CL2,3,4,5 |
| **43** | Tumor angiogenesis | 10+10+20 | CL1,2,3 |
| **44** | Viral oncogenesis | 5+5+20 | CL1,2,3 |
| **45** | Techniques to assess the prognosis of neoplastic lesions | 10+20+20 | CL2,3,4,6 |
| **46** | Haemopoietic malignancy | 10+5+20 | CL2,3,4 |
| **47** | Molecular basics of oral squamous cell carcinoma | 20+20+80 | CL2,3,4,5,6 |
| **48** | Lymphoreticular malignancy | 5+5+20 | CL2,3,4,5 |
| **49** | Oral aspects of metabolic disorders | 25+5+10 | CL2,3,4,5 |
| **50** | Current concepts in OSMF | 10+10+40 | CL2,3,4,5,6 |
| **51** | Matrix remodelling in pathological condition | 10+5+20 | CL1,2,3 |
| **52** | Etiopathogenesis of developmental defects of teeth | 20+3+30 | CL2,3,4,5 |
| **53** | Lesions associated with impacted and missing teeth | 10+3+30 | CL2,3,4,5 |
| **54** | Syndromes affecting oro-facial region | 10+5+20 | CL2,3,4,5 |
| **55** | Hereditary oral defects | 6+2+20 | CL2,3,4,5 |
| **56** | Vesiculo-bullous lesions | 10+5+40 | CL2,3,4,5 |
| **57** | Micronutrients | 5+5+10 | CL1,2,3 |
| **58** | Hormones and oro-maxillofacial lesions | 5+5+20 | CL2,3,4,5 |
| **59** | Matrix metalloproteinases | 3+3+10 | CL1,2,6 |
| **60** | Current concepts in HIV related oral diseases | 5+10+20 | CL2,3,4,5,6 |
| **61** | Epithelial –connective tissue interaction | 5+10+30 | CL1,2,6 |
| **62** | Stem cell research | 10+10+30 | CL1,2,3,6 |
| **63** | Molecular biology | 2+2+2 | CL1,2,6 |
| **64** | Oncology | 3+2+5 | CL1,6 |
| **65** | Forensic odontology | 3+2+5 | CL1,2,6 |

## C. TEXT BOOKS

NIL

## D. REFERENCE BOOKS

**1.** Shafers ; Oral Pathology, 8th edition, Elsevier, 2020.
**2.** Regezi & Sciubba; Oral Pathology - Clinical Pathologic correlations, 7th edition, Saunders Publications, 2016.
**3.** Soames & Southam; Oral Pathology, 5th edition, Oup oxford, 2018.
**4.** Prabhu, Wilson, Johnson & Daftary; Oral Pathology in the Tropics
**5.** Arnold Berk- Molecular cell biology 2016, WH freeman publications
**6.** David J Kerr, Oxford Textbook of Oncology (3 edn), oxford university press publications
**7.** Nitul Jain ., Textbook of forensic odontology, 2013, Jaypee publications

## E. COMPETENCY LEVEL

| CL Number | Skill | Statement |
|---|---|---|
| CL1 | Knowledge | ● Student should understand the underlying biological principles governing treatment of oral diseases. |
| CL2 | Investigations | ● Perform routine histopathological evaluation of specimens relating to oral and perioral tissues, to carry out routine diagnostic procedures including hematological, cytological, microbiological, Immunological and ultra-structural investigations<br>● Microscopic study of common lesions affecting oral tissues through microscopic slides & projection slides.<br>● Study of the disease process by surgical specimens.<br>● Study of teeth anomalies/polymorphisms through tooth specimens & plaster casts.<br>● Microscopic study of plaque pathogens.<br>● Study of haematological preparations (blood films) of anaemias & leukemias. |
| CL3 | Patient Care: Diagnosis | ● An understanding of the oral manifestations of systemic diseases should help in correlating with the systemic physical signs & laboratory findings |
| CL4 | Patient Care: Treatment planning | ● Manifestations of common diseases, their diagnosis & correlation with clinical pathological processes |
| CL5 | Patient Care: Treatment | ● Comprehend the different types of pathological processes, that involve the oral cavity. |
| CL6 | Research and Innovation | ● Understanding of current research methodology, collection and interpretation of data, ability to carry out research projects on clinical and or epidemiological aspects, a working knowledge on current databases, automated data retrieval systems, referencing and skill in writing scientific papers. |

**PROGRAM SPECIFIC OBJECTIVE (PSO)**

| | | |
|---|---|---|
| PSO1 | Diagnosis | An understanding of the oral manifestations of systemic diseases should help in correlating with the systemic physical signs & laboratory findings for diagnosis. |
| PSO2 | Investigations | Perform routine histopathological evaluation of specimens relating to oral and perioral tissues, to carry out routine diagnostic procedures including haematological, cytological, microbiological, Immunological and ultra-structural investigations. |
| PSO3 | Treatment | Should be able to correlate the signs symptoms and investigation and aid in fabricating a treatment plan |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CL1** | 1 | 3 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 2 |
| **CL2** | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| **CL3** | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CL4** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CL5** | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CL6** | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 3 | 2 | 2 |
| **Avg** | **2.5** | **3** | **2.8** | **2.8** | **2.5** | **2.5** | **2.5** | **2.3** | **1.8** | **2.6** | **2.3** | **2.5** | **2.3** | **2.3** | **2.3** | **3** | **2.5** | **2.3** |

# ORAL AND MAXILOFACIAL SURGERY

**Oral and Maxillofacial Surgery deals with the diagnosis, surgical & adjunctive treatment of diseases, injuries and defects of the human jaws & associated oral and facial structures.**

## 1. AIM

- To train dental graduates as to ensure higher competence in both general and special areas of oral and maxillofacial surgery.
- To prepare a candidate for teaching, research and clinical abilities including diagnosis and treatment of various disorders, deficiencies, defects and trauma of the oral and maxillofacial region.

## 2. OBJECTIVES

- Training programme in Oral and Maxillofacial surgery is structured to achieve knowledge and proficiency in theoretical and surgical skills, attitude, communicative skills and ability to research with understanding of social, cultural, educational and environmental background of the society.
- Have a thorough understanding and applicable knowledge of basic and systemic medical science, with special focus on the head and neck region.
- The training program in Oral and maxillofacial Surgery is structured to achieve the following four objectives –Knowledge; Skills; Attitude; Communicative skills.

**Outcomes:** At the end of the course the student should be able to obtain proper clinical history, methodical examination of the patient, perform essential diagnostic procedures and order relevant laboratory tests and interpret them and to arrive at a reasonable diagnosis about the surgical condition, perform with competence minor oral surgical procedures and common maxillofacial surgery to treat both surgically and medically (or by other means) problems of the oral and maxillofacial and the related area), provide care of maxillofacial surgery patients both on a out-patient and in-patient basis, critically analyze of scientific literature and to incorporate evidence based knowledge in the practice of oral and maxillofacial surgery.

## 3. KNOWLEDGE

- To have acquired adequate knowledge and understanding of the etiology and of patho-physiology and diagnosis, treatment planning of various common oral and maxillofacial surgical problems both minor and major in nature.

- To have understood the general surgical principles like pre and post-surgical management, particularly of evaluation, post-surgical care, fluid and electrolyte management, blood transfusion and post-surgical pain-management.
- Understanding of basic sciences relevant to practice or oral and maxillofacial surgery.
- Able to identify special, cultural, economic, genetic and environmental factors and their relevance to disease process management in the oral and Maxillo-facial region.
- Essential knowledge of personal hygiene and infection control, prevention of cross infection and safe disposal of hospital waste keeping in view the high prevalence to hepatitis and HIV.

## 4. SKILLS

- To obtain proper clinical history, methodical examination of the patient, perform essential diagnostic procedures and order relevant laboratory tests and interpret them and to arrive at a reasonable diagnosis about the surgical condition.
- To perform with competence minor oral surgical procedures and common maxillofacial surgery. To treat both surgically and medically (or by other means) problems of the oral and Maxillofacial and the related area.
- Capable of providing care of maxillofacial surgery patients both on out-patient and in-patient basis.
- To develop skills for critical analysis of scientific literature and to incorporate evidence-based knowledge in the practice of oral and maxillofacial surgery.
- The student should be able to identify the problem search literature related to the problem critically evaluate and apply and share knowledge with the patient and involve him in decision making.

## 5. ATTITUDE

- Develop attitude to adopt ethical principles in all aspect of surgical practice, professional honesty and integrity are to fostered. Surgical care is to be delivering irrespective of the social status, caste, creed or religion of the patient.
- Willing to share the knowledge and clinical experience with professional colleagues.
- Willing to adopt new and techniques of surgical management developed from time to time based on scientific research which are in the best interest of the patient.
- Respect patient right and privileges, including patients right to information and right to seek a second opinion.
- Develop attitude to seek opinion from an allied medical and dental specialist as and when required.
- A student should develop an attitude towards embracing new research keeping abreast with the new developments in the field and must be able to critically evaluate the results before and after the application of knowledge and present it to the scientific community.

## 6. COMMUNICATION SKILLS

- Develop adequate communication skills particularly with the patients giving them the various options available to manage a particular surgical problem and obtain a true informed consent from them for the most appropriate treatment available at that point of time.
- Develop the ability to communicate with professional colleagues. Develop ability to teach undergraduates.
- The student should be able to take discuss the patient condition with the patient and patient relatives and should achieve expertise in taking true informed consent.

## 7. Course content

The program outline addresses both the The speciality of Oral & Maxillofacial Surgery deals with the diagnosis and management of the diseases of stomatognathic system, jaw bones, cranio-maxillofacial region, salivary glands and temporomandibular joints etc. Within this framework it also supports many vital organs like eye, oropharynx, nasopharynx and major blood vessels and nerves. The traumatic injuries of maxillofacial skeleton are independently managed by Oral & Maxillofacial Surgeons. Whenever there are orbital injuries the ophthalmologists are trained only to tackle injuries of the eye ball (globe) but if there are associated injuries of the orbital skeleton, the Maxillofacial Surgeon is involved in its re-construction. Similarly, nasal bone fracture may be managed by ENT surgeons. Most of the time nasal bone fractures are associated with fractures of the maxilla, mandible and zygomatic bones which are being managed by Oral & Maxillofacial Surgeons. The maxillofacial facial injuries at times are associated with head injuries also. The Oral & maxillofacial Surgeon is involved in the management of cleft lip & cleft palate, orthognathic surgery, micro vascular surgery, reconstructive and oncological surgical procedures of maxillofacial region. The speciality of Oral & Maxillofacial Surgery is a multi-disciplinary speciality and needs close working in co-ordination with Neurosurgeons, Oncosurgeons, Opthalmologists, ENT Surgeons and Plastic Surgeons. The Oral & Maxillofacial Surgeons, Ophthalmologist, ENT Surgeons, Plastic Surgeons, Neuro-Surgeons and Oncologists complement each other by performing Surgical Procedures with their respective expertise and knowledge thereby benefiting the patients and students of the respective specialities. knowledge needed in Oral and Maxillofacial Surgery and allied medical specialties in its scope. A minimum of three years of formal training through a graded system of education as specified will equip the trainee with skill and knowledge at its completion to be able to practice basic oral and Maxillofacial surgery competently and have the ability to intelligently pursue further apprenticeship towards advanced Maxillofacial surgery.

**The topics are considered as under: -**

**A) Applied Basic sciences**
**B) Oral and Maxillofacial surgery**
**C) Allied specialties**

### 1. Applied Basic Sciences:

Applied Anatomy, Physiology, Biochemistry, General and Oral Pathology and Microbiology, Pharmacology and Knowledge in Basic Statistics.

**Applied Anatomy:**

1. Surgical anatomy of the scalp, temple and face
2. Anatomy of the triangles of neck and deep structures of the neck
3. Cranial and facial bones and its surrounding soft tissues with its applied aspects in maxillofacial injuries.

A Muscles of head and neck; chest , lower and upper extremities (in consideration to grafts/flaps)

4. Arterial supply, venous drainage and lymphatics of head and neck
6. Congenital abnormalities of the head and neck
7. Surgical anatomy of the cranial nerves
8. Anatomy of the tongue and its applied aspects
9. Surgical anatomy of the temporal and infratemporal regions
10. Anatomy and its applied aspects of salivary glands, pharynx, thyroid and parathyroid gland, larynx, trachea, esophagus
11. Tooth eruption, morphology, and occlusion.
12. Surgical anatomy of the nose.
13. The structure and function of the brain including surgical anatomy of intra cranial venous sinuses.
14. Autonomous nervous system of head and neck
15. Functional anatomy of mastication, deglutition, speech, respiration and circulation
16. Development of face, paranasal sinuses and associated structures and their anomalies
17. TMJ: surgical anatomy and function

**Physiology:**

1. **Nervous system**
   - Physiology of nerve conduction, pain pathway, sympathetic and parasympathetic nervous system, hypothalamus and mechanism of controlling body temperature

2. **Blood**
   - Composition
   - Haemostasis, various blood dyscrasias and management of patients with the same
   - Hemorrhage and its control
   - Capillary and lymphatic circulation.
   - Blood grouping, transfusing procedures.

3. **Digestive system**
   - Saliva - composition and functions of saliva
   - Mastication, deglutition, digestion, assimilation
   - Urine formation, normal and abnormal constituents
4. **Respiration**
   - Control of ventilation, anoxia, asphyxia, artificial respiration
   - Hypoxia – types and management
5. **CardioVascular System**

- Cardiac cycle,
- Shock
- Heart sounds,
- Blood pressure,
- Hypertension:

**6. Endocrinology**

- General endocrinal activity and disorder relating to thyroid gland,
- Parathyroid gland, adrenal gland, pituitary gland, pancreas and gonads:
- Metabolism of calcium

**7. Nutrition**

- General principles of a balanced diet, effect of dietary deficiency, protein energy malnutrition, Kwashiorkor, Marasmus.
- Fluid and Electrolytic balance in maintaining haemostasis and significance in minor and major surgical procedures.

**Biochemistry:**

- General principles governing the various biological activities of the body, such as osmotic pressure, electrolytes, dissociation, oxidation, reduction etc.
- General composition of the body
- Intermediary metabolism
- Carbohydrates, proteins, lipids, and their metabolism
- Nucleoproteins, nucleic acid and nucleotides and their metabolism
- Enzymes, vitamins and minerals
- Hormones
- Body and other fluids.
- Metabolism of inorganic elements.
- Detoxification in the body.
- Antimetabolites.

**Pathology:**

**1. Inflammation –**

- Repair and regeneration, necrosis and gangrene
- Role of component system in acute inflammation,
- Role of arachidonic acid and its metabolites in acute inflammation,
- Growth factors in acute inflammation
- Role of molecular events in cell growth and intercellular signaling cell surface receptors
- Role of NSAIDs in inflammation,
- Cellular changes in radiation injury and its manifestation:

2. **Hemostasis**
   - Role of endothelium in thrombogenesis,
   - Arterial and venous thrombi,
   - Disseminated Intravascular coagulation
3. **Shock:**
   - Pathogenesis of hemorrhagic, neurogenic, septic, cardiogenic shock
   - Circulatory disturbances, ischemia, hyperemia, venous congestion, edema, infarction
4. **Chromosomal abnormalities:**
   - Marfans Syndrome, Ehler's Danlos Syndrome, Fragile X- Syndrome
5. **Hypersensitivity:**
   - Anaphylaxis, type 2 hypersensitivity, type 3 hyper sensitivity and cell mediated reaction and its clinical importance, systemic lupus erythematosus.
   - Infection and infective granulomas.
6. **Neoplasia:**
   - Classification of tumors.
   - Carcinogenesis and carcinogens- chemical, viral and microbial
   - Grading and staging of cancers, tumor Angiogenesis, Paraneoplastic syndrome, spread of tumors
   - Characteristics of benign and malignant tumors
7. **Others:**

   - Sex linked agammaglobulinemia.
   - AIDS
   - Management of immuno deficiency patients requiring surgical procedures
   - De George Syndrome
   - Ghons complex, post primary pulmonary tuberculosis – pathology and pathogenesis.

**<u>Oral Pathology:</u>**

- Developmental disturbances of oral and Para oral structures
- Regressive changes of teeth.
- Bacterial, viral and mycotic infections of oral cavity
- Dental caries,, diseases of pulp and periapical tissues
- Physical and chemical injuries of the oral cavity
- Oral manifestations of metabolic and endocrinal disturbances
- Diseases of jawbones and TMJ
- Diseases of blood and blood forming organs in relation to oral cavity
- Cysts of the oral cavity
- Salivary gland diseases
- Role of laboratory investigations in oral surgery

**Microbiology:**

- Immunity
- Knowledge of organisms commonly associated with diseases of oral cavity.
- Morphology cultural characteristics of strepto, staphylo, pneumo, gono, meningo, clostridium group of organisms, spirochetes, organisms of TB, leprosy, diphtheria, actinomycosis and moniliasis
- Hepatitis B and its prophylaxis
- Culture and sensitivity test
- Laboratory determinations
- Blood groups, blood matching, RBC and WBC count
- Bleeding and clotting time etc., smears and cultures
- Urine analysis and cultures.

**Applied Pharmacology and Therapeutics:**

1. Definition of terminologies used
2. Dosage and mode of administration of drugs.
3. Action and fate of drugs in the body
4. Drug addiction, tolerance and hypersensitivity reactions.
5. Drugs acting on the CNS
6. General and local anesthetics, hypnotics, analeptics, and tranquilizers.
7. Chemo therapeutics and antibiotics
8. Analgesics and antipyretics
9. Antitubercular and antisyphilitic drugs.
10. Antiseptics, sialogogues and antisialogogues
11. Haematinics
12. Antidiabetics
13. Vitamins A, B-complex, C, D, E, K

**B) Oral and Maxillofacial Surgery:**

- Evolution of Maxillofacial surgery.
- Diagnosis, history taking, clinical examination, investigations.
- Informed consent/medico-legal issues.
- Concept of essential drugs and rational use of drugs.
- Communication skills with patients- understanding, clarity in communication, compassionate explanations and giving emotional support at the time of suffering and bereavement
- Principles of surgical audit – understanding the audit of process and outcome. Methods adopted for the same. Basic statistics.
- Principles of evidence based surgery- understanding journal based literature study; the value of textbook, reference book articles, value of review articles; original articles and their critical assessment, understanding the value of retrospective, prospective, randomized control and blinded studies, understanding the principles and the meaning of various Bio-statistical tests applied in these studies.

- Principles of surgery- developing a surgical diagnosis, basic necessities for surgery, aseptic technique, incisions, flap designs, tissue handling, hemostasis, dead space management, decontamination and debridement, suturing, edema control, patient general health and nutrition.
- Medical emergencies – Prevention and management of altered consciousness, hyper sensitivity reaction, chest discomfort, respiratory difficulty.
- Pre-operative workup – Concept of fitness for surgery; basic medical work up; work up in special situation like diabetes, renal failure, cardiac and respiratory illness; risk stratification
- Surgical sutures, drains
- Post-operative care- concept of recovery room care, Airway management, Assessment of Wakefulness, management of cardio vascular instability in this period, Criteria for shifting to the ward, pain management
- Wound management- Wound healing, factors influencing healing, basic surgical techniques, Properties of suture materials, appropriate use of sutures.
- Surgical Infections – Asepsis and antisepsis, Microbiological principles, Rational use of antibiotics, special infections like Synergistic Gangrene and Diabetic foot infection, Hepatitis and HIV infection and cross infection.
- Airway obstruction/management – Anatomy of the airway, principles of keeping the airway patent, mouth to mouth resuscitation, Oropharyngeal airway, endotracheal intubation, Cricothyroidectomy, Tracheostomy.
- Anesthesia – stages of Anesthesia, pharmacology of inhalation, intravenous and regional anesthetics, muscle relaxants.
- Facial pain; Facial palsy and nerve injuries.
- Pain control – acute and chronic pain, cancer and non-cancer pain, patient controlled analgesia
- General patient management – competence in physical assessment of patients of surgery, competence in evaluation of patients presenting with acute injury, particularly to maxillofacial region. Competence in the evaluation of management of patients for Anesthesia
- Clinical oral surgery – all aspects of dento alveolar surgery
- Pre-prosthetic surgery – A wide range of surgical reconstructive procedures involving their hard and soft tissues of the edentulous jaws.
- Temporomandibular joint disorders – TMJ disorders and their sequelae need expert evaluation, assessment and management. It is preferable to be familiar with diagnostic and therapeutic arthroscopic surgery procedures.
- Tissue grafting – Understanding of the biological mechanisms involved in autogenous and heterogeneous tissue grafting.
- Reconstructive oral and maxillofacial surgery – hard tissue and soft tissue reconstruction.
- Cyst and tumors of head and neck region and their management – including principles of tumor surgery, giant cell lesion of jaw bones, fibro osseous lesions of jaw.
- Neurological disorders of maxillofacial region-diagnosis and management of Trigeminal Neuralgia, MPDS, Bell's palsy, Frey's Syndrome, Nerve injuries
- Maxillofacial trauma – basic principles of treatment, primary care, diagnosis and management of hard and soft tissue injuries, Comprehensive management including polytrauma patients
- Assessment of trauma-multiple injuries patient, closed abdominal and chest injuries, penetrating injuries, pelvic fractures, urological injuries, vascular injuries.

- Orthognathic surgery – The trainee must be familiar with the assessment and correcting of jaw deformities
- Laser surgery – The application of laser technology in the surgical treatment of lesions amenable to such therapy
- Distraction osteogenesis in maxillofacial region.
- Cryosurgeries – Principles, the application of cryosurgery in the surgical management of lesions amenable to such surgeries.
- Cleft lip and palate surgery- detailed knowledge of the development of the face, head and neck, diagnosis and treatment planning, Current concepts in the management of cleft lip and palate deformity, knowledge of nasal endoscopy and other diagnostic techniques in the evaluation of speech and hearing, concept of multi-disciplinary team management.
- Aesthetic facial surgery – detailed knowledge of structures of face & neck including skin and underlying soft tissues, diagnosis and treatment planning of deformities and conditions affecting facial skin, underlying facial muscles, bone, eyelids, external ear etc., surgical management of post acne scaring, face lift, blepharoplasty, otoplasty, facial bone recontouring etc.
- Craniofacial surgery – basic knowledge of developmental anomalies of face, head and neck, basics concept in the diagnosis and planning of various head and neck anomalies including facial cleft, craniosynostosis, syndromes, etc., Current concepts in the management of craniofacial anomalies.
- Head and neck oncology – understanding of the principles of management of head and neck oncology including various pre-cancerous lesions, Experience in the surgical techniques of reconstruction following ablative surgery.
- Micro vascular surgery.
- Implantology – principles, surgical procedures for insertion of various types of implants.
- Maxillofacial radiology/ radio diagnosis
- Other diagnostic methods and imaging techniques

**C) Allied Specialties:**

- General medicine: General assessment of the patient including children with special emphasis on cardiovascular diseases, endocrinal, metabolic respiratory and renal diseases, Blood dyscrasias
- General surgery: Principles of general surgery, exposure to common general surgical procedures.
- Neuro – surgery: Evaluation of a patient with head injury, knowledge & exposure of various Neuro – surgical procedures
- ENT/Ophthalmology: Examination of ear, nose, throat, exposure to ENT surgical procedures, ophthalmic examination and evaluation, exposure to ophthalmic surgical procedures.
- Orthopedic: basic principles of orthopedic surgery, bone diseases and trauma as relevant to Maxillofacial surgery, interpretation of radiographs, CT, MRI and ultrasound

- Anesthesiology: Evaluation of patients for GA technique, general anesthetic drugs use and complications, management of emergencies, various IV sedation techniques.
- Plastic Surgery- Basic Principles

**TEACHING / LEARNING ACTIVITIES:**

**The post graduate is expected to complete the following at the end of :**

***I Year***

Study of applied basic sciences including practicals (wherever necessary), basic computer sciences, exodontia, seminars on basic topics, selection of dissertation topic, library assignment topic, attending O.T, ward rounds, Medical Record keeping, Pre-clinical exercises, preparation of synopsis and its submission within the six months after admission to the university as per calendar of events.

**Course Enrichment**
**Preclinical exercises:**

- Different types of suturing techniques on a pillow
- Layer wise suturing and closure on a silicon mat
- Different wiring techniques on cast models
- Virtual surgical planning of single edentulous spaces and placement of implants virtually

**Rotation and postings in other departments:**

| | |
|---|---|
| General medicine | 1 month |
| General surgery | 1 month |
| Ophthalmology | 15 days |
| Neuro Surgery | 15 days |
| ENT | 15 days |
| Orthopedic | 15 days |
| Plastic Surgery | 15 days |
| Casualty | 15 days |
| Anesthesia (ICU) | 15 days |
| Radiology (CT, MRI, USG) | 15 days |

***II Year***

- Minor oral surgery and higher surgical training including observation and assisting under general anesthesia.
- Submission of library assignment
- Oncology posting – 1 month (Start of 2nd year)

***III Year***

- Maxillofacial surgery including assisting and operating under general anesthesia
- Submission of dissertation to the university, six months before the final examination.

It is desirable to enter general surgical skills and operative procedures that are observed, assisted or performed in the log book in the format as given below: -

| Sl.No | Procedure | Category | Number |
|---|---|---|---|
| 1 | Injection I.M. and I.V. | PI | 50, 20 |
| 2 | Minor suturing and removal of sutures | PI | N,A |
| 3 | Incision & drainage of an abscess | PI | 10 |
| 4 | Surgical extraction | PI | 15 |
| 5 | Impacted teeth | PI, A | 30,20 |
| 6 | Pre prosthetic surgery- | | |
| | corrective procedures | PI | 10 |
| | ridge extension | A | 3 |
| | ridge reconstruction | A | 3 |
| 7 | OAF closure | PI, A | 3,2 |
| 8 | Cyst enuleation | PI,A | 5,5 |
| 9 | Mandibular fractures | PI,A | 10,10 |
| 10 | Peri-apical surgery | PI,A | 5 |
| 11 | Infection management | PI,A | 3,3 |
| 12 | Biopsy procedures | PI, A | 10, 3 |
| 13 | Removal of salivary calculi | A | 3 |
| 14 | Benign tumors | A | 3,3 |
| 15 | mid face fractures | PI,A | 3,5 |
| 16 | Implants | PI,A | 5,5 |
| 17 | Tracheotomy | A | 2 |
| 18 | Skin grafts | PI,A | 2,2 |
| 19 | Orthognathic surgery | A,O | 3,5 |
| 20 | Harvesting bone & cartilage | A,O | 3,5 |

| | | | |
|---|---|---|---|
| | grafts | A,O | 3,3 |
| | Iliac crest | A,O | 2,2 |
| | Rib | A,O | 2,2 |
| | Calvarial | | |
| | Fibula | | |
| 21 | T.M. Joint surgery | A | 3 |
| 22 | Jaw resections | A,O | 3,5 |
| 23 | Onco surgery | A,O | 3,3 |
| 24 | Micro vascular anastomosis | A,O | 2,2 |
| 25 | Cleft lip & palate | A,O | 3,5 |
| 26 | Distraction osteogenesis | A,O | 2,3 |
| 27 | Rhinoplasty | A,O | 2,3 |
| 28 | Access osteotomies and | A,O | 1,3 |
| | base of skull surgeries | | |
| 29 | Emergency Management for | PI,O | 5,5 |
| | OMFS Patients in Casualty / | | |
| | Accident & Emergency | | |

PI: - Performed Independently
A: - Assisted
O: - Observed

**Didactic Lectures on**

- Relevant anatomy of TMJ region and its relations
- Brief account of TMJ disorderes with radiographic evaluation
- Introduction to arthrocentesis and its indications
- Criteria for patient selection
- Description of the armamentarium required
- Lavage solutions and medications
- Technique
- Advantages and post treatment prognosis
- Brief introduction to arthroscopy.

**Monitoring Learning Progress:**

It is essential to monitor the learning progress to each candidate through continuous appraisal and regular assessment. It not only helps teachers to evaluate students, but also students to evaluate themselves. The monitoring to be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using checklists that assess various aspects.

**Paper wise distribution of syllabus:**

**PART- I:**

**Applied Basic Sciences**

**PART-II:**

**Paper– I: Minor Oral Surgery and Maxillofacial Trauma**

**Minor Oral Surgery:**

- **Principles of Surgery**: Developing A Surgical Diagnosis, Basic Necessities For Surgery, Aseptic Technique, Incisions, Flap Design Tissue Handling, Haemostasis, Dead Space Management, Decontamination And Debridement, Suturing, Oedema Control, Patient General Health And Nutrition.
- **Medical Emergencies**: Prevention and management of altered cons-ciousness (syncope, orthostatic hypotension, seizures, diabetes mellitus, adrenal insufficiency), hypersensitivity reactions, chest discomfort, and respiratory difficulty.
- **Examination and Diagnosis**: Clinical history, physical and radiographic, clinical and laboratory diagnosis, oral manifestations of systemic diseases, implications of systemic diseases in surgical patients.
- **Haemorrhage and Shock**: Applied physiology, clinical abnormalities of coagulation, extra vascular hemorrhage, and hemorrhagic lesions, management of secondary hemorrhage, shock.
- **Exodontia**: Principles of extraction, indications and contraindications, types of extraction, complications and their management, principles of elevators and elevators used in oral surgery.
- **Impaction:** Surgical anatomy, classification, indications and contraindications, diagnosis, procedures, complications and their management.
- **Surgical aids to eruption of teeth**: Surgical exposure of unerupted teeth, surgical repositioning of partially erupted teeth.
- **Transplantation of teeth**
- **Surgical Endodontics:** Indications and contraindications, diagnosis, procedures of periradicular surgery
- **Preprosthetic Surgery:** Requirements, types (alvoloplasty, tuberosity reduction, mylohyoid ridge reduction, genial reduction, removal of exostosis, vestibuloplasty)
- **Procedures to Improve Alveolar Soft Tissues**: Hypermobile tissues- operative / sclerosing method, epulis fissuratum, frenectomy and frenotomy
- **Infectionsof Head and Neck:** Odontogenic and non Odontogenic infections, factors affecting spread of infection, diagnosis and differential diagnosis, management of facial space infections, Ludwig angina, cavernous sinus thrombosis.
- **Chronic infections of the jaws:** Osteomyelitis (types, etiology, pathogenesis, management) osteoradionecrosis
- **Maxillary Sinus:** Maxillary sinusitis – types, pathology, treatment, closure of Oro – antral fistula, Caldwell- luc operation
- **Cysts of the Orofacial Region:** Classification, diagnosis, management of OKC, dentigerous, radicular, non Odontogenic, ranula

- **Neurological disorders of the Maxillofacial Region:** Diagnosis and management of trigeminal neuralgia, MPDS, bell's palsy, Frey's syndrome, nerve injuries.
- **Implantology**: Definition, classification, indications and contraindications, advantages and disadvantages, surgical procedure.
- **Anesthesia** Local
  Anesthesia**:**
  Classification of local anesthetic drugs, mode of action, indications and contra indications, advantages and disadvantages, techniques, complications and their management.
  General Anesthesia:
  Classification, stages of GA, mechanism of action, indications, and contra indications, advantages and disadvantages, post anesthetic complications and emergencies, anesthetic for dental procedures in children, pre medication, conscious sedation, legal aspects for GA

**Maxillofacial Trauma:**

- Surgical Anatomy of Head and Neck.
- Etiology of Injury.
- Basic Principles of Treatment
- Primary Care: resuscitation, establishment of airway, management of hemorrhage, management of head injuries and admission to hospital.
- Diagnosis: clinical, radiological
- Soft Tissue Injury of Face and Scalp: classification and management of soft tissue wounds, injuries to structure requiring special treatment.
- Dento Alveolar Fractures: examination and diagnosis, classification, treatment, prevention.
- Mandibular Fractures: classification, examination and diagnosis, general principles of treatment, complications and their management
- Fracture of Zygomatic Complex: classification, examination and diagnosis, general principles of treatment, complications and their management.
- Orbital Fractures: blow out fractures
- Nasal Fractures
- Fractures of Middle Third of the Facial Skeleton: emergency care, fracture of maxilla, and treatment of le fort I, II, III, fractures of Naso orbito ethmoidal region.
- Opthalmic Injuries: minor injuries, non-perforating injuries, perforating injuries, retro bulbar hemorrhage, and traumatic optic neuropathy.
- Traumatic Injuries To Frontal Sinus: diagnosis, classification, treatment
- Maxillofacial Injuries in Geriatric and Pediatric Patients.
- Gun Shot Wounds and War Injuries
- Osseointegration in Maxillofacial Reconstruction
- Metabolic Response to Trauma: neuro endocrine responses, inflammatory mediators, clinical implications
- Healing of Traumatic Injuries: soft tissues, bone, cartilage, response of peripheral nerve to injury
- Nutritional consideration following Trauma.
- Tracheostomy: indications and contraindications, procedure, complications and their management.

**Paper – II: Maxillofacial Surgery**

**a) Salivary gland**

- Sialography
- Salivary fistula and management
- Diseases of salivary gland – developmental disturbances, cysts, inflammation and sialolithiasis
- Mucocele and Ranula
- Tumors of salivary gland and their management
- Staging of salivary gland tumors
- Parotidectomy

**b) Temporomandibular Joint**

- Etiology, history signs, symptoms, examination and diagnosis of temporomandibular joint disorders
- Ankylosis and management of the same with different treatment modalities
- MPDS and management
- Condylectomy – different procedures
- Various approaches to TMJ
- Recurrent dislocations – Etiology and Management

**c) Oncology**

- Biopsy
- Management of pre-malignant tumors of head and neck region
- Benign and Malignant tumors of Head and Neck region
- Staging of oral cancer and tumor markers
- Management of oral cancer
- Radical Neck dissection
- Modes of spread of tumors
- Diagnosis and management of tumors of nasal, paranasal, neck, tongue, cheek, maxilla and mandible
- Radiation therapy in maxillofacial regions
- Lateral neck swellings

**d) Orthognathic surgery**

- Diagnosis and treatment planning
- Cephalometric analysis
- Model surgery
- Maxillary and mandibular repositioning procedures
- Segmental osteotomies
- Management of apertognathia

- Genioplasty
- Distraction osteogenesis

**e) Cysts and tumors of oro facial region**

- Odontogenic and non-Odontogenic tumors and their management
- Giant Cell lesions of jawbone
- Fibro osseous lesions of jawbone
- Cysts of jaw

**f) Laser surgery**

- The application of laser technology in surgical treatment of lesions

**g) Cryosurgery**

- Principles, applications of cryosurgery in surgical management

**h) Cleft lip and palate surgery**

- Detailed knowledge of the development of the face, head and neck
- Diagnosis and treatment planning
- Current concepts in the management of cleft lip and palate deformity
- Knowledge of Naso endoscopy and other diagnostic techniques in the evaluation of speech and hearing
- Concept of multidisciplinary team management

**i) Aesthetic facial surgery**

- Detailed knowledge of the structures of the face and neck including skin and underlying soft tissue
- Diagnosis and treatment planning of deformities and conditions affecting facial skin
- Underlying facial muscles, bone, Eyelids, external ear
- Surgical management of post acne scarring, facelift, blepharoplasty, otoplasty, facial bone recontouring, etc

**j) Craniofacial surgery**

- Basic knowledge of developmental anomalies of the face, head and neck
- Basic concepts in the diagnosis and planning of various head and neck anomalies including facial clefts, craniosynostosis, syndromes, etc.
- Current concept in the management of Craniofacial anomalies

**Paper – III:** Essays (descriptive and analyzing type questions)

**<u>Scheme of Examination:</u>**

Part-II: Paper-I, Paper-II & Paper-III – 300 Marks
(100 Marks for each paper)

Written examination shall consist of Basic Sciences Paper (Part-I) of three hours duration and should be conducted at the end of First year of MDS course. Part-II Examination will be conducted at the end of Third year of MDS course. Part-II Examination will consist of Paper-I, Paper-II & Paper-III, each of three hours duration. Paper-I & Paper-II shall consist of two long answer questions carrying 25 marks each and five questions carrying 10 marks each. Paper-III will be on Essays. In Paper-III three Questions will be given and student has to answer any two questions. Each question carries 50 marks. Questions on recent advances may be asked in any or all the papers. Distribution of topics for each paper will be as follows: *

**PART-I** : Applied Basic Sciences: Applied Anatomy, Physiology, & Biochemistry, Pathology, Microbiology, Pharmacology, Research Methodology and Biostatistics.

**PART- II**

**Paper – I :** Minor Oral Surgery and Maxillofacial Trauma
**Paper – II:** Maxillofacial Surgery
**Paper – III:** Essays (descriptive and analyzing type questions)

**The topics assigned to the different papers are generally evaluated under those sections. However, a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics*.

**1. Minor Oral Surgery - 100 Marks**

Each candidate is required to perform the minor oral surgical procedures under local anesthesia. The minor surgical cases may include removal of impacted lower third molar, cyst enucleation, any similar procedure where students can exhibit their professional skills in raising the flap, removing the bone and suturing the wound.

**2. Case presentation and discussion: 100 Marks**

(a) One long case 60 Marks

(b) Two short cases 40 Marks (20 Marks each)

**C. Viva Voce 100 Marks**

***i. Viva-Voce examination:*** *80 Marks*

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression, interpretation of data and communication skills. It includes all components of course contents. It includes presentation and discussion on dissertation also.

***ii. Pedagogy:*** *20 Marks*

A topic be given to each candidate in the beginning of clinical examination. He/she is asked to make a presentation on the topic for 8-10 minutes.

**List of books**

| Sr. No. | TITLES |
|---|---|
| 1 | Implants in Dentistry By BLOCK,M S W.B.SAUNDERS :London 1st Ed. |
| 2 | Killey&kay's outline of oral surg.I By SEWARD:Bombay:VARGHESE 2nd ed. |
| 3 | Killey' fractures of the mandible By BANKS,P: BOMBAY:VARGHESE 4th Ed. |
| 4 | Medical emergencies in the dental office By MALAMED: HARCOURT 5th Ed |
| 5 | Oral and max.surgery volume1:By LASKIN D M PUB: DELHI :AITBS 1st Ed. |
| 6 | Oral and maxillofacial surgery volume 2 : By LASKIN D M AITBS : Delhi 1st Ed. |
| 7 | Outline of oral surgery part IIBy KILLEY,H C: BOMBAY :VARGHESE 1st Ed. |
| 8 | Principles of oral surgeryBy MOORE,J R : NEW DELHI :JAYPEE 4th Ed |
| 9 | T.B. of oral & Maxi. Surgery By KRUGER,G O:NEW DELHI :JAYPEE 6th Ed. |
| 10 | Tooth extraction :A pract. Guide By ROBINSON,P D Varghese :Mumbai 1st Ed |
| 11 | Treat. of facial cleft deformities ByBUTOW,K W: NEW DELHI :AITBS 1st Ed. |
| 12 | T.B. of Oral & Maxillofacial Surgery By Neelima Malik Jaypee:New Delhi 1st Ed. |
| 13 | Contemporary Oral Surgery By Peterson Elsevier:New Delhi 4th Ed. |
| 14 | Medical Problems in Dentistry By Scully Varghese:Mumbai 4th Ed. |
| 15 | T.B. of Oral & Maxillofacial Surgery By Kruger Jaypee:New Delhi 6th Ed. |
| 16 | Oral & Maxillofacial Truma 2 Volume By Fonseca Elsevier:New Delhi 3rd Ed. |
| 17 | Minor oral surgery By HOWE,G L: MUMBAI :VARGHESE 3rd Ed. |
| 18 | MCQs in Oral Surgery By Parmar B S: JAYPEE NEW DELHI-1st Ed. |
| 19 | T.B.of Oral and Maxillo.surgery By Balaji S M:ELSEVIER-NEW DELHI 1st Ed. |
| 20 | Princ.of Oral & Max.Surgery Vol-1 By Miloro,M BC DECKER:London 2nd Ed. |
| 21 | Princ.of Oral & Max.Surgery Vol-2 By Miloro,M BC DECKER:London 2nd Ed. |
| 22 | Contemporary Implant Surgery By Misch C Elsevier:New Delhi 3rd Ed. |
| 23 | Contemporary Maxillofacial Surgery By Peterson Elsevier:New Delhi 4th Ed. |
| 24 | Cysts of Orofacial Region By Shear,M Black:Lowa 4th Ed. |
| 25 | Oral Surgery Vol.1 By Seward G R Varghese:Mumbai 2nd Ed. |
| 26 | Oral Surgery Vol.2 By Killey H C Varghese Mumbai 1st Ed. |
| 27 | Mandibular Fracture By Banks,P Varghese:Mumbai 4th Ed. |
| 28 | Oral & Maxillofacial Surgery Vol.1 By Laskin D M AITBS:New Delhi 1st Ed. |
| 29 | Oral & Maxillofacial Surgery Vol.2 By Laskin D M AITBS:New Delhi 1st Ed. |
| 30 | Maxillofacial Infection By Topazian,R G Elsevier :Noida 4th Ed. |
| 31 | Oral Cancer Head,Neck Surgery & Oncology By Shah J Martin Dunitz 1st Ed. |

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| 32 | Maxillofacial SurgeryVol 1 By Wardbooth P Churchill Livingstone 2nd Ed. |
| 33 | Maxillofacial SurgeryVol 2 By Wardbooth P Churchill Livingstone 2nd Ed. |
| 34 | Oral & Maxillofacial Trauma Vol.1 By Fonseca,R J Elsevier:Noida 3rd Ed. |
| 35 | Oral & Maxillofacial Trauma Vol.2 By Fonseca,R J Elsevier:Noida 3rd Ed. |
| 36 | Oral & Maxillofacial Surgery Vol.1 By Fonseca,R J Elsevier New Delhi 1st Ed. |
| 37 | Oral & Maxillofacial Surgery Vol.2 By Fonseca,R J Elsevier New Delhi 1st Ed. |
| 38 | Oral & Maxillofacial Surgery Vol.3 By Fonseca,R J Elsevier New Delhi 1st Ed. |
| 39 | Oral & Maxillofacial Surgery Vol.4 By Fonseca,R J Elsevier New Delhi 1st Ed. |
| 40 | Oral & Maxillofacial Surgery Vol.5 By Fonseca,R J Elsevier New Delhi 1st Ed. |
| 41 | Oral & Maxillofacial Surgery Vol.6 By Fonseca,R J Elsevier New Delhi 1st Ed. |
| 42 | Oral & Maxillofacial Surgery Vol.7 By Fonseca,R J Elsevier New Delhi 1st Ed. |
| 43 | Textbook of Oral & Maxillofacial Surgery By Malik N Jaypee:New Delhi 2nd Ed. |
| 44 | Fractures Maxillofacial Injuries Vol.1 By Rowe,N L Elsevier:Noida 1st Ed. |
| 45 | Fractures Maxillofacial Injuries Vol.2 By Rowe,N L Elsevier:Noida 1st Ed. |
| 46 | MCQs in Oral & Max. Surgery For PG By Chandra:JAYPEE NEW Delhi 1st Ed. |
| 47 | MCQs in Oral & Max. Surgery By Lalita : JAYPEE NEW DELHI 1st Ed. |
| 48 | MCQs in Oral Surgery By Parmar : JAYPEE NEW DELHI 1st Ed. |
| 49 | MCQs in Surgery By Sood : Elsevier NEW DELHI 1st Ed. |
| 50 | Dental Clinical Advisor By Hupp Elsevier:Noida 1st Ed. |
| 51 | Contemoporary Oral & Maxillofacial Surgery By Hupp Elsevier:Noida 5th Ed. |
| 52 | Distraction Osteogenesis of Facial Skeleton By Bell C A:BC Decker 1st ED. |
| 53 | Implantology made easy By Chaturvedi T P:Jaypee 1st Ed. |
| 54 | Principles & Practice of Laser Dentistry By Convissar R A:Mosby 1st Ed. |
| 55 | Orthodontic & Orthognathic Surgery: Diagnosis & Planning By Gregoret 1st Ed. |
| 56 | Atlas of Craniomaxillofacial Osteosynthesis By Haerle 2nd Ed. |
| 57 | Contemporary Oral & Maxillofacial Surgery By Hupp J P:Elsevier 5th Ed. |
| 58 | Complication in Oral & Maxillofacial Surgery By Kaban L B:Elsevier 1st Ed. |
| 59 | Pediatric Oral & Maxillofacial Surgery 2009 By Kaban L B:Elsevier 1st Ed. |
| 60 | Bone Grafting Techniques for Maxillary Implants By Kahnberg :Blackwell 1st Ed. |
| 61 | Infection Control & Management of Hazardous By Miller C H:Elsevier 4th Ed. |
| 62 | Craniofacial & Maxillofacial Surgery in Children By Posnick J C 1st Ed. |
| 63 | Atlas of Dentofacial Orthopedics for Growing child By Saadia:ESPAXS 1st Ed. |
| 64 | Manual of Dental Implants By Sarment D P:LEXI 1st Ed. |
| 65 | Oral & Maxillofacial Disease 4th Edition By Scully C:informa 4th Ed. |
| 66 | Oral & Maxillofacial Disease 3rd Edition By Scully C:informa 3rd Ed. |
| 67 | Clinical & Laboratory Manual of Implant overdentures By Shafie:Blackwell 1st Ed. |
| 68 | Manipal Manual of Surgery with Clinnical Methods By Shenoy:CBS 2nd Ed. |
| 69 | The art of computer guided Implantology By Tardieu:Quintessence 1st Ed. |
| 70 | Surgical Correction of Facial Deformities By Mani V Jaypee1st Ed. |
| 71 | Maxillofacial Trauma & Esthetic Facial Reconstruction By Booth:Elsevier 1st Ed. |
| 72 | Local Anaesthesia in Dentistry. 2009 Baart,J A:Blackwell 1st Ed. |
| 73 | Handbook of Local Anaesthesia By Malamed S F:Elsevier 5th Ed. |
| 74 | Medical Emergencies in the Dental Office By Malamed S F:Elsevier 6th ed. |
| 75 | Manual of Temporomandibular Disorders By Wright:Blackwell 2nd ed. |
| 76 | Gray's Anatomy:The Anatomical Basis of Clinical Practice By Standring 14th Ed. |
| 77 | Fracture of Middle-third of the Facial Skeleton By Sen:Jaypee 1st Ed. |
| 78 | Fracture of Mandible By Sen:Jaypee 1st Ed. |
| 79 | Contemporary Treatment of Dentofacial Deformity By Proffit:Wlsevier 1st Ed. |

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| 80 | Medical Emergiencies in the Dental Office By Malamed:Elsevier 6th Ed. |
| 81 | A Concise Textbook of surgery By Das S 6th Ed. |
| 82 | Handbook of surgery By Basu S C:Current 2nd Ed. |
| 83 | Textbook of Oral & Maxillofacial Surgery By Malik N Jaypee:New Delhi 2nd Ed. |
| 84 | Biochemistry By Satynarayana 3rd Ed. |
| 85 | Oral & Maxillofacial infection By Topazian 4th Ed. |
| 86 | Textbook of surgical short case By Das S 4th Ed. |
| 87 | A System of surgical diagnosis By Patel T N:Jaypee 2nd Ed. |
| 88 | A manual of clinical surgery By Das S 8th Ed. |
| 89 | Anesthesia & Analgesia in Dentistry By Bajaj,P:Paras 1st Ed. |
| 90 | Gray's anatomy for students By Drake R L:Elsevier 2nd Ed. |
| 91 | A manual of clinical surgery By Das S 8th Ed. |
| 92 | Textbook of Medical Physiology By Hall J E:Elsevier 12th Ed. |
| 93 | Textbook of Oral & Maxillofacial Surgery By Kruger:Jaypee:New Delhi 6th Ed. |
| 94 | Essentials of pharmacology for dentistry By Tripathy, K D |
| 95 | Essentials of medical pharmacology for dentistry By Tripathy, K D |
| 96 | Essentials of medical physiology By Sembulingum, K |
| 97 | Consice Medical Physiology By Chaudhri S K |
| 98 | Essential Pathology for Dental Students By Mohan, M |
| 99 | Textbook of Pathology By Mohan, M |
| 100 | Pathology quick review and MCQs By Mohan, M |
| 101 | Multiple Choice Questions In Anatomy By Bhutnagar, S M Roychaudhary S |
| 102 | MCQs in Biochemistry By Sharma D C and Riyut M |
| 103 | MCQs on Head and Neck Anatomy For Dental Students By Chandra S |
| 104 | MCQs on Physiology For Dental Students with explanations By Chandra S |
| 105 | MCQs on Pharmacology For Dental Students By Chandra:Jaypee New Delhi 1st Ed. |
| 106 | Consice Pharmacology: Basic and Applied By Bhagwat, A W |
| 107 | Pharmacology and Pharmacotherapeutics By Satoskar R S |
| 108 | Textbook of Microbiology By Ananthnarayan, R and Panikar C K |
| 109 | Craniofacial & Maxillofacial Surgery in Children and Young By Posnick |

**M.D.S**

**SUBJECT: ORAL & MAXILLOFACIAL SURGERY**

| Teaching Scheme (Hours) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | External | | Internal | | Total |
| Lec(L) | Prac(P) | Clinical(C) | Total | | Theory | Pract | Theory | Pract | |
| 946 | 939 | 4877 | 6762 | | 2 | 1 | 2 | 1 | 6 |

## A. COURSE OVERVIEW

To produce a post graduate who is competent in performing extraction of teeth under both local and general anesthesia, perform with competence minor oral surgical procedures and common maxillofacial surgery, prevent and manage related complications, acquire a reasonable knowledge and understanding of the various diseases, injuries, infections occurring in the Oral & Maxillofacial region and offer solutions to such of those common conditions and has an exposure in to the in-patient management of maxillofacial problems

## B. COURSE CONTENT

| NO | TOPIC | L+P+C | CLs |
|---|---|---|---|
| 1 | Applied Anatomy | 14+14+70 | CL1 |
| 2 | Physiology | 14+14+70 | CL1 |
| 3 | Biochemistry | 14+14+70 | CL1 |
| 4 | Pathology | 14+14+70 | CL1 |
| 5 | Oral Pathology | 14+14+70 | CL1,2 |
| 6 | Microbiology | 14+14+70 | CL1 |
| 7 | Applied Pharmacology and Therapeutics | 14+14+70 | CL1 |
| | Oral and Maxillofacial Surgery | | |
| 8 | Evolution of Maxillofacial surgery | 2+0+10 | CL1 |
| 9 | Diagnosis, history taking, clinical examination, investigations | 2+0+10 | CL1 |
| 10 | Informed consent/medico-legal issues | 2+0+10 | CL1 |
| 11 | Concept of essential drugs and rational use of drugs | 4+0+20 | CL1 |
| 12 | Communication skills with patients | 2+0+10 | CL1 |
| 13 | Principles of surgical audit | 14+0+70 | CL1 |
| 14 | Principles of evidence based surgery | 14+0+70 | CL1 |
| 15 | Principles of surgery | 26+0+130 | CL1 |
| 16 | Medical emergencies | 26+0+130 | CL1 |
| 17 | Pre operative workup | 13+0+65 | CL1,2,3 |
| 18 | Surgical sutures, drains | 2+0+10 | CL1 |
| 19 | Post operative care | 2+0+10 | CL1 |
| 20 | Wound management | 2+0+10 | CL1 |
| 21 | Surgical Infections | 6+0+30 | CL1,2,3,5 |

| | | | |
|---|---|---|---|
| **22** | Airway obstruction/management | 7+0+35 | CL1,2,4,5 |
| **23** | Anesthesia | 14+0+70 | CL1,2,4,5 |
| **24** | Facial pain; Facial palsy and nerve injuries | 6+0+30 | CL1,2,5 |
| **25** | Pain control | 6+0+30 | CL1,2,5,6 |
| **26** | General patient management | 30+0+150 | CL1,2,4,5,6 |
| **27** | Clinical oral surgery | 32+0+160 | CL1,2,5,6 |
| **28** | Pre-prosthetic surgery | 20+0+100 | CL1,4,5,6 |
| **29** | Temporomandibular joint disorders<br>(TMJ Arthrocentesis) | 35+0+175<br>10 +3+17 | CL1,2,3,4,5,6 |
| **30** | Tissue grafting | 20+0+100 | CL1,2,3,4,5,6 |
| **31** | Reconstructive oral and maxillofacial surgery | 20+0+100 | CL1,2,4,6 |
| **32** | Cyst and tumors of head and neck region | 40+0+200 | CL1,2,3,4,5,6 |
| **33** | Neurological disorders | 20+0+100 | CL1,2,3,4,5 |
| **34** | Maxillofacial trauma | 60+0+300 | CL1,2,3,4,5,6 |
| **35** | Assessment of trauma-multiple injuries patient | 35+0+175 | CL1,2,3,4,5,6 |
| **36** | Orthognathic surgery | 40+0+200 | CL1,2,3,4,5,6 |
| **37** | Laser surgery | 20+0+100 | CL1,2,5,6 |
| **38** | Distraction osteogenesis in maxillofacial region | 30+0+300 | CL1,2,3,4,5,6 |
| **39** | Cryosurgeries | 24+0+120 | CL1,2,6 |
| **40** | Cleft lip and palate surgery | 30+0+150 | CL1,2,3,4,6 |
| **41** | Craniofacial surgery | 30+0+150 | CL1,2,3,4,6 |
| **42** | Head and neck oncology | 50+0+250 | CL1,2,3,4,6 |
| **43** | Micro vascular surgery | 20+0+100 | CL1,2,3,4,6 |
| **44** | Implantology | 30+0+150 | CL1,2,3,4,5,6 |
| **45** | Maxillofacial radiology/ radio diagnosi | 20+0+100 | CL1,2,3,6 |
| **46** | Other diagnostic methods and imaging technique | 16+0+90 | CL1,2,3,6 |
| **47** | General medicine | 13+90+0 | CL1,2,3 |
| **48** | General surgery | 13+90+0 | CL1,2,3 |
| **49** | Neuro – surgery | 13+90+0 | CL1,2,3 |
| **50** | ENT/Ophthalmology | 13+90+0 | CL1,2,3 |
| **51** | Orthopedic | 13+90+0 | CL1,2,3 |
| **52** | Anesthesiology | 14+90+0 | CL1,2,3 |
| **53** | Plastic Surgery | 13+90+0 | CL1,2,3 |
| **54** | PRE – CLINICAL EXERCISES | 0+208+0 | CL1,2 |

## C. TEXT BOOKS

## D. REFERENCE BOOKS


1. ALLING JOHN F & ET AL; IMPACTED TEETH, 1S EDITION, SAUNDERS , 1993.
2. PETERSON LJ & ET AL; PRINCIPLES OF ORAL AND MAXILLOFACIAL SURGERY; VOL.1,2 & 3, 3RD EDITION, B.C DECKER PUBLICATIONS, 2012.
3. MALAMED SF; HANDBOOK OF MEDICAL EMERGENCIES IN THE DENTAL OFFICE, 7TH EDITION, MOSBY, 2014.

4. Banks P; Killeys Fractures of the mandible, 4th edition, Varghese Publishing House, 2018.
5. B29anks P; Killeys fractures of the middle 3rd of the facial skeleton, subse30quent edition, John Wright, 1998.
6. Seward GR & et al; Killey and Kays -Outline of oral surgery – Part-1, Butterworth-Heinemann Ltd., 1987.
7. Mc Carthy FM; Essentials of safe dentistry for the medically compromised patients, Saunders, 1989.
8. Howe, GL; Extraction of teeth, 2nd edition, Butterworth-Heinemann Ltd., 1974.
9. Howe, GL; Minor Oral Surgery, 3nd edition, Butterworth-Heinemann Ltd., 1985.

## E. COMPETENCY LEVEL

| CL Number | Skill | Statement |
|---|---|---|
| **CL1** | Knowledge | • To have acquired adequate knowledge and understanding of the etiology, pathophysiology and diagnosis, treatment planning of various common oral and Maxillofacial surgical problems both minor and major in nature<br>• To have understood the general surgical principles like pre and post surgical management, particularly evaluation, post surgical care, fluid and electrolyte management, blood transfusion and post surgical pain management. |
| **CL2** | Investigations | • Competent to take intra-oral radiographs and interpret the radiographic findings and adequate knowledge about common laboratory investigations and interpretation of their results |
| **CL3** | Patient Care: Diagnosis | • Should have acquired the skill to examine any patient with a basic oral surgical problem in an orderly manner<br>• Get familiarized with concepts of osseointegration and basic surgical aspects of implantology |
| **CL4** | Patient Care: Treatment planning | • Ethically Integrate multiple disciplines into an individual comprehensive sequence treatment plan using diagnostic and prognostic information |
| **CL5** | Patient Care: Treatment | • Should be competent in the extraction of the teeth under both local and general anaesthesia<br>• Competent to carry out certain minor oral surgical procedure and common maxillofacial surgery under LA like trans-alveolar extraction, frenectomy, dentoalveolar procedures, simple impaction, biopsy, etc. |

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| **CL6** | Research and Innovation | • Upgradation of knowledge and skill from time to time, familiarize with new concept and equipment in oral and maxillofacial surgery. |

**PROGRAM SPECIFIC OUTCOME (PSO)**

| | | |
|---|---|---|
| PSO1 | DIAGNOSIS | • Understanding of basic sciences relevant to practice of oral and maxillofacial surgery<br>• Essential knowledge of personal hygiene and infection control, prevention of cross infection and safe disposal of hospital waste keeping in view the high prevalence of hepatitis and HIV. |
| PSO2 | INVESTIGATIONS | • Competent to take intra-oral radiographs and interpret the radiographic findings and adequate knowledge about common laboratory investigations and interpretation of their results |
| PSO3 | TREATMENT | • To perform with competence minor oral surgical procedures and common maxillofacial surgery. To treat both surgically and medically the problems of the oral and Maxillofacial and the related area |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CL1** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CL2** | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CL3** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CL4** | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CL5** | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 2 | 1 | 3 | 3 | 2 | 3 | 3 | 3 |
| **CL6** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **Avg** | **2.8** | **2.5** | **3** | **3** | **2.6** | **2.5** | **2.8** | **2.5** | **2.6** | **2.8** | **2.5** | **2.3** | **2.6** | **3** | **2.8** | **3** | **2.5** | **2.3** |

# CONSERVATIVE DENTISTRY AND ENDODONTICS

**Operative dentistry- is the art and science of the diagnosis, treatment, and prognosis of defects of teeth that do not require full coverage restorations for correction. Such treatment should result in the restoration of proper tooth form, function and esthetics while maintaining the physiologic integrity of the teeth in harmonious relationship with the adjacent hard and soft tissues, all of which should enhance the general health and welfare of the patient.**

**Endodontics - is defined as that branch of dentistry concern with the morphology, physiology and pathology of the human dental pulp and peri-radicular tissues. It is a study and practice encompass the basics and clinical science including biology of normal pulp, etiology, diagnosis, prevention and treatment of disease and injuries of pulp and associated peri-radicular tissues.**

**Aesthetic Dentistry- is defined as appreciative of, responsive to or zealous about the beautiful having sense of beauty or fine culture.**

## 1. OBJECTIVES:

**The following objectives are laid out to achieve the goals of the course. These are to be achieved by the time the candidate completes the course. The objectives may be considered under the following subtitles A. Knowledge:**

- **Describe aetiology, pathophysiology, periapical diagnosis and management of common restorative situations, endodontic situation that will include contemporary management of dental caries, management of trauma and pulpal pathosis including periodontal situations.**
- **Demonstrate understanding of basic sciences as relevant to conservative/restorative dentistry and endodontics.**
- **Identify social economic environmental and emotional determinants in a given case or community and take them into account for planning and execution at individual community level.**
- **Ability to master differential diagnosis and recognize that may require multi-disciplinary approach or clinical situation outside the realm of the specialty**

**which he or she should be able to recognize and refer to appropriate specialist.**

- **Update himself by self-study and by attending basic and advanced courses conferences seminars and workshops in the speciality of conservative dentistry-endodontics-dental materials and restorative dentistry.**
- **Ability to teach/guide, colleagues and other students.**
- **Use information technology tools and carry out research both basic and clinical with the aim of his publishing his work and presenting the same at scientific platform.**
- **Acquiring knowledge to evidence-based decision making, appraising evidence, implementing evidence-based decision in clinical practice. C. Skills:**
- **Take proper chair side history, examine the patient and perform medical and dental diagnostic procedures and order as well as perform relevant tests and interpret to them. To come to a reasonable diagnosis about the dental condition in general and conservative dentistry-endodontics in particular and undertake complete patient monitoring including pre-operative as well as post-operative care of the patients.**
- **Perform all levels of restorative work and surgical and non-surgical Endodontics including part of multidisciplinary approach to clinical condition.**
- **Provide basic life support in emergency situations.**
- **Manage acute pulpal and pulpo- periodontal situations.**
- **Have a thorough knowledge of infection control measures in the dental clinical environment and laboratories.**

- **Student should be able to identify clinical problem, acquired the most suitable evidence and critically appraise the same along with application of result as per patient's need and preference.**

  - **Ethics and Attitudes:**

- **Human Values Ethical practice and Communication Abilities.**

- **Adopt, Ethical principals in all aspects of restorative and contemporary endodontic including non-surgical and surgical Endodontic.**

- **Professional honesty and integrity should be the top priority.**

- **Dental care has to be provided regardless of social status, caste, creed or religion of the patient.**

- **Develop communication skills in particular to explain various options available management and to obtain true informed consent from the patient.**

- **He/She shall not carry out any heroic procedure and must know his limitation in performing all aspects of restorative dentistry including Endodontics ask for help from the colleagues or senior when required without hesitation.**

- **Respect patients Rights and Privileges including patient's right to information.**

- **Develop a communication skill in particular, to explain the treatment options available in management and to involve the patient in evidence-based decision making.**

**Outcomes: At the end of the course the Postgraduate student should be able to take proper chair side history, examine the patient and perform medical and dental diagnostic procedures and order as well as perform relevant tests and interpret them, come to a reasonable diagnosis about the dental condition in general and**

**conservative dentistry-endodontics in particular and undertake complete patient monitoring including pre-operative as well as post-operative care of the patients, perform all levels of restorative work and surgical and non-surgical endodontics including part of multidisciplinary approach to clinical condition, provide basic life support in emergency situations, manage acute pulpal and pulpo- periodontal situations, have knowledge of infection control measures in the dental clinical environment and laboratories, know about the advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in different countries, different phase of clinical trials and submitting regulatory documents in filing process of IND, NDA and ANDA.**

- **Syllabus**

- **PART I, PAPER I: APPLIED BASIC SCIENCES**

**A. APPLIED ANATOMY OF HEAD AND NECK**

**i. Development of face.**

**ii. Paranasal sinuses and the associated structures and their anomalies.**

**iii. Cranial and facial bones.**

**iv. TMJ anatomy and functions.**

**v. Arterial and venous drainage of head and neck.**

**vi. Muscles of face and neck including muscles of mastication and deglutition.**

**vii. Brief consideration of structure and functions of brain.**

**viii. Brief consideration of all cranial nerves and autonomic nervous system of head and neck.**

**ix. Salivary glands.**

**x. Functional anatomy of mastication, deglutition and speech.**

**xi. Detailed anatomy of deciduous and permanent teeth.**

**xii. General Consideration in physiology of permanent dentition, form, function, alignment, contact, occlusion.**

xiii. **Internal anatomy of permanent teeth and its significance.**

xiv. **Histology of skin, Oral mucosa, Connective tissue, Bone, cartilage, Blood vessels, Lymphatics, Nerves, Muscles and Tongue.**

**B. Applied anatomy of dental and paradental structures:**

I. **Enamel-Development and composition. Physical characteristics, Chemical properties & Structure**

II. **Age changes – enamel, dentin and pulp.**

III. **Dentin-Development, Physical and chemical properties, Structure type of Dentin, Innervations, age & functional changes.**

IV. **Pulp-Development, Histological structures, Innervations, Functions, Regressive changes and Clinical considerations.**

V. **Cementum-Composition, Structure, Function, Cementogenesis and Clinical considerations.**

VI. **Periodontal ligament development, Structure, Function and Clinical consideration.**

VII. **Salivary glands-Structure, Function, Clinical considerations.**

VIII. **Eruption of teeth.**

**I. APPLIED PHYSIOLOGY**

i. **Digestive system- Mastication and Deglutition, Digestion& assimilation, Fluid electrolyte balance.**
ii. **Circulatory system- Blood composition, volume, function, Blood groups, Haemostasis, Coagulation, Blood transfusion, Circulation, Heart, Pulse, Blood pressure, Shock.**
iii. **Respiratory system- Respiration, control, Anoxia, Hypoxia, Asphyxia, and Artificial respiration.**
iv. **Endocrine system**
   - **General principles of endocrine activity and disorders.**
   - **Pituitary, Thyroid, Parathyroid and Adrenals including pregnancy and lactation.**

v. Physiology of saliva-Composition, Function and Clinical significance.
vi. Clinical significance of vitamins, Diet and nutrition, Balanced diet.
vii. Physiology of pain.
- Sympathetic and para sympathetic nervous system.
- Pain pathway.
- Physiology of pulpal pain.
- Odontogenic and non odontogenic pain.
- Pain disorders –typical and atypical. viii. Biochemistry such as Osmotic pressure, Electrolytic dissociation, Oxidation, Reduction.

ix. Carbohydrates, proteins, lipids, and their metabolism; Nucleoproteins, nucleic acids and their metabolism.
x. Enzymes, Vitamins and minerals.
xi. Metabolism of inorganic elements.
xii. Detoxification in the body.
xiii. Anti-metabolites.
xiv. Chemistry of blood lymph and urine.

## II. PATHOLOGY:

i. Inflammation, Repair, Degeneration, Necrosis and Gangrene.
ii. Circulatory disturbances- Ischemia, Hyperaemia, Oedema, Thrombosis, Embolism, Infarction, Allergy, and hypersensitivity reaction.
iii. Neoplasms- Classifications of tumours, Characteristics of benign and malignant Tumors, Spread of tumors.
iv. Blood dyscrasias.
v. Developmental disturbances of oral and para-oral structures.
vi. Dental caries, Regressive changes of teeth & Pulp, Periapical pathology.
vii. Pulp reaction to dental caries and dental procedures
viii. Infections of the oral cavity-Bacterial, Viral and Mycotic

## E. MICROBIOLOGY:

i. Pathway of pulpal infection.
ii. Oral flora and microorganism associated with endodontic disease.
iii. Pathogenesis.
iv. Host defense

v. Bacterial virulence factors.
vi. Healing. vii. Theory of focal infection.
viii. Microbes relevance to dentistry Streptococcus, Staphylococci, Lactobacilli, Corny bacterium, Actinomycetes, Clostridium, Neisseria, Vibrio, Bacteroides, Fusobacteria, Spirochetes, Mycobacterium, Virus and Fungi
ix. Cross infection, Infection control, Infection control procedure, Sterilization and disinfection.
x. Immunology – Antigen antibody reactions, Allergy, Hypersensitivity and anaphylaxis, Auto immunity, Grafts, Viral hepatitis, HIV infections and AIDS.

xi. Identification and isolation of microorganisms from infected root canals.
xii. Culture medium and culturing technique (Aerobic and anaerobic interpretation and antibiotics, sensitivity test).

## F. PHARMACOLOGY

i. Dosage and route of administration of the drugs
ii. Action and fate of drug in body
iii. Drug addiction
iv. Tolerance of hypersensitivity reactions.
v. Local anaesthesia

- Agents and chemistry
- Pharmacological actions
- Fate and metabolism of anaesthetic
- Ideal properties
- Technique and complications

vi. General anesthesia
- Pre medications
- Neuro muscular blocking agents
- Induction agents
- Inhalation anesthesia and agents used
- Assessment of anesthetic problems in medically compromised patients.

vii. Anesthetic Emergencies.
viii. Antihistamines
ix. Corticosteroids
x. Chemotherapeutic and antibiotics
xi. Drug resistance
xii. Haemostatic agents
xiii. Anticoagulants
xiv. Sympathomimitic drugs

xiv. Vitamins and minerals (A, B, C, D, E, K, IRON)
xv. Anti sialogogue
xvi. Immunosuppressant's
xviii. Drug interactions
xix. Antiseptics
xx. Disinfectants
xxi. Anti-viral agents
xxii. Drugs acting on CNS.

## G. BIOSTATISTICS

I. Introduction,
II. Basic concepts,
III. Sampling, Health information systems – collection,
IV. compilation,
V. presentation of data.
VI. Elementary statistical methods – presentation of statistical data,
VII. Statistical averages – measures of central tendency,
VIII. measures of dispersion,
IX. Normal distribution. Tests of significance – parametric and non – parametric tests (Fisher extract test, Sign test, Median test, Mann Whitney test, Kruskal Wallis one way analysis, Friedmann two way analysis, ANOVA, Regression analysis),
X. Correlation and regression,
XI. Use of computers.

## H. RESEARCH METHODOLOGY

I. Essential features of a protocol for research in humans
II. Experimental and non-experimental study designs
III. Ethical consideration of research

## I. APPLIED DENTAL MATERIALS:

i. Physical and mechanical properties of dental materials,
ii. biocompatibility.
iii. Impression materials
iv. detailed study of various restorative materials,
   a. restorative resin and recent advances incomposite resins,
   b. bonding- recent developments,

c. tarnish and corrosion,
d. dental amalgam,
e. direct filling gold,

v. casting alloys,
vi. inlay wax,
vii. die materials,
viii. investments,
ix. casting procedures and defects,
x. dental cements for restoration and pulp protection (luting, liners, bases) cavity varnishes.
xi. Dental ceramics-recent advances
xii. finishing and polishing materials.
xiii. Dental burs – design and mechanics of cutting – other modalities of tooth preparation.
xiv. Methods of testing biocompatibility of materials used.

**PART-II:**

## A. Paper-I: Conservative Dentistry

1. Examination, diagnosis and treatment plan
2. Occlusion as related to conservative dentistry, contact, contour, its significance. Separation of teeth, matrices, used in conservative dentistry.
3. Dental caries- epidemiology, recent concept of etiological factors, pathophysiology, histopathology, diagnosis, caries activity tests, prevention of dental caries and management – recent methods.
4. Hand and rotary cutting instruments, development of rotary equipment, speed ranges, hazards.
5. Dental burs and other modalities of tooth reparation- recent developments (air abrasions, lasers etc.)
6. Infection control procedures in conservative dentistry, isolation equipments etc.
7. Direct concepts in tooth preparation for amalgam, composite, GIC and restorative techniques, failures and management.
8. Biologic response of pulp to various restorative materials and operative procedures.
9. Direct and indirect composite restorations.
10. Indirect tooth colored restorations- ceramic, inlays and onlays, veneers, crowns, recent advances in fabrication and gingival tissue management.
11. Impression procedures used for indirect restorations.
12. Cast metal restorations, indications, contraindications, tooth preparation for class II inlay, onlay, full crown restorations.
    Restorative techniques, direct and indirect methods of fabrication including materials used for fabrication like inlay wax, investment materials and casting.
13. Direct gold restorations.
14. Recent advances in restorative materials.
15. Esthetics including smile design
16. Management of non-carious lesions.
17. Management of discolored tooth
18. Minimal intervention dentistry.

19. **Recent advances in restoration of endodontically treated teeth and grossly mutilated teeth.**
20. **Hypersensitivity-theories, causes and management.**
21. **Lasers in Conservative Dentistry.**
22. **CAD-CAM in restorative dentistry.**
23. **Digital imaging and its applications in restorative dentistry.**
24. **Clinical Photography.**

## B. Paper-II: Endodontics

1. **Rationale of endodontics.**
2. **Pulp and periapical pathology.**
3. **Pathobiology of periapex.**
4. **Diagnostic procedures – Orofacial dental pain emergencies: endodontic diagnosis and management, recent advances used for diagnosis.**
5. **Case selection and treatment planning.**
6. **Endodontic microbiology.**
7. **Infection control procedures used in Endodontics (aseptic techniques such as rubber dam, sterilization of instruments etc.)**
8. **Endodontic emergencies and management.**
9. **Access cavity preparation – objectives and principles**
10. **Endodontic instruments and instrumentation – recent developments, detailed description of hand, rotary, sonic, ultra sonic etc.**
11. **Working length determination, cleaning and shaping of root canal system and recent developments in techniques of canal preparation.**
12. **Root canal irrigants and intra canal medicaments.**
13. **Obturation materials, techniques and recent advances.**
14. **Traumatic injuries and management – endodontic treatment for young permanent teeth.**
15. **Endodontic surgeries, recent developments in technique and devices and wound healing.**
16. **Endoperio interrelationship and management.**
17. **Lasers in Endodontics.**
18. **Multidisciplinary approach to endodontic situations.**
19. **Radiology and CBCT in endodontic practice.**
20. **Procedural errors in endodontics and their management.**
21. **Endodontic failures and retreatment.**
22. **Resorptions and its management.**
23. **Microscopes and Microsurgery in endodontics.**
24. **Single visit endodontics, current concepts and controversies.**
25. **Regenerative Endodontics**

## C. Paper-III: Essays (descriptive and analyzing type questions)

## D. Teaching / Learning Activities

**The post graduate is expected to complete the following at the end of :**

The following is the minimum required to be completed before the candidate can be considered eligible to appear for final MDS exam.

**First Year**

- **Pre Clinical Work – Conservative and Endodontics**
- **Preclinical work on typhodont teeth**

1. Class II amalgam cavities
   a. Conservative preparation - 03
   b. Conventional preparation - 03

2. Inlay cavity preparation including wax pattern and casting on premolars and molars – MO, DO, MOD - 02
3. Onlay preparation on molars including wax pattern and casting - 02

4. Full Crown

   a. Anterior - 02
   b. Posterior - 02
   (1 each to be processed)

- **Pre Clinical work on natural teeth**

1. Wax Carving of all permanent teeth
2. Inlay on molars and premolars MO, DO, and MOD including wax pattern and casting - 05

3. Amalgam cavity preparation
   a. Conventional - 02
   b. Conservative - 02
4. Complex amalgam on molar teeth - 02
5. Onlay on molars including wax pattern and casting - 02
   (1 to be processed)
6. Full crown premolars and molars (metal, PFM & Ceramic) - 04
7. Full crown anterior (PFM, composite& Ceramic) - 03
8. Veneers anterior teeth - 02
9. Composite
   a. Composite Filling (Class I,II,III & V) -05 (each)
   b. Inlay (Class I & II) -02
   c. Veneer -02
   d. Diastema Closure -02
   e. Angle Buildups -02

**<u>Endodontics:</u>**

1. Sectioning of all maxillary and mandibular teeth (vertical & horizontal).
2. Access cavity opening in relation to maxillary and mandibular permanent teeth.
3. Access cavity preparation, BMP and Obturation
   a) Anterior (3 maxillary and 3 mandibular) - 06

- Conventional prep - 02
- Step back - 02
- Crown down - 02
- Obturation - 03
  (2 lateral compaction and 1 thermo-plasticized)

b) Premolar - 04
   (2 upper and 2 lower) obturation 1 each

c) Molar - 06
   (3 upper – 2 first molars and 1 second molar
   3 lower – 2 first molars and 1 second molar) obturation 1 each

4. Post and core preparation and fabrication in relation to anterior and posterior teeth
   a. Anterior 10 (Cast Post 5 and prefabricated post 5)

   b. Posterior 05 (Cast Post 2 and prefabricated post 5)

5. Removable dies - 04

**Note: technical work to be completed in 1st four months.**

**Minimum Requirement of Academic & Clinical Work to be carried out by the Postgraduate (MDS) Student of Conservative Dentistry and Endodontics in Each Year:**

| | | |
|---|---|---|
| A | Composite restorations | 30 |
| B | GIC Restorations | 30 |
| C | Complex amalgam restorations | 05 |
| D | Composite inlay + veneers (direct and indirect) | 10 |
| E | Ceramic jacket crowns | 05 |
| F | Post and core for anterior teeth | 10 |
| G | Bleaching vital<br>Non vital | 05<br>05 |
| H | RCT Anterior | 20 |
| I | Endo surgery – observation and assisting | 05 |
| J | Class iv esthetic restoration with putty index technique | 03 |
| H | Alternative approach for restoring endodontically treated teeth with endo crown | 03 |
| I | Endodontic treatment under magnification on extracted teeth | 05 |

**Presentation of:**

- Seminars – 5 seminars by each student – should include topics in dental materials, conservative dentistry and endodontics
- Journal clubs – 5 by each student
- Submission of synopsis at the end of 6 months
- Library assignment work
- Internal assessment – theory and clinicals.

**Second Year**
**Case discussion- 5**

| | | |
|---|---|---|
| 1 | Ceramic jacket crowns | 10 |
| 2 | Post and core for anterior teeth | 10 |
| 3 | Post and core for posterior teeth | 05 |
| 4 | Composite restoration | 15 |
| 5 | Full crown for posterior teeth | 15 |
| 6 | Cast gold inlay | 05 |
| 7 | Other special types of work such as splinting<br>- Reattachment of fractured teeth etc. | 10 |
| 8 | Anterior RCT | 30 |
| 9 | Posterior RCT | 40 |
| 10 | Endo surgery performed independently | 05 |
| 11 | Management of endo – Perio problems | 05 |
| 12 | Angle build up composite | 05 |
| 13 | Diastema closure | 05 |
| 14 | Composite Veneers | 05 |
| 15. | Demonstration of One step apexification in open apex cases | 01 |
| 16. | Demonstration of biomimetic material for carious procedures<br>▪ DPC<br>▪ IPC<br>▪ Perforation sealing<br>▪ Root resorption<br>▪ Root end filling | 01 each |

- Under graduate teaching program as allotted by the HOD
- Seminars – 5 by each student
- Journal club – 5 by each student
- Dissertation work
- Prepare scientific paper / poster and present in conference and clinical meeting
- Library assignment to be submitted 18 months after starting of the course
- Internal assessment – theory and clinical

**Third Year**

Dissertation work to be submitted 6 months before final examination.

**Clinical work**

- Cast gold inlay- Onlay, cuspal restoration 10
- Post and core 20
- Molar endodontics 50
- Endo surgery 05
- Diastema Closure 05
- Angle Build-up 05

- All other types of surgeries including crown lengthening, perioesthetics, hemi sectioning, splinting, replantation.

**Presentation of:**

- Seminars – 5 by each student
- Journal club – 5 by each student
- Under graduate teaching program as allotted by the HOD
- Internal assessment – theory and clinical

**Scheme of Examination:**

| | | | | |
|---|---|---|---|---|
| **A. Theory:** | Part-I: | Basic Sciences Paper | - | **100 Marks** |
| | Part-II: | Paper-I, Paper-II & Paper-III | - | **300 Marks** |
| | | | | (100 Marks for each Paper) |

Written examination shall consist of Basic Sciences Paper (Part-I) of three hours duration and should be conducted at the end of First year of MDS course. Part-II Examination will be conducted at the end of Third year of MDS course. Part-II Examination will consist of Paper-I, Paper-II & Paper-III, each of three hours duration. Paper-I & Paper-II shall consist of two long answer questions carrying 25 marks each and five questions carrying 10 marks each. Paper-III will be on Essays. In Paper-III three Questions will be given and student has to answer any two questions. Each question carries 50 marks. Questions on recent advances may be asked in any or all the papers. Distribution of topics for each paper will be as follows: *

**PART-I** : Applied Basic Sciences: Applied Anatomy, Physiology, Pathology including Oral Microbiology, Pharmacology, Biostatistics and Research Methodology and Applied Dental Materials.

**PART-II**

| | | |
|---|---|---|
| **Paper-I** | : | Conservative Dentistry |
| **Paper-II** | : | Endodontics |
| Paper-III | : | Essays (descriptive and analyzing type questions) |

**The topics assigned to the different papers are generally evaluated under those sections. However a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics*.

**B. Practical / Clinical Examination : 200 Marks**

The duration of Clinical and Viva Voce examination will be 2 days for a batch of four students. If the number of candidates exceeds 4, the programme can be extended to 3rd day.

**Day 1**

**Clinical Exercise I – Random case discussion – (2) - 10+10 Marks**

**(Diagnosis, Treatment, Planning & Discussion)**

Cast core preparation

| | | |
|---|---|---|
| (i) Tooth Preparation | - | 20 marks |
| (ii) Direct Wax Pattern | - | 10 marks |
| (iii) Casting | - | 10 marks |
| (iv) Cementation | - | 05 marks |
| (v) Retraction & Elastomeric Impression | - | 05 marks |

**Clinical Exercise II - 30 Marks**
**(Inlay Exercise )**

| | | |
|---|---|---|
| (i) Tooth preparation for Class II Inlay (Gold or Esthetic) | - | 20 marks |
| (ii) Fabrication of Indirect Pattern | - | 10 marks |

**Day 2**
**Clinical Exercise III - 100 Marks**
**(Molar Endodontics)**

| | | |
|---|---|---|
| (i) Local Anaesthesia and Rubber Dam application | - | 20 marks |
| (ii) Access Cavity | - | 20 marks |
| (iii) Working length determination | - | 20 marks |
| (iv) Canal Preparation | - | 20 marks |
| (v) Master cone selection | - | 20 marks |

**C. Viva Voce : 100 Marks**

***i. Viva-Voce examination : 80 marks***

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression, interpretation of data and communication skills. It includes all components of course contents. It includes presentation and discussion on dissertation also.

***ii. Pedagogy Exercise : 20 marks***

A topic be given to each candidate in the beginning of clinical examination. He/she is asked to make a presentation on the topic for 8-10 minutes.

## LIST OF BOOKS

| Sr.no. | Titles |
|---|---|
| 1 | Endodontics By Ingle J I:BC Decker:Canada 5th Ed. |
| 2 | Endodontics By Ingle J I:BC Decker:Canada 6th Ed. |
| 3 | Operative Dentistry Modern And Theory And Practice By Marzouk M.A.Pub: Chennai : Aipd 1st Ed. |
| 4 | Preservation And Restoration Of Tooth Structure By Mount,G J Pub: London :Mosby 1st Ed. |
| 5 | Sturdevant's Art & Science Of Operative Dentistry By Roberson,T M Pub: London:Mosby 4th Ed. |
| 6 | Sturdevant's Art & Science Of Operative Dentistry By Roberson,T M Pub: London:Mosby 5th Ed. |
| 7 | Prin.& Pract.of Operative Dentistry By Charbeneau,G T Varghase 3rd Ed. |
| 8 | T.B.of Operative Dentistry By Sikri,V.K.CBS:New Delhi 1st Ed. |
| 9 | Endodontic Practice By Grossman,L I Varghase:Bombay 11th Ed. |
| 10 | Pathways of the Pulp By Cohen,S Elsevier:New Delhi 9th Ed. |
| 11 | T.B of Endodontics With MCQs By Chandra,S Jaypee:New Delhi 1st Ed. |
| 12 | Endodontic Therapy By Weine,F S Elsevier:Noida 6th Ed. |
| 13 | Textbook of Operative Dentistry By Chandra S:Jaypee:New Delhi 1st Ed. |
| 14 | Endodontics Prep Manual for Undergraduates By Hegde,J:Elsevier 1st Ed. |
| 15 | Community Dentistry By Sikri,V CBS:New Delhi 1st Ed. |
| 16 | Textbook of Operative Dentistry By Charabanae Varghase:Bombay 3rd Ed. |
| 17 | Pkt Atlas of Endodontics By Beer,R Thieme:New York 1st Ed. |
| 18 | A Clinical Atlas of Endodontics Surgery By Bellizzi,R Quintessence 1st Ed. |
| 19 | Problem Solving in Endodontics ByGutmann,J L Elsevier:Noida 4th Ed. |
| 20 | Endodontics :Prin.Pract.of Oper.Dentistry By Torabinejad,M Elsevier 4th Ed. |
| 21 | Surgical Endodontics By Gutmann |
| 22 | MCQ'S Operative Dentistry By Chandra S Jaypee:New Delhi 1st Ed. |
| 23 | Textbook of Endodontics with MCQs By Chandra S 1st Ed. |
| 24 | The Dental Pulp By Hargreaves,K M Quintessence:New Delhi 1st Ed. |
| 25 | Preclinical Operative Dentistry-MCQs&PG Entrance By Reddy CBS 1st Ed. |
| 26 | Textbook of Operative Dentistry By Chandra S Jaypee:New Delhi 1st Ed. |
| 27 | Textbook of Endodontics By Kohli A Elsevier:New Delhi 1st Ed. |
| 28 | MCQ'S Operative Dentistry & Endodontics By Chandra S :Jaypee 1st Ed. |
| 29 | T.B. of Endodontics with MCQs By Chandara Jaypee:New Delhi 1st Ed. |
| 30 | BDS & CBS Exam Oriented Conser. Dentistry By Bansal,P CBS 1st Ed. |
| 31 | Grossman's Endodontics Practice By Chandra B S: LWW 12 th ed. |

| | |
|---|---|
| 32 | A Colour Atlas of Acid Etch Technique By Murray J J:Wolfe 1st Ed. |
| 33 | Atlas of Porcelain Restoration By Denissen H:Paccin 1st Ed. |
| 34 | Change your Smile By Goldstein R E:Quintessence 4th Ed |
| 35 | Dental Anatomy and Histology By Bhalajhi S I ;Arya 2nd Ed. |
| 36 | Endodontics By Torabinejad M:Elsevier 4th Ed. |
| 37 | Endodontics Microbiology By Fouad A F:Wiley-Black 1st Ed. |
| 38 | Endodontics PFMU By Ingle J I:BC Decker |
| 39 | Endodontics Princ.& Prac.with DVD By Torabinejad M:Elsevier 4th Ed. |
| 40 | Ess.Endo.Prev.&Treat.op Apical Perio.By Orstavik:Blackwell 2nd Ed. |
| 41 | Esthe.Dentistry in Clinical Practice By Geissberger:WileyBlackwell |
| 42 | Esthetics in Dentistry Vol I By Goldstein R E: BC Decker 2nd Ed. |
| 43 | Esthetics in Dentistry Vol II By Goldstein R E: BC Decker 2nd Ed. |
| 44 | Fundamentals of operative dentistry By Summitt J B:Quin.3rd Ed |
| 45 | Grossman's Endodontics Practice By Chandra B S: LWW 12 th ed. |
| 46 | Harty's Endodontics By Chong B S:Churchill Levingstone 6th Ed. |
| 47 | Operative dentistry By Glimore H W:Mosby 4th Ed. |
| 48 | Orban's Dental Histology & Embrology By Kumar G S:Elsevier 13th Ed. |
| 49 | Picard's Manual of Operative Dentistry By Kidd E A 8th Ed. |
| 50 | Pocket atlas Of Endodontics- Clinical Sciences By Beer R:Thieme 1st |
| 51 | Pre clinical Conservative Dentistry By Sikri B K:CBS 1st Ed. |
| 52 | Preclinical and Operatice dentistry & Dentistry By Reddy:CBS 1st Ed. |
| 53 | Preclinical Manual of conservative dentistry By Andreasen:Wiley 3rd Ed. |
| 54 | Principles & Practice of Laser Dentistry By Convissar R A:Mosby |
| 55 | Sturdevart's Art and science of operative dentistry By Roberson:Els.5th |
| 56 | T.B. & C/A of Traumative Injury to the teeth By Andreasen:Blackwell 4th |
| 57 | Textbook of Endodontics By Kohli A Elsevier:New Delhi 1st Ed. |
| 58 | T.B. of Endodontics with 2 Interactive DVD By Garg N:Jaypee 2nd Ed. |
| 59 | Textbook of endodontology By Bergenholtz:Wiley 2nd |
| 60 | Textbook of Operative Dentistry By Chandra S Jaypee:New Delhi 1st Ed. |
| 61 | Textbook of Operative dentistry By Sikri V K:CBS 2nd Ed. |
| 62 | Tooth Wear & senditivity Clin.Adv.in Resto.Dentistry By Addy:Informa 1st |
| 63 | Traumatic Dental Injuries a Manual By Andreasen:Wiley 2nd Ed |
| 64 | Wheeler's Dental Anat. Physio.&Occlusal By Nelson S J:Elsevier 9th Ed. |
| 65 | T.B. of Operative Dentistry By Garg,N:Jaypee:3rd Ed. |

## M.D.S
## SUBJECT: CONSERVATIVE DENTISTRY AND ENDODONTICS

| Teaching Scheme(Hours) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lec (L) | Prac (P) | Clinical(C) | Total | | External | | Internal | | Total |
| | | | | | Theory | Pract | Theory | Pract | |
| 946 | 941 | 4868 | 6755 | | 2 | 1 | 2 | 1 | 6 |

### A. COURSE OVERVIEW

Conservative dentistry deals with prevention and treatment of the diseases and injuries of the hard tissues and the pulp of the tooth and associated periapical lesions, along with restoration of those teeth to normal form function and aesthetics Knowledge about aetiology, pathophysiology, periapical diagnosis and management of common restorative situations, endodontic situations that will include contemporary management of dental caries, management of trauma and pulpal pathosis including periodontal situations.

### B. COURSE CONTENT

| NO | TOPIC | L+P+C (hrs) | CLs |
|---|---|---|---|
| 1. | Applied Anatomy of Head and Neck | 18+0+0 | CL1 |
| 2. | Anatomy and Development of Teeth | 6+0+0 | CL1 |
| 3. | Applied Physiology | 12+0+0 | CL1 |
| 4. | Pathology | 12+0+0 | CL1 |
| 5. | Microbiology | 12+0+0 | CL1 |
| 6. | Pharmacology | 12+0+0 | CL1 |
| 7. | Biostatistics | 30+0+0 | CL1 |
| 8. | Research Methodology | 15+0+0 | CL1 |
| 9. | Applied Dental Materials | 30+3+10 | CL1,5,6 |
| 10. | Introduction to Conservative Dentistry | 18+30+60 | CL1,2,3,4,5,6 |
| 11. | Examination, diagnosis and treatment planning | 30+60+180 | CL1,2,3,4,5,6 |
| 12. | Occlusion | 18+30+90 | CL1,2,3,4,5 |
| 13. | Dental caries | 18+30+120 | CL1,2,3,4,5,6 |
| 14. | Hand instruments in operative dentistry | 18+30+90 | CL1,2,4,3,5 |
| 15. | Operative Rotary instruments | 18+30+90 | CL1,2,3,5 |
| 16. | Infection control procedures | 18+0+090 | CL1,5 |

| | | | |
|---|---|---|---|
| 17. | Direct concepts in tooth preparation for amalgam, GIC and other materials, restorative techniques, failures and management. | 60+120+240 | CL1,2,3,4,5,6 |
| 18. | Biologic response of pulp to various material and procedures | 12+0+120 | CL1,2,3,4,5,6 |
| 19. | Direct and indirect composite restorations | 20+32+92 | CL1,2,3,5,6 |
| 20. | Indirect tooth colored restorations | 18+30+120 | CL1,2,3,5,6 |
| 21. | Impression procedures used for indirect restorations | 12+24+60 | CL1,5 |
| 22. | Cast metal restorations | 24+30+120 | CL1,5 |
| 23. | Direct gold restorations | 6+18+30 | CL1,5 |
| 24. | Recent advances in restorative materials | 6+18+30 | CL,1,5 |
| 25. | Esthetics including smile design | 12+18+120 | CL1,4,5,6 |
| 26. | Management of non-carious lesions. | 6+0+90 | CL1,2,3,4,5,6 |
| 27. | Management of discolored tooth | 12+0+60 | CL1,4,56, |
| 28. | Minimal intervention dentistry | 6+18+60 | CL1,5 |
| 29. | Recent advances in restoration of endodontically treated teeth and grossly mutilated teeth | 40+90+150 | CL1,4,5,6 |
| 30. | Hypersensitivity | 6+0+30 | CL1,4,5,6 |
| 31. | Lasers | 6+0+30 | CL1,4,5,6 |
| 32. | CAD-CAM in restorative dentistry | 6+0+30 | CL1,5 |
| 33. | Digital imaging and its applications in restorative dentistry and endodontics | 12+0+30 | CL1,2,3,4,6 |
| 34. | Rationale of endodontic therapy | 6+0+60 | CL1,5 |
| **35.** | Vital Pulp Therapy | 6+2+3 | CL1,6 |
| 36. | Pulp and periapical lesions | 12+0+60 | CL1,2,3 |
| 37. | Pathobiology of periapex | 12+0+60 | CL1,2,3 |
| 38. | Diagnostic procedures | 24+0+120 | CL1,2,3,4 |
| 39. | Case selection and treatment planning in endodontics | 12+0+90 | CL1,2,3,4 |
| 40. | Principles of endodontic therapy | 6+0+60 | CL1,5 |
| 41. | Infection control procedures used in Endodontics | 6+0+90 | CL1,5 |
| 42. | Endodontic emergencies and management | 12+0+90 | CL,1,5 |
| 43. | Access cavity preparation | 18+60+150 | CL1,5,6 |
| 44. | Endodontic instruments and instrumentation | 18+60+150 | CL1,5,6 |
| 45. | Working length determination, cleaning and shaping technique | 40+60+150 | CL1,5,6 |
| 46. | Root canal irrigants and intra canal medicaments. | 18+60+150 | CL1,5,6 |
| 47. | Obturation materials, techniques and recent advances | 40+60+150 | CL1,5,6 |
| 48. | Traumatic injuries and management | 30+0+180 | CL1,2,3,4,5,6 |
| 49. | Endodontic surgeries, recent developments in technique and devices and wound healing | 21+0+120 | CL1,6 |
| 50. | Endoperio interrelationship and management | 18+0+90 | CL1,2,3,4,5,6 |
| 51. | Geriatric Endodontics. | 6+0+30 | CL1,4 |
| 52. | Multidisciplinary approach to endodontic situations. | 6+0+120 | CL1,2,3,4,5,6 |
| 53. | Radiology and CBCT in endodontic practice. | 18+0+30 | CL1,2,3 |
| 54. | Procedural errors in endodontics and their management. | 19+0+122 | CL1,2,3,4,5,6 |
| 55. | Endodontic failures and retreatment. | 12+0+120 | CL1,4,5 |

| | | | |
|---|---|---|---|
| 56. | Resorptions and its management. | 6+0+30 | CL1,2,3,4,5,6 |
| 57. | Microscopes and Microsurgery in endodontics. | 6+0+180 | CL1,4,5,6 |
| 58. | Single visit endodontics, current concepts and controversies. | 12+0+180 | CL1,5,6 |
| **59.** | Management of open apex | 1+1+1 | CL1,2,3,4,5,6 |
| 60. | Regenerative Endodontics | 12+0+60 | CL1,5,6 |

## C. TEXT BOOKS

## D. REFERENCE BOOKS


1. Scharer & others; Esthetic guidelines for restorative dentistry, 1st edition, Quintessence Publishing Co Inc., 1982.
2. Chiche & Pinault; Esthetics of anterior fixed prosthodontics, 1st edition, Quintessence Publishing Co Inc., 1994.
3. Mc Namara; Esthetic & the treatment of facial form, Vol 28, Centre for human growth and developement, University of Michigan, 1992.


1. Scharer & others; Esthetic guidelines for restorative dentistry, 1st edition, Quintessence Publishing Co Inc., 1982.
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3. Mc Namara; Esthetic & the treatment of facial form, Vol 28, Centre for human growth and developement, University of Michigan, 1992


## E. COMPETENCY LEVEL

| CL Number | Skill | Statement |
|---|---|---|
| **CL1** | Knowledge | • knowledge of basic sciences as relevant to conservative / restorative dentistry and Endodontics<br>• proper knowledge of sterilization procedures<br>• Understand the principles of aesthetic dental procedures. |
| **CL2** | Investigations | • Competent to take intra-oral radiographs and interpret the radiographic findings and adequate knowledge about common laboratory investigations and interpretation of their results |
| **CL3** | Patient Care: Diagnosis | • Take proper chair side history, examine the patient and perform medical and dental diagnostic procedures as well as perform relevant tests and interpret to them to come to a reasonable diagnosis about the dental condition in general and Conservative Dentistry – Endodontics in particular |

| | | |
|---|---|---|
| **CL4** | Patient Care: Treatment planning | ● Ethically Integrate multiple disciplines into an individual comprehensive sequence treatment plan using diagnostic and prognostic information |
| **CL5** | Patient Care: Treatment | ● Perform all levels of restorative work, surgical and non-surgical Endodontics as well as endodontic-periodontal surgical procedures as part of multidisciplinary approach to clinical condition.<br>● Provide basic life saving support in emergency situations.<br>● Manage acute pulpal and pulpo periodontal situations |
| **CL6** | Research and Innovation | ● Upgradation of knowledge and skill from time to time, familiarize with new concept and equipment in conservative dentistry and endodontics. |

## PROGRAM SPECIFIC OUTCOME (PSO)

| | | |
|---|---|---|
| PSO1 | KNOWLEDGE | ● Gain knowledge about restorative and endodontic material and treatment. |
| PSO2 | INVESTIGATIONS | ● Competent to take intra-oral radiographs and interpret the radiographic findings and adequate knowledge about common laboratory investigations and interpretation of their results. |
| PSO3 | TREATMENT | ● Ethically Manage treatment of restorative, endodontic and esthetic treatment. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CL1** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CL2** | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CL3** | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CL4** | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CL5** | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| **CL6** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **Avg** | **2.3** | **3** | **3** | **3** | **2.3** | **2.3** | **2.3** | **3** | **3** | **3** | **2** | **2.3** | **2.5** | **3** | **3** | **3** | **2.5** | **2.3** |

# PERIODONTOLOGY

Periodontology is the science dealing with the health and diseases of the investing and supporting structures of the teeth and oral mucous membrane, the practice of which is called Periodontics.

**AIM :**

- To train dental graduates as to ensure higher competence in both general and special areas of Periodontics
- To prepare a candidate for teaching, research and clinical abilities, including prevention and after care in Periodontal surgical therapy.
- To prepare the candidates to practice evidence-based periodontics

**OBJECTIVES:**

The following objectives are laid out to achieve the goals of the course

**A) KNOWLEDGE:**

Discuss historical perspective to advancement in the subject proper and related topics.

- Describe etiology, pathogenesis, diagnosis and management of common periodontal diseases with emphasis on Indian population
- Familiarize with the biochemical, microbiologic and immunologic genetic aspects of periodontal pathology
- Describe various preventive periodontal measures
- Describe various treatment modalities of periodontal disease from historical aspect to currently available ones
- Describe interrelationship between periodontal disease and various systemic conditions
- Describe periodontal hazards due to estrogenic causes and deleterious habits and prevention of it
- Identify rarities in periodontal disease and environmental/Emotional determinates in a given case
- Recognize conditions that may be outside the area of his/her Speciality/ competence and refer them to an appropriate Specialist
- Decide regarding non-surgical or surgical management of the case
- Update the student by attending courses, conferences and seminars relevant to periodontics or by self-learning process.
- Plan out/ carry out research activity both basic and clinical aspects with the aim of publishing his/her work in scientific journals
- Reach to the public to motivate and educate regarding periodontal disease, its prevention and consequences if not treated
- Plan out epidemiological survey to assess prevalence and incidence of early onset periodontitis and adult periodontitis in Indian population (Region wise)
- Shall develop knowledge, skill in the science and practice of Oral Implantology
- Shall develop teaching skill in the field of Periodontology and Oral Implantology
- Principals of Surgery and Medical Emergencies.

- To sensitize students about inter disciplinary approach towards the soft tissues of the oral cavity with the help of specialist from other departments.

**B) SKILLS:**

- Take a proper clinical history, thorough examination of intra oral, extra oral, medical history evaluation, advice essential diagnostic procedures and interpret them to come to a reasonable diagnosis
- Effective motivation and education regarding periodontal disease maintenance after the treatment
- Perform both non-surgical & education regarding periodontal disease, maintenance after the treatment
- Perform both non-surgical and surgical procedures independently
- Provide Basic Life Support Service (BLS) recognizes the need for advance life support and does the immediate need for that.
- Human values, ethical practice to communication abilities
- Adopt ethical principles in all aspects of treatment modalities; Professional honesty & integrity are to be fostered.
- Develop Communication skills to make awareness regarding periodontal disease
- Apply high moral and ethical standards while carrying out human or animal research,
- Be humble, accept the limitations in his/her knowledge and skill, and ask for help from colleagues when needed,\
- Respect patients rights and privileges, including patients right to information and right to seek a second opinion.
- To learn the principal of lip repositioning and perio esthetics surgeries.

**COURSE CONTENTS:**

**PART-I:**

**APPLIED BASIC SCIENCES**

**APPLIED ANATOMY:**

1. Development of the Periodontium
2. Micro and Macro structural anatomy and biology of the periodontal tissues
3. Age changes in the periodontal tissues
4. Anatomy of the Periodontium
   - Macroscopic and microscopic anatomy
   - Blood supply of the Periodontium
   - Lymphatic system of the Periodontium
   - Nerves of the Periodontium
5. Temporomandibular joint, Maxillae and Mandible
6. Tongue, oropharynx
7. Muscles of mastication / Face
8. Blood Supply and Nerve Supply of Head & Neck and Lymphatics.
9. Spaces of Head & Neck

**PHYSIOLOGY:**

1. Blood
2. Respiratory system – knowledge of the respiratory diseases which are a cause of periodontal diseases (periodontal Medicine)
3. Cardiovascular system
   a. Blood pressure
   b. Normal ECG
   c. Shock
4. Endocrinology – hormonal influences on Periodontium
5. Gastrointestinal system
   a. Salivary secretion – composition, function & regulation
   b. Reproductive physiology
   c. Hormones – Actions and regulations, role in periodontal disease
   d. Family planning methods
6. Nervous system
   a. Pain pathways
   b. Taste – Taste buds, primary taste sensation & pathways for sensation
7. Hemostasis

**BIOCHEMISTRY:**

1. Basics of carbohydrates, lipids, proteins, vitamins, enzymes and minerals
2. Diet and nutrition and periodontium
3. Biochemical tests and their significance
4. Calcium and phosphorus

**PATHOLOGY:**

1. Cell structure and metabolism
2. Inflammation and repair, necrosis and degeneration
3. Immunity and hypersensitivity
4. Circulatory disturbances – edema, hemorrhage, shock, thrombosis, embolism, infarction and hypertension
5. Disturbances of nutrition
6. Diabetes mellitus
7. Cellular growth and differentiation, regulation
8. Lab investigations
9. Blood

**MICROBIOLOGY:**

1. General bacteriology
   a. Identification of bacteria
   b. Culture media and methods
   c. Sterilization and disinfection
2. Immunology and Infection
3. Systemic bacteriology with special emphasis on oral microbiology – staphylococci, genus actinomyces and other filamentous bacteria and actinobacillus actinomycetum comitans
4. Virology
   a. General properties of viruses
   b. Herpes, Hepatitis, virus, HIV virus
5. Mycology
   a. Candidiasis
6. Applied microbiology
7. Diagnostic microbiology and immunology, hospital infections and management

**PHARMACOLOGY:**

1. General pharmacology
   a. Definitions – Pharmacokinetics with clinical applications, routes of administration including local drug delivery in Periodontics
   b. Adverse drug reactions and drug interactions
2. Detailed pharmacology of
   a. Analgesics – opiod and nonopiod
   b. Local anesthetics
   c. Haematinics and coagulants, Anticoagulants
   d. Vit D and Calcium preparations
   e. Antidiabetics drugs
   f. Steroids
   g. Antibiotics
   h. Antihypertensive
   i. Immunosuppressive drugs and their effects on oral tissues
   j. Antiepileptic drugs
3. Brief pharmacology, dental use and adverse effects of
   a. General anesthetics
   b. Antipsychotics
   c. Antidepressants
   d. Anxiolytic drugs
   e. Sedatives
   f. Antiepileptics
   g. Antihypertensives
   h. Antianginal drugs
   i. Diuretics
   j. Hormones
   k. Pre-anesthetic medications
4. Drugs used in Bronchial asthma, cough
5. Drug therapy of
   a. Emergencies
   b. Seizures
   c. Anaphylaxis
   d. Bleeding
   e. Shock
   f. Diabetic ketoacidosis
   g. Acute addisonian crisis
6. Dental Pharmacology
   a. Antiseptics
   b. Astringents
   c. Sialogogues
   d. Disclosing agents
   e. Antiplaque agents
7. Fluoride pharmacology

**BIOSTATISTICS:**

1. Introduction, definition and branches of biostatistics
2. Collection of data, sampling, types, bias and errors
3. Compiling data-graphs and charts
4. Measures of central tendency (mean, median and mode), standard deviation and variability

5. Tests of significance (chi square test, t-test and z-test)
   Null hypothesis

**PART II**

**PAPER 1**

**ETIOPATHOGENESIS:**

1. Classification of periodontal diseases and conditions
2. Epidemiology of gingival and periodontal diseases
3. Defense mechanisms of gingival
4. Periodontal microbiology
5. Basic concepts of inflammation and immunity
6. Microbial interactions with the host in periodontal diseases
7. Pathogenesis of plaque associated periodontal diseases
8. Dental calculus
9. Role of iatrogenic and other local factors
10. Genetic factors associated with periodontal diseases
11. Influence of systemic diseases and disorders of the periodontium
12. Role of environmental factors in the etiology of periodontal disease
13. Stress and periodontal diseases
14. Occlusion and periodontal diseases
15. Smoking and tobacco in the etiology of periodontal diseases
16. AIDS and periodontium
17. Periodontal medicine
18. Dentinal hypersensitivity

**PAPER-II**

**CLINICAL AND THERAPEUTIC PERIODONTOLOGY AND ORAL IMPLANTOLOGY**

**Please note**:
Clinical periodontology includes gingival diseases, periodontal diseases, periodontal instrumentation, diagnosis, prognosis and treatment of periodontal diseases.

**(i) GINGIVAL DISEASES**

1. Gingival inflammation
2. Clinical features of gingivitis
3. Gingival enlargement
4. Acute gingival infections
5. Desquamative gingivitis and oral mucous membrane diseases
6. Gingival diseases in the childhood

**(ii) PERIODONTAL DISEASES**

1. Periodontal pocket
2. Bone loss and patterns of bone destruction

3. Periodontal response to external forces
4. Masticatory system disorders
5. Chronic periodontitis
6. Aggressive periodontitis
7. Necrotising ulcerative periodontitis
8. Interdisciplinary approaches
   - Orthodontic
   - Endodontic

**(iii) TREATMENT OF PERIODONTAL DISEASES**

A. History, examination, diagnosis, prognosis and treatment planning
   1. Clinical diagnosis
   2. Radiographic and other aids in the diagnosis of periodontal diseases
   3. Advanced diagnostic techniques
   4. Risk assessment
   5. Determination of prognosis
   6. Treatment plan
   7. Rationale for periodontal treatment
   8. General principles of anti-infective therapy with special emphasis on infection control in periodontal practice
   9. Halitosis and its treatment
   10. Bruxism and its treatment

B. Periodontal instrumentation
   1. Periodontal Instruments
   2. Principles of periodontal instrumentation

C. Periodontal therapy
   1. Preparation of tooth surface
   2. Plaque control
   3. Anti microbial and other drugs used in periodontal therapy and wasting diseases of teeth
   4. Periodontal management of HIV infected patients
   5. Occlusal evaluation and therapy in the management of periodontal diseases
   6. Role of orthodontics as an adjunct to periodontal therapy
   7. Special emphasis on precautions and treatment for medically compromised patients
   8. Periodontal splints
   9. Management of dentinal hypersensitivity

D. Periodontal surgical phase – special emphasis on drug prescription
   1. General principles of periodontal surgery
   2. Surgical anatomy of periodontium and related structures
   3. Gingival curettage
   4. Gingivectomy technique
   5. Treatment of gingival enlargements
   6. Periodontal flap
   7. Osseous surgery (resective and regenerative)
   8. Furcation; Problem and its management
   9. The periodontic – endodontic relationship
   10. Periodontic plastic and esthetic surgery
   11. Recent advances in surgical techniques

E. Future directions and controversial questions in periodontal therapy
   1. Future directions for infection control
   2. Research directions in regenerative therapy
   3. Future directions in anti-inflammatory therapy
   4. Future directions in measurement of periodontal diseases

F. Periodontal maintenance phase
   1. Supportive periodontal treatment
   2. Results of periodontal treatment

**(iv) ORAL IMPLANTOLOGY**
   1. Introduction and historical review
   2. Biological, clinical and surgical aspects of dental implants
   3. Diagnosis and treatment planning
   4. Implant surgery
   5. Prosthetic aspects of dental implants
   6. Diagnosis and treatment of Peri implant complications
   7. Special emphasis on plaque control measures in implant patients
   8. Maintenance phase

**(v) MANAGEMENT OF MEDICAL EMERGENCIES IN PERIODONTAL PRACTICE**

Periodontology treatment should be practiced by various treatment plans and more number of patients to establish skill for diagnosis and treatment and after care with bio-mechanical, biological, bio-esthetics, bio-phonetics and all treatment should be carried out in more number for developing clinical skill.

**TEACHING / LEARNING ACTIVITIES:**

**The post graduate is expected to complete the following at the end of:**

| S.NO | Year Wise | ACTIVITIES WORKS TO BE DONE |
|---|---|---|
| 1. | **Module 1 (First Year)** | Orientation to the PG program<br><br>**Pre-clinical work (4 months)**<br>**a. Dental**<br>1. Practice of incisions and suturing techniques on the typodont models.<br>2. Fabrication of bite guards and splints.<br>3. Occlusal adjustment on the casts mounted on the |

| | | |
|---|---|---|
| | | articulator<br>4. X-ray techniques and interpretation.<br>5. Local anaesthetic techniques.<br>6. Identification of Common Periodontal Instruments.<br>7. To learn science of Periodontal Instruments maintenance (Sharpening , Sterlization and Storate)<br>8. Concept of Biological width<br>a. Typhodont Exercise<br>(i) Class II Filling with Band and Wedge Application<br>(ii) Crown cuttings<br>9. Plaster models for Furcation involvement and various bony defects<br>10. Plaster models for furcation defects and various bony defects.<br>11. Plaster models for intra and external splints. |
| | | **b. Medical**<br>1. Basic diagnostic microbiology and immunology, collection and handling of sample and culture techniques.<br>2. Introduction to genetics, bioinformatics.<br>3. Basic understanding of cell biology and immunological diseases.<br>**Clinical work**<br>1. Applied periodontal indices — 10 cases<br>2. Scaling and root planing:- with Proper written history<br>a. Manual — 20 Cases<br>b. Ultrasonic — 20 Cases<br>3. Observation / assessment of all periodontal procedures including implants |
| 2. | **Module 2 (First Year)** | 1. Interpretation of various bio-chemical investigations.<br>2. Practical training and handling medical emergencies and basic life support devices.<br>3. Basic biostatistics – Surveying and data analysis.<br>**Clinical**<br>1. Case history and treatment planning — 10 cases<br>2. Root planing — 50 cases<br>3. Observation / assessment of all periodontal Procedures including implant.<br>4. Selection of topic for Library dissertation and Submission of Dissertation Synopsis<br>5. Selection, approval and completion of Epidemiological survey |
| 3. | **Module 3 (First Year)** | Minor surgical cases — 20cases<br>(i) Gingival Depigmentation — 3 Cases<br>(ii) Gingival Curettage — no limits |

| | | |
|---|---|---|
| | | (iii) ENAP 1 Case<br>(iv) Gingivectomy/ Gingivoplasty 5 cases<br>(v) Operculectomy 3 cases |
| 4. | **Module 4 (Second Year)** | • Poster Presentation at the Speciality conference<br>• Epidemiological survey- At least one per student<br><br>**Clinical work**<br>1. Case history and treatment planning 10 cases<br>2. Occlusal adjustments 10 cases<br>3. Perio splints 10 cases<br>4. Local drug delivery techniques 5 cases<br>5. Screening cases for dissertation 5 cases<br>6. Basic module for lasers and its applications |
| 5. | **Module 5 (Second Year)** | 1. Periodontal surgical procedures.<br>a. Basic flap procedures 20 cases<br>2. Periodontal plastic and esthetic 10 cases<br>a. Increasing width of attached gingival 5 cases |

| | | |
|---|---|---|
| | | b. Root coverage procedures / Papilla Preservation and Reconstruction 5 cases<br>c. Crown lengthening procedures 5 cases<br>d. Frenectomy 5 cases<br>e. Vestibuloplasty 5 cases<br>3. Furcation treatment (Hemisection, Rootsection, Tunneling Tunnelling) 5 cases<br>4.Surgical closure of diastema<br>5.Laser assisted surgery 10 cases<br>6. Basic module for lasers and its applications 05 cases<br>7. Laser assisted surgeries 05cases |
| 6. | **Module 6 (Third Year)** | 1. Ridge augmentation procedures 5 cases<br>2. Implants Placements and monitoring 5 cases<br>3. Sinus lift procedures 2 cases<br>4. Case selection, preparation and investigation of implants.<br>5. Interdisciplinary Periodontics 2 each<br>(i) Ortho – Perio<br>(ii) Endo – Perio<br>(iii) Restorative Perio<br>(iv) Preprosthetic<br>(v) Crown Prep<br>6. Osseous Surgery 2 each<br>(i) Resective<br>(ii) Regenerative<br>7. Scientific paper/ poster presentation at the conference. |
| 7. | **Module 7 (Third Year)** | **Clinical work**<br>1. Flap surgeries & regenerative techniques 25 cases (using various grafts & barrier membranes)<br>2. Assistance / observation of advanced surgical Procedure 5 each<br>3. Micro surgery 5 each |
| | | 4. Laser assisted surgery 10 each<br>5. Full mouth rehabilitation case 5 each |

| | | |
|---|---|---|
| | | 6. Full mouth rehabilitation with interdisciplinary approach 5 each<br>7. Record maintenance & follow-up of all treated cases including implants.<br>8. Submission of dissertation – 6 months before completion of III year.<br>9. Scientific paper presentation at conferences. |
| 8. | **Module 8**<br>**(Third Year)** | 1. Refining of surgical skills.<br>2. Publication of an article in a scientific journal.<br>3. Preparation for final exams. |
| 9. | **Module 9**<br>**(Third Year)** | 1. Preparation for final exams.<br>2. University exam |

- **Course revision**
  **Do more case of aesthetic rehabilitation and interdisciplinary approach**

**Note: Maintenance of Work Diary / Check list / Log books as prescribed.**

**ASSESSMENT EXAMINATION:**
In addition to regular evaluation, log book etc., Assessment examination should be conducted after every 3 modules & progress of the student monitored.
**MONITORING LEARNING PROGRESS:**
It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only helps teachers to evaluate students, but also students to evaluate themselves. The monitoring is to be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using checklists that assess various aspects.

**SCHEME OF EXAMINATION:**

**A. Theory:** Part-I: Basic Sciences Paper - **100 Marks**
Part-II: Paper-I, Paper-II & Paper-III - **300 Marks** (100 Marks for each Paper)

Written examination shall consist of Basic Sciences Paper (Part-I) of three hours duration and should be conducted at the end of First year of MDS course. Part-II Examination will be conducted at the end of Third year of MDS course. Part-II Examination will consist of Paper-I, Paper-II & Paper-III, each of three hours duration. Paper-I & Paper-II shall consist of two long answer questions carrying 25 marks each and five questions carrying 10 marks each. Paper-III will be on Essays. In Paper-III three Questions will be given and student has to answer any two questions. Each question carries 50 marks. Questions on recent advances may be asked in any or all the papers. Distribution of topics for each paper will be as follows:

**Part- I:** Applied Basic Sciences: Applied Anatomy, Physiology, & Biochemistry, Pathology, Microbiology, Pharmacology, Research Methodology and Biostatistics.

**Part-II**
**Paper I:** Normal Periodontal structure, Etiology & Pathogenesis of Periodontal diseases, epidemiology as related to Periodontics

**Paper II:** Periodontal diagnosis, therapy & Oral Implantology
**Paper III:** Essays (descriptive and analyzing type questions)

**The topics assigned to the different papers are generally evaluated under those sections. However a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.*

**B. Practical / Clinical Examination : 200 Marks**

The clinical examination shall be of two days duration

**1st day**

Case discussion

- Long case - One
- Short case - One

Periodontal surgery – Periodontal Surgery on a previously prepared case after getting approval from the examiners

**2nd day**
Post-surgical review and discussion of the case treated on the 1st day
Presentation of dissertation & discussion
All the examiners shall participate in all the aspects of clinical examinations / Viva Voce

Distribution of Marks for Clinical examination (recommended)

| | | | |
|---|---|---|---|
| a) Long Case discussion | 75 | | |
| b) 1 short case | 25 | | |
| c) Periodontal surgery | 1. | Anaesthesia | 10 |
| | 2. | Incision | 20 |
| | 3. | Post-Surgery Evaluation | 25 |
| | 4. | Sutures | 10 |
| | 5. | Pack (if any) | 10 |
| Post – operative review | 25 | | |
| **Total** | **200** | | |

**C. Viva Voce : 100 Marks**
***i. Viva-Voce examination: 80 marks***

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression, interpretation of data and communication skills. It includes all components of course contents. It includes presentation and discussion on dissertation also.

***ii. Pedagogy Exercise :*** ***20 marks***

A topic will be given to each candidate in the beginning of clinical examination. He/she is asked to make a presentation on the topic for 8-10 minutes.

- **List of Textbooks**

| Sr.no. | Title |
|---|---|
| 1 | Periodontology and periodontics : Modern theory and practice By Ramfjord S P PUB: Delhi |
| 2 | Carranza's Clin. Periodontology By Newman M G |
| 3 | Textbook of Peridontology |
| 4 | Clinical Periodo. & Implant Dentistry by Blackwell Scientific Publishers .vol1 5th Ed 2008 |
| 5 | Clinical Periodo. & Implant Dentistry Blackwell Scientific Publishers 5th Ed. Vol 2 2008 |
| 6 | Fundamental of Perio.Instru.& Advanced Root Instrumentation by Lippincott William & Wilkin s LWW:London 6th Ed. 2008 |
| 7 | Tissu Engineering By Lynch,S E : |
| 8 | Atlas of Cosme& Reconstructive Perio Surgery By Cohen |
| 9 | Practical Advanced Periodontal Surgery By Dibart,S |
| 10 | Practical Periodontal Plastic Surgery by Blackwell Scientific Publishers 1st Ed. 2006 |
| 11 | Periodontal Tissue Destruction Remod By Tuncer,O |
| 12 | Periodontal Gingival Health & Diseases By Bimstein,E |
| 13 | Periodontics By Eley,B M |
| 14 | Periodontal Syllebus By Vernino A R |
| 15 | Periodontal Medicine By Rose,L F |
| 16 | Concise Encyclopedia of Periolontology By Vandersall,D C |
| 17 | Periodontics for the Dental Hygienist By Nield-Gehrig,J S |
| 18 | Periodontal Medicine & Systems Biology By Henderson,B |
| 19 | Periodontology Dental Hygeniest By Perry,D A |
| 20 | Clinical Periodontology By Varma |
| 21 | Manual of Clinical Periodontics. By Serio,F G Lexi-Comp:Ohio |
| 22 | Clinical Periodontology By Chandra,K M |
| 23 | MCQs in Periodontology By Uppal |
| 24 | MCQs in Periodontology By Bhavani |
| 25 | MCQs in Periodontology for PG By Chandra |
| 26 | Clinical Periodontology By Carranza |
| 27 | Biology of Periodontal Connective Tissues By Bartold |
| 28 | Perio-medicine surg and implants By Rose |
| 29 | Text Book of Anatomy By Singh,I |
| 30 | Essentials of Anatomy By Singh,I |
| 31 | Principles of Biochemistry By Nelson |
| 32 | Text book of Medical Physiology By Guyton |
| 33 | Anatomy By Gray |
| 34 | Practical Perio diag and Rx Planning By Dibart |
| 35 | Cellular and Molecular Immunology By Abbas |
| 36 | Diagnosis and Risk of prediction of Periodontal Disease By Axelsson |
| 37 | Minimally Invasive Treat.Arrest & Control of Periodontal Diseases By Axelsson |
| 38 | Osseointegration and Multidisciplinary Treatment By Francischone |
| 39 | Infection control for dental team, Quintessentials By Martin |
| 40 | Principles & Practice of laser Dentistry By Convissar |
| 41 | Bone Grafting techniques for Maxillary Implants By Kahnberg |
| 42 | Handbook of Local Anaesthesia By Malamed |

| | |
|---|---|
| 43 | Medical Emergencies in Dental Office By Malamed |
| 44 | Concise Periodontics By Nymphea |
| 45 | Molecular biology of periodontium 2010 By Arun,K V |
| 46 | Tips and Tricks in Periodontology 2009 Shalu Bathla |
| 47 | Periodontics revisited 2009 By Shalu Bathla |
| 48 | BDS and CBS India exam - oriented series - periodontics (Q & A) By Bansal |
| 49 | Q & A Exam.- Oriented:Periodontics with Colour Diagram By Radhakrishnan |
| 50 | Critical Decisions in Periodontology by Hall, W.B |
| 51 | Contemporary Implant Dentistry by Misch C.E |
| 52 | Essential of Medical Pharmacology by Tripathi, K.D. |
| 53 | BDC's HumanAnatomy Vol.1 by Chaurasia,B D |
| 54 | BDC's Human Anatomy Vol.2 by Chaurasia,B D |
| 55 | BDC's Human Anatomy Vol.3 by Chaurasia,B D |
| 56 | Concise Medical Physiology by Chaudhari,S K |
| 57 | Essential Medical Physiology by Sembulingam,K |
| 58 | T.B.of Dental Biochemistry by Singh,S P |
| 59 | T.B.of Microbiology by Anathnarayana,R |
| 60 | Pharmacology and Pharmacotherapeutics by Satoskar,R |
| 61 | Essential of Pharmacology for Dentistry by Tripathi,K D |
| 62 | Essential Pathology for Dental Students by Mohan,H |
| 63 | T.B.of Pathology by Mohan,H |
| 64 | Robbin's Basic Pathology by Kumar,V S |
| 65 | Periodontal Diseases by Schluger,S |
| 66 | Essential of Periodontology &Periodontics by Macphee,T |
| 67 | History of Periodontology by Carranza,F |
| 68 | Fundamental of Periodontics By Wilson,T G |
| 69 | Drugs,Diseases & the Periodontium by Seymour,R A |
| 70 | Essential of Preventive & Community Dentistry by Peter,S |
| 71 | Proceedings of the 3rd European Workshop on Periodontology by Lung,N P |
| 72 | Periodontal Therapy by Goldman |
| 73 | Oral Cells & Tissues by Garant |
| 74 | Carranza's Clin. Periodontology Vol.1 |
| 75 | Essentials of Clinical Periodontology Periodontics |
| 76 | Carranza's Clin. Periodontology Vol.2. |

## M.D.S
## SUBJECT: PERIODONTOLOGY

| Teaching Scheme (Hours) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lec(L) | Prac(P) | Clinical (C) | Total | | External | | Internal | | Total |
| | | | | | Theory | Pract | Theory | Pract | |
| 936 | 936 | 4860 | 6732 | | 2 | 1 | 2 | 1 | 6 |

### A. COURSE OVERVIEW

The student shall acquire the skill to perform dental scaling, diagnostic tests of periodontal diseases; to use the instruments for periodontal therapy and maintenance of the same. The student shall develop attitude to impart the preventive measures namely, the prevention of periodontal diseases and prevention of the progress of the disease. The student shall also develop an attitude to perform the treatment with full aseptic precautions; shall develop an attitude to prevent iatrogenic diseases; to conserve the tooth to the maximum possible time by maintaining periodontal health.

### B. COURSE CONTENT

| NO | TOPIC | L+P+C | CLs |
|---|---|---|---|
| 1 | APPLIED ANATOMY | 15+10+10 | CL1,2,3,6 |
| 2 | PHYSIOLOGY | 15+10+10 | CL1,2,3,6 |
| 3 | BIOCHEMISTRY | 10+10+10 | CL1,2,3,6 |
| 4 | PATHOLOGY | 10+10+10 | CL1,2,3,5,6 |
| 5 | MICROBIOLOGY | 10+10+10 | CL1,2,3,5,6 |
| 6 | PHARMACOLOGY | 10+10+10 | CL1,2,3,6 |
| 7 | BIOSTATISTICS | 10+10+10 | CL1,3,6 |
| 8 | ETIOPATHOGENESIS | 110+8+100 | CL1,2,3 |
| 9 | GINGIVAL DISEASES | 80+10+210 | CL1,2,3,4 |
| 10 | PERIODONTAL DISEASES | 80+10+700 | CL1,2,3,4 |
| 11 | TREATMENT OF PERIODONTAL DISEASES | 400+20+3500 | CL1,2,3,4,5,6 |
| 12 | LASER APPLICATION IN PERIODONTICS | 50+8+50 | CL1,2,3,4,5,6 |
| 13 | ORAL IMPLANTOLOGY | 51+10+200 | CL1,2,3,4,5,6 |
| 14 | MANAGEMENT OF MEDICAL EMERGENCIES IN PERIODONTAL PRACTICE | 25+5+10 | CL1,2,3,4,5 |
| 15 | FULL MOUTH REHABILITATION CASES | 10+10+20 | CL1,2,3,4,5,6 |
| 16 | PRE – CLINICAL EXERCISES<br>Furcation involvement and other bony defects on model | 50+785+0 | CL1 |

### C. TEXT BOOKS

1. Newman's and Carranza; Clinical Periodontology, 13th edition, Saunders publication, 2018.

## D. REFERENCE BOOKS


1. Torquil MacPhee; Essentials of Periodontology and Periodontics, 2nd edition, Blackwell Science Ltd., 1975.
2. Cohen; Contemporary Periodontics, 6th edition, Mosby, 1990.
3. Goldman; Periodontal therapy, 6th edition, Mosby, 1980.
4. Orban; Orbans' Periodontics, 4th edition, Mosby Inc., 1972.
5. W.H.O; Oral Health Survey , 5th edition, World Health Organization, 2014.
6. Young and Stiffler; Preventive Periodontics.
7. Slack; Dental Public Health : An introduction to community dentistry, 1st edition, Wright, 1974.
8. John Prichard; Advanced Periodontal Disease, 2nd edition, W.B Saunders Company, 1972.
9. Forrest; Preventive Dentistry, 2nd edition, Butterworth-Heinemann Ltd., 1981.
10. Jan Lindhe; Clinical Periodontology, 7th edition, Wiley Blackwell, 2021.
11. Baer & Morris; Periodontics, 1st edition , Lippincott Williams and Wilkins, 1977.


## E. COMPETENCY LEVEL

| CL Number | Skill | Statement |
|---|---|---|
| **CL1** | Knowledge | • Have adequate knowledge about etiology, pathogenesis, diagnosis and management of common periodontal diseases with emphasis on Indian population<br>• Familiarize with the biochemical, microbiologic and immunologic genetic aspects of periodontal pathology.<br>• To learn the principal of Laser application in periodontics, lip repositioning and perio esthetics surgeries. |
| **CL2** | Investigations | • Competent to take intra-oral radiographs and interpret the radiographic findings and adequate knowledge about common laboratory investigations and interpretation of their results |
| **CL3** | Patient Care: Diagnosis | • Take a proper clinical history, thorough examination of intra oral, extra oral, medical history evaluation, advice essential diagnostic procedures and interpret them to come to a reasonable diagnosis and and get familiarized with concepts of periodontal diseases, osseointegration, and basic surgical aspects of implantology and application of LASER in periodontics |
| **CL4** | Patient Care: Treatment planning | • Ethically Integrate multiple disciplines into an individual comprehensive sequence treatment plan using diagnostic and prognostic information |
| **CL5** | Patient Care: Treatment | • Competent to perform thorough oral prophylaxis, subgingival scaling, root planning and minor periodontal surgical |

| | | |
|---|---|---|
| | | procedures, LASER assisted periodontal surgeries and oral implantology. |
| **CL6** | Research and Innovation | • Upgradation of knowledge and skill from time to time, familiarize with new concept and equipment in periodontology. |

**PROGRAM SPECIFIC OUTCOME (PSO)**

| | | |
|---|---|---|
| PSO1 | DIAGNOSIS | Students should be able to record a detailed periodontal case history, determine diagnosis, prognosis and plan treatment |
| PSO2 | INVESTIGATIONS | Competent to take intra-oral radiographs and interpret the radiographic findings and adequate knowledge about common laboratory investigations and interpretation of their results |
| PSO3 | TREATMENT | Student should perform scaling, root planning local drug delivery and SPT, various periodontal surgeries. |

## F. COURSE MATRIX

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CL1** | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **CL2** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| **CL3** | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 |
| **CL4** | 3 | 1 | 2 | 3 | 3 | 3 | 3 | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| **CL5** | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 3 | 2 | 1 | 3 | 3 | 2 | 3 | 3 | 3 |
| **CL6** | 3 | 1 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | 3 | 3 | 2 | 3 | 1 | 1 | 3 | 2 | 2 |
| **Avg** | **3** | **1.8** | **2.8** | **3** | **3** | **2.7** | **3** | **1.5** | **2.3** | **2.5** | **2.3** | **2.5** | **2.5** | **2.5** | **2.3** | **3** | **2.5** | **2.3** |

## (MH715 ) – ADVANCED MANUFACTURING PROCESSES

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **ADVANCED MANUFACTURING PROCESSES:** Introduction and need of advance manufacturing processes, classification of unconventional machining processes, merits and demerits. | 04 |
| 2 | **ADVANCED METAL REMOVAL PROCESSES:** Process principle, metal removal mechanism, parametric analysis and application of various non conventional machining processes like mechanical energy based processes, chemical and electro chemical energy based processes, thermal energy based processes, Introduction of hybrid machining processes. | 10 |
| 3 | **ADVANCED WELDING PROCESSES**: Physics of welding, solid state welding processes, radiant energy welding processes, Estimation of welding cost, Introduction to welding automation. | 12 |
| 4 | **ADVANCED METAL FORMING PROESSES**: Introduction of metal forming processes, introduction of High Energy Rate Forming processes, merits and demerits of HERF processes, various HERF processes like electromagnetic forming, explosive forming, electro hydraulic forming, and stretch forming. | 10 |
| 5 | **PRODUCT DEVELOPMENT AND PROTOTYPING:** introduction, product cycles, rapid product development, prototype, types of prototypes, role of prototype in product development. | 03 |
| 6 | **ADDITIVE MANUFACTURING:** Introduction, classification of rapid prototyping processes, types of rapid prototyping processes, introduction to rapid tooling and manufacturing. | 06 |
| | **Total Hours** | **45** |

**TEXTBOOKS**


1. Materials and Processes in Manufacturing" (8th Edition), E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi
2. Manufacturing Science" A. Ghosh, and A. K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi
3. Nontraditional Manufacturing Processes", G.F. Benedict, Marcel Dekker, Inc. New York
4. Rapid Prototyping: Principles and Applications in Manufacturing by Rafiq Noorani, John Wiley & Sons


**REFERENCE BOOKS**

1. Modern Machining Processes by P. C. Pandey and H. S. Shan, by Tata McGraw Hill
2. Manufacturing Processes for Engineering Materials by S. Kalpakjian and S. Schmid, Prentice Hall
3. Welding Processes and Technology by R. S. Parmar, Khanna Publisher
4. Rapid Tooling: Technologies and Industrial Applications by P.D. Hilton, and P.F Jacobs, CRC press

**COURSE OUTCOMES**

CO1 To identify the need of advanced manufacturing processes and their merits and demerits
CO2 To analyze non traditional machining methods for different parameters
CO3 To calculate cost of given welding process and understand advanced welding methods
CO4 To interpret and compare different advanced forming processes
CO5 To understand need of product development and to realize importance of prototypes in manufacturing
CO6 To understand role of additive manufacturing in today's era and select appropriate RP process for given application

**LIST OF EXPERIMENTS**

1. To study about importance of unconventional machining methods and process parameters for it.
2. To study about mechanical energy based unconventional machining methods
3. To study about thermal energy based unconventional machining methods
4. To study about electro chemical energy based unconventional machining methods
5. To calculate welding cost for the given examples
6. To study about advanced forming processes
7. To study about powder based and liquid based rapid prototyping technologies
8. To study about solid based rapid prototyping technologies
9. Software demonstration for rapid prototyping
10. To study about rapid tooling methods

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | - | 1 | - | - | - | - | - | 1 | 2 | 2 | 1 |
| CO2 | 3 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | - | 1 | 2 | 2 | 1 |
| CO3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | 1 | 3 | 2 | 1 |
| CO4 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | 2 | 2 | 1 |
| CO5 | 2 | 2 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 1 |
| CO6 | 2 | 2 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

## ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 1 | 0 | 2 | 00 | 00 | 25 | 25 | 50 | 1 | 0 | 1 | 2 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **INTRODUCTION TO ARTIFICIAL INTELLIGENCE** | 03 |
| | Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search. | |
| 2 | **KNOWLEDGE REPRESENTATION** | 03 |
| | Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction. | |
| 3 | **NATURAL LANGUAGE PROCESSING & VISUAL PERCEPTION** | 04 |
| | Language & its comprehension, reading, understanding conversation and essays. Language context, language in a social context, Introduction to problem solving, decision making and reasoning, Visual perception from sensation to representation, approaches to perception, perception of object sand forms, role of environment in seeing, deficits in perception, and perception in practice. Automatic and controlled processes in attention. | |
| 4 | **INTRODUCTION TO MACHINE LEARNING** | 05 |
| | Preliminaries, what is machine learning; varieties of machine learning, learning input/output functions, sample application. Boolean functions and their classes, CNF, DNF, decision lists. Version spaces for learning, version graphs, learning search of a version space, candidate elimination methods | |
| | **Total Hours** | **15** |

### TEXT BOOKS


1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-GrawHill
2. Introduction to AI & Expert System: Dan W.Patterson, PHI
3. Introduction to Machine learning, Nils J.Nilsson
4. Introduction to Machine Learning with Python A guide for data scientists, Andreas, C. Muller & Sarah Guido, O'Reilly


### REFERENCE BOOKS


1. Artificial Intelligence by Luger (Pearson Education)
2. Machine learning for dummies, IBM Limited ed, by Judith Hurwitz and Daniel Kirsch
3. Russel & Norvig, Artificial Intelligence: A Modern Approach, Pearson Education.

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Understand basics of artificial intelligence & its various methods.
CO2 Able to represent problem statement using AI.
CO3 Analyze & execute natural language instructions & visualize perception of the system.
CO4 Carryout analysis based on machine learning.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Installation of Python, and learning interactively at command prompt and writing simple programs. |
| 2 | Learning the conditions and iterations in Python by writing and running simple programs. |
| 3 | Random number generations, and problems based on random numbers |
| 4 | Handling tuples and exercises based on tuples. |
| 5 | Functions and files |
| 6 | Installation of gnu-prolog, Study of Prolog (gnu-prolog), its facts, and rules. |
| 7 | Write simple facts for the statements and querying it. |
| 8 | Write a program for Family-tree |
| 9 | Write programs for computation of recursive functions like factorial Fibonacci numbers, etc. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | - | 2 | 1 | - | 1 | - | - | 1 | 2 | 1 | 1 | 2 |
| CO2 | 1 | 1 | - | - | 1 | - | - | - | - | - | - | 2 | 1 | 1 | 1 |
| CO3 | 1 | 1 | - | - | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 | 1 |
| CO4 | 1 | 1 | 1 | - | 1 | 1 | - | 1 | - | - | 1 | 2 | 1 | 1 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## Automobile Systems

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 36 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **Vehicle Performance & Structure**<br>Vehicle motion, Resistances during motion, Power required for acceleration and constant velocity motions, Tractive efforts and draw bar pull, Power required and engine characteristics, Gear ratio requirement. Study various vehicle layouts as front engine and front wheel drive, front engine & rear wheel drive, rear engine & rear wheel drive, Components of transmission system, Four-wheel drives. Types of Chassis frames & body, Material, Frameless construction. | 06 |
| 2 | **Automatic Transmission & Drivelines**<br>Requirements, types, Torque converter, Epicyclic gearbox, Continuously variable transmission, Overdrive. Propellers shaft, Types of drive as torque tube and hotch kiss drive, Final drive types, Bevel, Hypoid, Worm and worm wheel, Type of drive axles & differential, Fully or semi floating and three-quarter floating. | 08 |
| 3 | **Clutch & Manual Transmission**<br>Functions, Type of clutches, Single, Multiple, Centrifugal, Electromagnetic and hydraulic clutches, Lining material, Release mechanism, Fluid flywheel. Types of gear boxes, Sliding mesh, Constant mesh, Synchromesh, Epicyclic gear 4 boxes, Gear ratios, Transfer case, Semi-automatic transmission system. | 08 |
| 4 | **Steering and Suspension systems**<br>Steering requirements, Steering system and linkages, Steering gears, Steering geometry, Ackermann linkages, Wheel alignment, Toe-in, Toe out, Caster, Camber, king-pin inclination, Under steer and over steer conditions, Power steering. Purpose, Types of suspension system, Front and rear suspension, Coil spring, Leaf spring, Torsion bars, Shock absorbers, Air and rubber suspension, Plastic suspensions, Independent suspension, Antiroll bar or stabilizer. | 09 |
| 5 | **Brakes, Wheels & Tyres**<br>Function, Internal expanding brakes, Brake lining material, Properties, Hydraulic braking system, Brake oil, Bleeding of brakes, Pneumatic braking system, Vacuum brakes, Antilock braking system, Parking brake and braking efficiency. Types of wheel rims, Types of tyres, Cross ply, Radial & tubeless tyres, Specifications of tyres, wheel balancing. | 07 |
| 6 | **Hybrid Electric Vehicles & Auxillaries**<br>Introduction to Hybrid Electric Vehicles, Architecture of hybrid and electric vehicles, Working of parallel, series parallel and complex drive trains and power flow in each case, Regenerative braking, Control system for hybrid and electric vehicles. Battery: Construction, working, methods of rating, charging methods, test, generator and cranking motor with drive purpose. Modern technique, Safety provisions, like air bags/ safety belts, Traction control system | 07 |
| | **Total Hours** | 45 |

## TEXT BOOKS

1. Heinz Heisler, —Vehicle and Engine Technology, Arnold, London
2. Dr. Kirpal Singh, —Automobile Engineering Vol- I & II, Standard Pub & Dist.

## REFERENCE BOOKS

1. Dr. N.K.Giri, —Automobile Technology, Khanna Pub
2. R.B.Gupta, —Automobile Engineering, Satya Prakashan, New Delhi
3. Narang G.B.S., —Automobile Engineering, Khanna Publishers, New Delhi.
4. Crause, W.H., —Automobile Mechanics, Tata McGraw Hill, New Delhi

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Understand basic vehicle layout, structure and performance of vehicle.

CO2 Understand working of Automatic transmission. Explain the importance of Differential in automobile.

CO3 Understand construction, working principles of clutch and manual gear boxes

CO4 Understand the construction and working principle of steering & suspension mechanisms.

CO5 Explain working of brake systems & constructional features of different types of tyres.

CO6 Understand the electric vehicles, batteries and auxillaries.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | To understand the working mechanism of truck chassis through it actual cut section model. |
| 2 | To study different types of automobile layout. |
| 3 | To study the different types of clutch. |
| 4 | To study the different types of Manual Transmission. |
| 5 | To study Automatic Transmission. |
| 6 | To study about Differential mechanism |
| 7 | To study the steering system |
| 8 | To study different types of suspension system |
| 9 | To study about brake system. |
| 10 | To study about lead acid battery |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO2 | 1 | 3 | 3 | 3 | - | 1 | - | - | - | - | - | 1 | 3 | 3 | 1 |
| CO3 | 1 | 2 | 3 | 2 | - | 1 | - | - | - | - | - | 1 | 3 | 3 | 1 |
| CO4 | 1 | 3 | 3 | 3 | 1 | 1 | - | - | - | - | - | 1 | 3 | 3 | 1 |
| CO5 | 1 | 3 | 3 | 2 | - | 2 | - | - | - | - | - | 1 | 3 | 3 | 1 |
| CO6 | 1 | 2 | 3 | 3 | - | 2 | - | - | - | - | - | 1 | 2 | 3 | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

## CONTROL ENGINEERING (MH 611)

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 2 | 5 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **BASIC CONTROL SYSTEM:**<br>System differential equation of electrical, mechanical, thermal, hydraulic and electromechanical network, analogy. | 06 |
| 2 | **THEORY OF AUTOMATIC CONTROL:**<br>Concept of feedback referred to linear control systems in general, e.g. displacement and speed control, process control, definition and terminology, open loop and closed loop systems and its advantages. Block diagrams and signal flow graph representation of a physical system, block diagram algebra, transfer function from a block diagram. Basic control actions and controllers – on – off. Proportional, derivative and integral controllers, steady – state analysis. Transient response of first order and second order systems to step, ramp and sinusoidal input, steady state errors, Applications of Laplace transform methods, Routh's stability criteria and root locus methods improving system performance. | 12 |
| 3 | **HYDRAULIC CONTROL:**<br>Characteristic of hydraulic components control valves, sources of hydraulic power hydraulic meters, pistons and transmission, elements of circuit design, Accumulation control circuit such as position control and speed control circuit. | 06 |
| 4 | **PNEUMATIC CONTROL:**<br>Pneumatic power supply, Amplifiers with different controlling actions, Pneumatic valves and cylinders, theory of four way and pilot valves. | 04 |
| 5 | **ELECTRICAL CONTROL SYSTEMS:**<br>Speed control of D.C. motors, Remote control positional servo mechanism (including effect of gearing between motor and load). | 04 |
| 6 | **MICROCONTROLLER BASED DIGITAL CONTROL:**<br>Microcontrollers & microprocessors, 8051 architecture, 8051 assembly language programming, Jump Loop & call instructions, Counters & timers, 8051 addressing modes, arithmetic logic instructions & programs. | 08 |

| | | |
|---|---|---|
| 7 | **ARDUINO AND MOTION LOGIC DRIVE BASED DIGITAL CONTROL:** | **08** |
| | Introduction of hardware & software, Basics of Arduino, Functional block diagram of Arduino, Functions of each pin of arduino, Arduino development board diagram (including different blocks): IDE, I/O functions, looping techniques, decision making techniques, Programming of an arduino, basic circuit for arduino, basic interfacing & i/o concept, interfacing LED, switch and seven segment LED & its code. Introduction to motion logic drive (Hardware & software), Programming in motion logic drive. | |
| | **Total Hours** | **48** |

**Text Books:**

1. Control Systems Engineering By Nagrath & Gopal, New Age International Publishers
2. Modern Control Engineering, By Ogata K, Pearson Education
3. Exploring Arduino: Tools and Techniques for Engineering Wizardry By Jeremy blum, Willey Publication
4. The 8051 microcontrollers and embedded systems by Muhammad Ali Mazidi, Janice gillispie mazidi & Rolin D. Mckinlay, Pearson Education

**Reference Books:**

1. Automatic Control System by Kuo, Benjamin.C, Prentice Hall
2. Control Systems Engineering By Nise, Norman S John Wiley & Sons, New York
3. Control Systems Engineering By S K Bhattacharya, Pearson Education
4. Control Engineering By D. Ganesh Rao, K. Chennavenkatesh Pearson Education

**COURSE OUTCOMES**

After successful completion of the course, students will be able to;

CO1 Understand basics of Control system & able to make mathematical model as well as will be able to find transfer function of various physical system.

CO2 Understand importance of feedback & will be able find transfer function of complex control system using various method & identify errors

CO3 Understand behavior of Hydraulics & Pneumatics systems & able to understand various components of the circuit.

CO4 Understand working of Electrical control system & its characteristics for speed control of motor.

CO5 Learn about basic architecture of Microcontroller 8051 & able to program real world problems

CO6 Learn to use Arduino board & its architecture along with Motion control Drive.

## SUGGESTED LIST OF PRACTICALS

| Sr No. | Title |
|---|---|
| 1 | Mathematical modelling of basic mechanical systems. |
| 2 | Familiarization with matlab control system tool box, matlab/simulink tool box. |
| 3 | Determination of step & impulse response for a first order unity feedback system. |
| 4 | Determination of step & impulse response for a second order unity feedback system. |
| 5 | Determination of step & impulse response for a type '0', type '1', type '2' systems. |
| 6 | Determination of root locus plot using matlab control system toolbox for 2nd order system & obtain controller specification parameters. |
| 7 | Study & analyse the effect of pi & pd controller on system performance. |
| 8 | Study of Hydraulic control valves. |
| 9 | Study of Pneumatic control valves. |
| 10 | Study about architecture & pin diagram of arduino. |
| 11 | To perform various projects on arduino like blinking LED, Traffic light system design etc. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | | | | | | 1 | | | 2 | 1 | 1 | 1 |
| CO2 | 3 | 3 | 2 | 2 | | | | | 1 | | | 2 | 2 | 2 | 2 |
| CO3 | 2 | 1 | 1 | | | | | | 1 | | | 1 | 1 | 1 | 2 |
| CO4 | 2 | 1 | 1 | | | | | | 1 | | | 1 | 2 | 1 | 1 |
| CO5 | 2 | 2 | 2 | | | | | | 2 | | | 2 | 2 | 2 | 2 |
| CO6 | 2 | 2 | 1 | | | | | | 1 | | | 1 | 2 | 1 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## ENGINEERING GRAPHICS (ES203) (MH/CH/CL/IC)

| Teaching Scheme (Hours) | | | Examination Scheme | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Total | Lect | Tut | Prac | Total |
| 3 | - | 3 | 60 | 40 | 50 | 150 | 3 | - | 1.5 | 4.5 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **INTRODUCTION TO ENGINEERING DRAWING**<br>Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Dimensioning, Geometrical construction, Layout of drawing sheet | 2 |
| 2 | **CONIC SECTIONS AND PLANE AND SPACE CURVES**<br>Introduction, Ellipse, Parabola, Hyperbola, Cycloidal Curves (Cycloid, Epicycloid, Hypocycloid), Involutes, Archimedean Spiral | 14 |
| 3 | **SOLID GEOMETRY**<br>Projection of points, projection of lines and their applications. Projection of regular planes such as square, rectangle, triangle, circle, pentagon, hexagon, rhombus. Projection of right and regular solids inclined to both the planes (prisms, pyramids, cylinder and cone), Section of Solids. | 14 |
| 4 | **ORTHOGRAPHIC PROJECTIONS AND CAD SOFTWARE BASICS**<br>Introduction, First angle and third angle projection methods, Conversion of pictorial views into orthographic projections with dimensioning, Sectional orthographic projections.<br>CAD Software: Menu bar, Quick access toolbar, Dashboard/Ribbon, Toolbars, drawing space, Navigation bar (View controls: zoom, pan, orbit,), Command prompt, Status bar, Drawing Area (Background, Crosshairs, Coordinate System), Shortcut Menu, Properties manager. | 5 |
| 5 | **ISOMETRIC PROJECTIONS AND COMPUTER AIDED DRAWING**<br>Principles of Isometric projection, Isometric Scale, Isometric projection and view, Conversion of orthographic views to isometric projections and views.<br>Computer aided drawing: Exploring various commands with exercises of Orthographic drawing views and Isometric drawing views using different drawing tools, modifying tools, dimensioning tools etc. | 5 |
| 6 | **DEVELOPMENT OF SURFACES**<br>Introduction, Engineering applications of development of surfaces, Methods of Development, Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone. | 5 |
| | **Total Hours** | **45** |

**TEXT BOOKS**


1. Engineering Drawing, Bhatt N.D., Panchal V.M., Charotar Publishing House
2. Engineering Graphics, Shah P. J., S. Chand Publishing
3. Engineering Drawing, Gill P. S., S. K. Kataria & Sons


**REFERENCE BOOKS**


1. Text book on Engineering Drawing, Narayana, K.L. & P Kannaiah, Scitech Publishers
2. Fundamentals of Engineering Drawing, Luzadder W., Duff J., Peachpit Press
3. Engineering Graphics, Agrawal B. & Agrawal C. M., TMH Publication

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 To understand primary concepts of Engineering Drawing and geometrical construction.

CO2 Demonstrate correct usage of methods, concepts, and theories to illustrate and solve problem of conic sections and plane and space curves

CO3 Illustrate correct usage of methods, concepts, and theories to solve problem of solid geometry.

CO4 Select an appropriate standard projection system, break down complex 3D problem into various orthographic and sectional orthographic views, and illustrate missing features and learn basis aspects of CAD software.

CO5 Generate isometric projection from two-dimensional drawing and prepare drawing in CAD software.

CO6 Create development of various parts/components in real life situation.

## SUGGESTED LIST OF PRACTICALS

| **Sr. No.** | **Title** |
|---|---|
| 1 | Types of lines, Dimensioning methods and Dimensioning systems (Zero sheet) |
| 2 | Geometrical Constructions |
| 3 | Engineering Curves (Conics) and Orthographic Projection |
| 4 | Projections of Straight lines and Sectional Orthographic Projection |
| 5 | Engineering Curves: Cycloids & involute and Projections of right and regular Planes |
| 6 | Isometric Projection and Projections of right and regular solids |
| 7 | Archimedean spiral and Development of surfaces |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| CO2 | 3 | 1 | 1 | 1 | - | - | - | - | 1 | 1 | 1 | 2 | 2 | 2 | 1 |
| CO3 | 3 | 2 | 1 | 1 | - | - | - | - | 1 | 1 | 1 | 2 | 2 | 1 | 1 |
| CO4 | 3 | 2 | 1 | 1 | 2 | - | - | - | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| CO5 | 3 | 2 | 1 | 1 | 2 | - | - | - | 1 | 2 | 1 | 2 | 2 | 2 | 2 |
| CO6 | 3 | 2 | 1 | 1 | - | - | - | - | 1 | 2 | 1 | 2 | 2 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## FLUID MACHINES (MH 513)

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 2 | 5 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **Introduction:**<br>Major applications of hydropower plant, Classification of hydropower plant, Mini-micro hydro power plant, Elements of hydropower plant, Advantages and disadvantages of hydropower plant, selection of site for a hydropower plant | 02 |
| 2 | **Impact of Jet:**<br>Introduction, Force exerted by jet on stationary Flat, Inclined and Curved vanes, Force exerted by jet on moving flat, inclined and curved vanes,. Jet of water striking tangentially to symmetrical and unsymmetrical blades, Jet Propulsion. | 09 |
| 3 | **HYDRAULIC TURBINES:**<br>Introduction, Classification of Hydraulic Turbines, Head and efficiencies of hydraulic turbine Pelton Wheel Turbine- Construction and Working Velocity triangle and work done for Pelton Wheel turbine, design parameters Radial Flow Reaction Turbine- Inward radial flow and outward radial flow turbine, Construction and Working of Francis turbine Velocity triangle and work done for Francis turbine, Axial Flow Reaction turbine- Construction and Working of Kaplan Turbine Design parameters Draft tube- Types, Theory and efficiency of draft tube Specific speed of Hydraulic turbines, Unit quantities and characteristics curves of Hydraulic Turbines. Governing of Hydraulic turbines. | 13 |
| 4 | **HYDRAULIC PUMPS**<br>Introduction, Classification of pumps, Centrifugal Pump- Introduction, main parts of centrifugal pump Work done by centrifugal pump, Definition of Heads and efficiencies of centrifugal pump Minimum Starting speed of Centrifugal pump, Multistage centrifugal pumps, Specific speed of centrifugal pump, Model testing of Centrifugal pump, Priming, characteristics curves of Centrifugal pump, Cavitation, Maximum suction lift Centrifugal pump, NPSH Reciprocating Pump- Introduction, Construction and working, Indicator diagram, Air vessels, Comparison of Centrifugal pump and Reciprocating Pump | 08 |
| 5 | **COMPRESSORS:**<br>Centrifugal compressor-Introduction, Principle of operation, components of centrifugal compressor static and stagnation properties, Work done by the | 10 |

| | | |
|---|---|---|
| | impeller, pressure rise and temperature rise Degree of reaction, Power input factor, slip factor, Stodola formula, Enthalpy- entropy diagram, isentropic efficiency, Reciprocating compressor- Terminology, classification, single stage reciprocating air compressor without clearance- work done Power required to compress air, condition for minimum work, single stage reciprocating air compressor with clearance- work done, volumetric efficiency, FAD, Multistage compression- Work done Two stage compressor with intercooler without clearance, Condition for minimum work, Work done Two stage compressor with intercooler with clearance, Optimum intermediate pressure in two stage compressor with incomplete intercooling Actual p-v for reciprocating compressor, mean effective pressure and indicated power, compressor efficiency, Heat rejected in compressor and intercooler. | |
| **6** | **HYDRAULIC MACHINES:**<br>Introduction, Hydraulic accumulator, Hydraulic intensifier, Hydraulic Ram, Hydraulic Lift, Hydraulic Crane, Hydraulic Coupling, Hydraulic Torque converter, Airlift Pump, Gear Pump | **06** |
| | **Total Hours** | **48** |

TEXT BOOKS

1. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Prakashan

2. Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S. K. Kataria & Sons

3. Fluid Mechanics, Yunus A. Cengel, McGraw Hill Publication

REFERENCE BOOKS

1. Fluids Mechanics, F.M. White, McGraw-Hill Inc

2. Fluid Mechanics and Hydraulic Machines, Sukumar Pati, McGraw-Hill Inc

3. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som., G. Biswas, Tata McGraw Hill Co. Pvt. Ltd

SUGGESTED LIST OF PRACTICALS:

| Sr. No. | Title |
|---|---|
| 1 | Pelton Turbine |
| 2 | Francis Turbine |
| 3 | Kaplan Turbine |
| 4 | Impact of Jet |
| 5 | Centrifugal Pump |
| 6 | Reciprocating Pump |
| 7 | Gear Pump |
| 8 | Air Compressor |
| 9 | Cavitation |

| | |
|---|---|
| 10 | Hydraulic Ram |

**COURSE OUTCOMES**

CO1 Obtain fundamental knowledge of Hydro power plant and its vital components

CO2 Understand and analyze impact of jet on turbine blades.

CO3 Analyze turbine working and performance parameters.

CO4 Understand and analyze hydraulic pump working and its performance parameters.

CO5 Analyze compressor cycles, understand the working and its derivations, and evaluate design parameters.

CO6 Understand and apply fundamentals of hydraulic machines

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 | 1 |
| CO2 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | 1 |
| CO4 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO5 | 3 | 3 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO6 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 | 1 |

## INTERNAL COMBUSTION ENGINES

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

## DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **AIR STANDARD, FUEL-AIR AND ACTUAL CYCLES:**<br>Introduction, Assumptions, Stirling cycle, Ericsson cycle, Lenoir cycle, Atkinson cycle, Joule or Brayton cycle, Dual combustion cycle, Comparison between Otto, Dual and Diesel cycles, non-conventional IC engines, applications of IC engines.<br>Valve/Port timing Diagram for four-stroke/two- stroke SI/CI engine, Fuel-air cycles and their significance, Factors affecting the fuel air cycle, Difference between actual cycles and fuel- air cycles | 10 |
| 2 | **COMBUSTION IN SI AND CI ENGINES AND FUEL SUPPLY SYSTEMS:**<br>Introduction, Homogeneous and Heterogeneous mixtures, Ignition limits, Stages of combustion in SI engine, effect of engine variables on ignition lag, effect of engine variables on flame propagation, abnormal combustion: Detonation or knocking in SI engines, effect of engine variables on knock or detonation. Control of detonation, stages of combustion in CI engine, delay period and factors affecting delay period, diesel knock, Comparison of Knock in SI and CI engines, CI Engine Combustion Chambers, Cold Starting of CI Engines<br>Carburetion, Factors affecting carburetion, Air- fuel mixture requirement for different conditions, Simple Carburettor: Essential Parts and its working, Analysis of Single Jet Carburettor, Multipoint Fuel Injection System (MPFI), Requirement of Fuel injection system and its classification, Jerk type Fuel Injection Pump, Fuel Injectors, Nozzle and its type. | 10 |
| 3 | **CONVENTIONAL AND ALTERNATIVE FUELS FOR IC ENGINES**<br>Fuels for SI engines: Desirable properties, Volatility and its effects on engine performance, Rating of S.I. engine fuels: HUCR, Octane Number, Performance Number and Triptane Rating.<br>Fuels for CI engines: Desirable properties, Rating of C.I. engine fuels: Cetane Number, Diesel Index, Aniline point, API gravity and Specific gravity<br>Alternative Fuels: CNG, LNG, LPG, alcohol, biodiesel and hydrogen | 06 |
| 4 | **IC ENGINE SYSTEMS**<br>Lubrication System- Function of Lubrication, Lubrication of Engine Components, Lubrication System, Properties of Lubricants, Additives for Lubricants, SAE Rating of Lubricants.<br>Ignition System- Function of Ignition System, Requirements of Ignition System, Battery Ignition System, Magneto Ignition System, Electronic | 10 |

Ignition System, Ignition advance and methods of advancing, Firing order of the engine cylinders.

Cooling System- Need for Cooling System, Types of Cooling System: Air (Direct) Cooling System, Liquid (Indirect) Cooling System

Governing System-Function of Governor, Methods of governing: Hit and miss method, Quality governing and Quantity governing

Supercharging and Turbocharging- Objective of supercharging, Thermodynamics Cycle with supercharging, Types of superchargers, Effects of supercharging, Methods of supercharging, Supercharging limitations in SI and CI engines, Turbo Charging and its different methods.

| | | |
|---|---|---|
| **5** | **ENGINE PERFORMANCE PARAMETERS, MEASUREMENT AND TESTING:** | **06** |

Introduction, Sources of Losses, Factors affecting mechanical friction, Performance parameters, Measurement of speed, Measurement of fuel consumption, Measurement of air consumption: Air box method, Measurement of brake power: (a) Absorption Dynamometer: Rope brake Dynamometer, Prony brake Dynamometer, Hydraulic Dynamometer and Electrical Dynamometer, (b) Transmission

Dynamometer; Measurement of frictional power: Willan's line method, Motoring Test, Retardation Test; Measurement of indicated power of Multi cylinder engine by Morse test

| | | |
|---|---|---|
| **6** | **ENGINE EMISSIONS:** | **03** |

Emission of pollutants from SI & CI engines, Control of emissions from SI and CI engines, Measurement of pollutants in exhaust gases, Emission norms.

**Total Hours 45**

**TEXT BOOKS:**

1. A course in internal combustion engines, V.M. Domkundwar, Dhanpatrai& Co
2. Internal combustion engines, Mathur& Sharma, Dhanpatrai& sons
3. Internal combustion engines, V. Ganeshan (Tata Mc Grawhill Pub. co. ltd

**REFERENCE BOOKS:**

1. Internal combustion engines, Ramalingam, Scitech publications
2. Internal combustion engines, H. N. Gupta, PHI Learning, New Delhi
3. Internal combustion engines, B. L. Singhal, Tech-max publications
4. Internal combustion engines, S. S. Thipse, Jaico Publishing house
5. Fundamental of I.C. Engines, John Heywood, McGraw Hill Publication

**COURSE OUTCOMES**

After successful completion of the course, students will be able to;

CO1 Obtain fundamental knowledge and analyze theoretical and actual cycles of IC engines

CO2 Understand combustion process and fuel supply system in IC engines

CO3 Obtain the knowledge of conventional and alternative fuels and their properties

CO4 Understand important systems of IC engines

CO5 Understand and evaluate engine performance parameters

CO6 Obtain the knowledge of engine emissions and emission control methods

**SUGGESTED LIST OF PRACTICALS**

| Sr.No. | Title |
|---|---|
| 1 | Study of lubrication systems, lubricants and their additives for IC engines |
| 2 | Study of cooling systems of IC engines |
| 3 | Study of conventional ignition systems of IC engines |
| 4 | Study of modern ignition systems of IC engines |
| 5 | Study of combustion chambers in SI engines |
| 6 | Study of combustion chambers in CI engines |
| 7 | Study the governing systems of SI and CI engines |
| 8 | Study engine emissions and emission control methods |
| 9 | Performance testing of 4 stroke 4cylinder SI engine on SI engine test rig |
| 10 | Performance testing of 4 stroke single cylinder CI engine on computerized CI engine test rig |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | - | - | - | 1 | - | - | - | - | - | 1 | 2 | - | 1 |
| CO2 | 3 | 2 | - | - | - | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO3 | 1 | - | - | - | - | 2 | 1 | - | - | - | - | 1 | 1 | 2 | - |
| CO4 | 2 | 1 | 1 | - | - | 1 | 1 | 1 | 1 | - | - | 1 | 1 | 1 | 1 |
| CO5 | 3 | - | - | - | - | 1 | 1 | - | 1 | 1 | - | 1 | 2 | 1 | 1 |
| CO6 | 1 | - | - | - | - | 2 | 2 | 1 | - | 1 | - | 1 | 1 | 1 | - |

**1-Slightly; 2-Moderately; 3-Substantially**

## MACHINE DESIGN - II (MH608)

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **DESIGN AGAINST VARYING LOAD** | 12 |
| | Stress concentration – causes and remedies, Stress concentration factors, Fluctuating stresses, Fatigue failure, S-N curve, Endurance limit, Notch sensitivity, Design for finite and infinite life, Soderberg and Goodman lines, Modified Goodman diagrams, Gerber equation, Fatigue design under combine stresses, Impact stresses. | |
| 2 | **SURFACE FAILURE** | 8 |
| | Introduction, Surface geometry, Mating surfaces, Friction, Effect of roughness on friction, Effect of velocity on friction, Rolling friction, Effect of lubrication on friction, Adhesive wear, Abrasive wear, Corrosive wear, Surface fatigue, Spherical contact, Cylindrical contact, General contact, Surface fatigue failure models, Surface fatigue strength. | |
| 3 | **BEARINGS** | 14 |
| | Introduction, Types of rolling contact bearings, Comparison of rolling and sliding contact bearings, Selection of rolling bearing type, Static and dynamic load carrying capacity, Equivalent bearing load, Bearing life, Load factor, Design for cyclic loads and speeds, Probability of survival, Bearing mounting, Failure of rolling contact bearing, Causes and remedies, Lubricants, Viscosity, Basic modes of lubrication, Material combination in sliding bearings, Hydrodynamic lubrication theory, Design of hydrodynamic journal bearings, Journal bearing Failure causes and remedies, Viscous flow through rectangular slot, Design of hydrostatic bearing. | |
| 4 | **SPUR GEAR DESIGN** | 8 |
| | Overview of gear drive terminology, Standard systems of gear tooth, Gear material selection, Force analysis of spur gear, Minimum no. of teeth, Estimation of module based on beam and wear strength for gears, Design of spur gears, Friction and wear of spur gears, Contact stresses, Lubrication of gears, Surface failures, Offline monitoring of gears, Online monitoring of gears. | |
| 5 | **HELICAL, BEVEL AND WORM & WORM GEAR DESIGN** | 10 |
| | Virtual number of teeth, Force analysis of helical gears, Design of helical gears, Bevel gear geometry, Force analysis of bevel gears, Design of bevel gears, Wormset geometry, Force analysis of wormset, Design of wormset. | |
| 6 | **DESIGN OF GEAR BOXES** | 8 |
| | Basic considerations in design of drives, Determination of variable speed range, Preliminary steps in the design of multi speed gear box, Structure diagram, Graphical representation of ray and speed diagram, Rules and guidelines for layout. | |
| | **Total Hours** | **60** |

## TEXTBOOKS

1. Design of Machine Elements , V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd.
2. Machine Design- An Integrated Approach, Robert L. Norton, Pearson Education, Inc.
3. Machine Tool Design and Numerical Control, N. K. Mehta, Tata McGraw-Hill Education Pvt. Ltd.

## REFERENCE BOOKS

4. Mechanical Engineering Design , Shigley J.E. and Mischke C.R., McGraw Hill Publ. Co. Ltd.
5. Fundamental of Engineering Tribology with Application, Harish Hirani, Cambridge University Press.
6. Design of Machine Elements, M. F. Spott, T. E. Shoup, L. E. Hornberger, S. R. Jayram & C. V. Venkatesh, Pearson Education Inc.
7. Machine Design , Black P.H. and O. Eugene Adams , McGraw Hill Book Co.Ltd.
8. Design Data (PSG College of Engg. & Tech.), DPV Printers.
9. Mechanical Design Data Book, V. S. Konnur & A. A. Memon, New Popular Prakashan, Surat.

## COURSE OUTCOMES

After successful completion of the course, students will be able to:

CO1 Understand the concept of varying/cyclic loads and different terms related to it. Design and analyze parts subjected to various types of cyclic loading under direct and shear stresses.

CO2 Understand the concept of surface failure. Make use of surface failure in design and analysis of mechanical components.

CO3 Select an appropriate bearing based on the condition. Also, they will be able to design rolling element and journal bearing.

CO4 Understand selection of gears, failure of gears, design of spur gear and lubrication aspects.

CO5 Design of helical gears, bevel gears and worm & worm wheel drive.

CO6 Design gearboxes for machine tools.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | To study design against fluctuating loads. |
| 2 | To study spur gear design. |
| 3 | To study helical gear design. |
| 4 | To study bevel gear design. |
| 5 | To study worm gear design. |
| 6 | To study rolling contact bearing selection. |
| 7 | To study sliding contact bearing design. |
| 8 | To demonstrate the fatigue life test of rolling element bearing. |
| 9 | To study the pressure distribution in slider and journal bearing. |
| 10 | To study design of gear box. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 3 | 1 | - | - | - | 1 | 3 | - | 1 | 3 | 3 | 2 |
| CO2 | 3 | 3 | 1 | 3 | 1 | - | - | - | 1 | 3 | - | 1 | 3 | 3 | 2 |
| CO3 | 3 | 2 | 3 | 1 | 1 | - | - | - | 1 | 3 | - | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 1 | 1 | - | - | - | 1 | 3 | - | 2 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 1 | 1 | - | - | - | 1 | 3 | - | 2 | 3 | 3 | 2 |
| CO6 | 2 | 3 | 1 | 2 | 1 | - | - | - | 1 | 3 | - | 2 | 3 | 3 | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

**DHARMSINH DESAI UNIVERSITY, NADIAD**
**FACULTY OF TECHNOLOGY**
**MECHANICAL ENGINEERING DEPARTMENT**
**B.TECH. - SEMESTER VI**
**SUBJECT: HEAT AND MASS TRANSFER (MH 612)**

| Teaching Scheme (Hours/week) | | | Examination scheme (Marks) | | | | |
|---|---|---|---|---|---|---|---|
| Lectures | Tutorials | Practical | Theory | Sessional | Practical | T.W. | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 |

**A. OBJECTIVE OF THE COURSE**

To understand the fundamentals of heat transfer mechanism, their applications in various heat transfer equipment in industries and to develop methodologies for solving a wide variety of practical engineering problems.

**B. DETAILED SYLLABUS**

| Sr No. | Content | Hrs. |
|---|---|---|
| 1. | **Basic Concepts**<br>Thermodynamics vs. Heat transfer, Modes of Heat transfer, Basic laws of heat transfer: Fourier's law, Newtons law, Stephen Boltzmann law, Steady and unsteady state of heat transfer, Thermal resistance, Thermal conductivity of material, General heat conduction equation in cartesian, cylindrical and spherical coordinate system. | 2 |
| 2. | **Conduction**<br>**Steady state one dimension heat conduction**- Heat conduction through plane and composite wall, heat flow between surface and surroundings, overall heat transfer coefficient, heat conduction through hollow and composite cylinders, heat conduction through hollow and composite spheres, Shape Factor, effect of variable conductivity, critical thickness of insulation.<br>**Heat transfer from extended surfaces-** Introduction, heat flow through rectangular fin, heat dissipation from, an infinitely long fin, a fin insulated at the tip and fin losing heat at the tip, Fin performance.<br>**Unsteady state heat conduction-** Transient conduction in solid with infinite thermal conductivity, Time constant and response of thermo couple, Transient conduction in solid with finite conduction and convection resistance | 12 |
| 3. | **Convection**<br>**Introduction**- Basic law of heat convection, Free and Force convection.<br>**Dimensional analysis**- Dimensional homogeneity, Methods of dimensional analysis, Dimensional analysis applied to force and free convection, Dimensional numbers and their physical significance. | 12 |

| | | |
|---|---|---|
| | **Empirical relation for free convection and forced convection-** Bulk temperature and mean film temperature, Local and average convection coefficient, Correlations for force convection, Correlations for free convection.<br>**Force convection-** Hydrodynamic Boundary layer, thicknesses of boundary layer, and Thermal boundary layer, continuity, momentum and energy equations for force convection. Blasius solution for laminar boundary layer, General solution of Von- Karman integral momentum equation.<br>**Free convection-** Introduction, characteristic parameters in free convection, momentum and energy equations for laminar free convection heat transfer. | |
| **4.** | **Radiation**<br>**Thermal Radiation Basic relations-** Introduction, Surface emission properties, absorptivity, reflectivity and transitivity, black, white and grey body, emissive power and emissivity, laws of radiation: Planck, Stefan-Boltzmann, Wein's displacement, Kirchhoff's law, intensity of radiation and solid angle, Lambert's cosine law<br>**Radiation heat exchange between surfaces-** black bodies, shape factor, heat exchange between non-black bodies- infinite parallel planes and infinite long concentric cylinder, small grey surfaces, small body in large enclosure, Electrical network approach for radiation heat exchange. Radiation shield, error in temperature measurement due to radiation. | **10** |
| **5.** | **Heat exchanger**<br>Introduction, Classification of heat exchanger, performance analysis, overall heat transfer coefficient, LMTD, Correction factor for multi-pass arrangement, effectiveness and NTU, Limiting value of capacity ratio. | **06** |
| **6.** | **Condensation, Boiling and Concept of Mass transfer**<br>**Condensation-** Laminar film condensation on vertical plate, turbulence film condensation, convective coefficient for film condensation on tube.<br>**Boiling-** Boiling regimes, Bubble growth and nucleate boiling, Boiling correlation.<br>**Mass Transfer-** Classification, Concentration, velocity and fluxes. Fick's law, General equation of mass diffusion, Steady state diffusion, Mass transfer coefficient. | **03** |
| | **Total** | **45** |

**C. RECOMMENDED TEXTBOOKS**

1. Heat and Mass Transfer, R.K. Rajput, S. Chand Publication
2. Heat and Mass Transfer, D. S. Kumar, S.K. Kataria and sons
3. Cengel Y A, Heat Transfer – A Practical Approach, McGraw Hill

**D. REFERENCE BOOKS**

1. Fundamentals of Heat and Mass Transfer, D. P. Incropera, P.P. and Dewitt, Wiley Eastern
2. Convective Heat Transfer, Adrian Bejan, Wiley India.
3. Heat Transfer, J. P. Holman, McGraw Hill
4. Heat and Mass Transfer, Domkundawar arora, Dhanapat rai & CO.
5. Heat and Mass Transfer, P. K. Nag, McGraw Hill

**E. LIST OF EXPERIMENTS TO BE PERFORMED UNDER THIS SUBJECT HEAD:**

1. To determine overall thermal conductivity of composite wall.
2. To determine the thermal conductivity of lagging material by assuming the heater input to be the heat flow rate through lagged pipe.
3. Determine emissivity of test plate.
4. To determine heat transfer coefficient for natural and forced convection from pin fin.
5. To determine average surface heat transfer coefficient in forced convection
6. To study and observe boiling heat transfer.
7. To determine effectiveness and overall heat transfer coefficient for concentric tube heat exchanger.
8. To study plate type heat exchanger.
9. To determine inside and outside heat transfer coefficient for film wise and drop wise condensation.

**F. COURSE OUTCOMES**

Upon successful completion of this course, the student will be able to:

| | |
|---|---|
| CO1 | Know importance of heat transfer, understand the modes of heat transfer and corresponding basic laws. |
| CO2 | Analyze problems involving one dimensional steady state heat conduction; heat transfer through extended surface and develop solutions for transient heat conduction. |
| CO3 | Understand the fundamentals of convective heat transfer process and apply empirical correlations for forced and free convection to determine values for the convective heat transfer coefficient. |
| CO4 | Understand the fundamentals of radiation heat transfer process and calculate radiation heat transfer between black body surfaces and gray body surfaces and concept of radiation shield. |
| CO5 | Understand the basics of heat exchanger, analysis of heat exchanger performance by using the LMTD method and NTU method. |
| CO6 | Ability to understand the phenomena of boiling, condensation and basics of mass transfer. |

**G. COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | --- | --- | 1 | --- | -- | --- | --- | --- | 2 | 2 | 1 | 1 |
| CO2 | 2 | 2 | 2 | 1 | --- | 1 | --- | 1 | --- | --- | --- | 2 | 2 | 2 | 1 |
| CO3 | 3 | 2 | 2 | 2 | --- | --- | --- | 1 | 1 | --- | --- | 1 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 2 | 1 | --- | --- | --- | 1 | 1 | --- | --- | 1 | 2 | 1 | 2 |
| CO5 | 2 | 2 | 2 | 1 | --- | --- | --- | 1 | 1 | --- | --- | 1 | 2 | 2 | 2 |
| CO6 | 2 | 1 | 1 | 1 | --- | --- | --- | 1 | 1 | --- | --- | 1 | 1 | 1 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

# ELECTIVE - III

# (MH716) – THERMAL SYSTEM DESIGN

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

## A. DETAILED SYLLABUS

| | | |
|---|---|---|
| 1 | **BASIC CONSIDERATION IN DESIGN**<br>Engineering Design, Formulation of the Design Problem, Steps in the Design Process, Conceptual Design | **05** |
| 2 | **DESIGN OF HEAT EXCHANGER**<br>Review of heat exchanger basics, Basic design methodologies - Number of Transfer Units (NTU) method and Logarithmic Mean Temperature Deference (LMTD) method, Design of double pipe heat exchangers, Shell & tube type heat exchangers, Plate type Heat exchangers, Compact heat exchangers, Classification and design methods for Condensers and Evaporators | **25** |
| 3 | **DESIGN OF REFRIGERATION AND AIR CONDITIONING**<br>Review of basics of Refrigeration and air conditioning, Choice of inside design condition, Outside conditions and supply air condition, load calculation and applied Psychrometric, Selection of compressor, condenser, expansion device and evaporator for refrigeration system design, Design of air-conditioning system, Indoor air quality | **15** |

## B. RECOMMENDED TEXTBOOKS

1. Thermodynamics: An Engineering approach; Y. A. Cengel; TMH publication
2. Design and optimization of Thermal system; Yogesh Jaluriya; CRC Press
3. Heat Exchanger: Selection, Rating and thermal design; S. Kakac; CRC press
4. Refrigeration and Air-conditioning; Manohar Prasad; New Age international publication

## C. REFERENCE BOOKS

1. Design of thermal system; W. F. Stoecker; Mc Graw Hill Publication
2. Fundamental of heat exchanger design; R. K. Shah; John Wiley & Sons Inc.
3. Fundamental of Engineering Thermodynamics; M. J. Moran & H. N. Shapiro
4. Principle of refrigeration; R. J. Dossat; Pearson publication

## D. LIST OF EXPERIMENTS:

| | |
|---|---|
| 1. | Study of TEMA standards for heat exchanger. |
| 2. | Design of Tube in Tube Heat Exchanger. |
| 3. | Design of shell and tube heat exchanger. |
| 4. | Design of plate type heat exchanger. |
| 5. | Design of compact heat exchanger. |
| 6. | Study of different components for control and protection of Refrigeration and air-conditioning system. |
| 7. | Analysis of Cold room cooling load calculation. |
| 8. | Design of refrigeration system for cold room. |
| 9. | Analysis of Heat load calculation for comfort air conditioning. |
| 10. | Design of air-conditioning and air-distribution system for comfort air conditioning. |

## E. COURSE OUTCOMES

After successful completion of the course, students will be able to;

| | |
|---|---|
| CO1 | Obtain fundamental knowledge in design consideration for thermal systems and prepare them to work in that area. |
| CO2 | Understand design and analysis of various types of heat exchangers. |
| CO3 | Design and evaluate refrigeration and air conditioning systems. |

## F. COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 1 | --- | --- | 1 | --- | 1 | --- | --- | --- | 2 | 2 | 1 | 1 |
| CO2 | 2 | 2 | 2 | 1 | --- | 1 | --- | 1 | --- | --- | --- | 2 | 2 | 2 | 1 |
| CO3 | 2 | 2 | 2 | 2 | --- | --- | --- | --- | 1 | --- | --- | 1 | 3 | 2 | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

## ADVANCED SOLID MECHANICS

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **STRESSES AND STRAINS IN THREE DIMENSIONS** | **15** |
| | Solid mechanics approaches, concept of continuum, homogeneity and isotropy, types of forces on a body, state of stress at a point, rectangular stress components, stress sign convention, equality of cross shear, traction on an arbitrary surface, principal stresses and planes, stress invariants, hydrostatic and deviatoric stress tensor, Mohr's circle for general state of stress, octahedral planes and stresses, differential equation of equilibrium | |
| | Difference between displacement and deformation, strain at a point, strain displacement relationship, engineers and mathematician's strain tensors, rigid body rotation, cubical dilatation, principle axes of strain and principal strain, strain deviator, strain invariants, compatibility conditions, stress-strain relationship and elastic constants required for different types of materials, stress strain relationship for isotropic material, plane stress and plane strain | |
| 2 | **THEORIES OF ELASTIC FAILURE UNDER STATIC LOADING** | **05** |
| | Concept of factor of safety, factors affecting factor of safety, maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, maximum strain energy theory, maximum shear strain energy theory, region of safety for all theories | |
| 3 | **THICK CYLINDERS AND BENDING OF CURVED BARS** | **10** |
| | Cylinder Classification, design of thick cylinders, Lame's theory, Design based on various failure theories, cylinders subjected to external pressure, Methods of pre-stressing of cylinders | |
| | Introduction, Stresses in curved bars (Winkler-Bach theory) (Rectangular section, Circular section, Triangular section, Trapezoidal section, T-Section) | |
| 4 | **COLUMNS AND STRUTS** | **05** |
| | Classification of columns, strength of columns, end conditions and equivalent length, Euler's formula, Rankine's hypothesis | |
| 5 | **SLOPE AND DEFLECTION OF BEAMS** | **05** |
| | Introduction, Beam deflection, relation between slope, deflection and radius of curvature, slope and deflection at a section by various methods | |
| 6 | **STRESSES DUE TO ROTATION** | **05** |
| | Stresses in rotating ring, stresses in rotating thin solid and hollow disc, stresses in thin disc with a pin hole, disc of uniform strength | |
| | **Total Hours** | **45** |

**TEXT BOOKS**

1. Advanced Mechanics of Solids, L. S. Srinath, Tata McGraw Hill
2. Strength of Materials, R. K. Rajput, S. Chand & Co. Ltd.

**REFERENCE BOOKS**

1. Solid Mechanics, S. M. A. Kazimi, Tata McGraw Hill
2. Strength of Materials, D. S. Bedi, Khanna book publishing co. Pvt ltd.
3. Elements of Strength of Materials, Timoshenko S. P. and Young D.H., East-West Press Pvt. Ltd.
4. Mechanics of Materials, Timoshenko and Gere, CBS Publishers
5. Mechanics of Structures, S. B. Junarkar, Charotar Publishers

**COURSE OUTCOMES**

After successful completion of the course, students will be able to;

CO1 Analyse stresses and strain in three dimension and understand stress strain relationship for different types of materials

CO2 Apply various failure theories for designing different components subjected to bi-axial or tri-axial static loading

CO3 Design and analyze thick and compound cylinders subjected to internal and external pressure, evaluate stresses induced in different cross-sectional curved members subjected to bending.

CO4 Determine buckling of column and beam columns with different end conditions and loading.

CO5 Apply various methods to determine slope and deflection of beams under different types of loading.

CO6 Analysis of stresses setup due to rotation in ring and disc.

**SUGGESTED LIST OF PRACTICALS**

| **Sr. No.** | **Title** |
|---|---|
| 1 | Stresses in 3D |
| 2 | Strains in 3D |
| 3 | Theories of elastic failure under static loading |
| 4 | Thick cylinders |
| 5 | Columns and struts |
| 6 | Slope and deflection of beams |
| 7 | Bending of curved bars |
| 8 | Stresses due to rotation |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | 3 | 3 | 2 | 3 |
| CO2 | 3 | 2 | 3 | 1 | - | - | - | 2 | 2 | 2 | - | 3 | 3 | 2 | 3 |
| CO3 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | 3 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | 3 | 3 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | 3 | 3 | 2 | 3 |
| CO6 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 2 | - | 3 | 3 | 2 | 3 |

**1-Slightly; 2-Moderately; 3-Substantially**

## MECHANICAL MEASUREMENT AND METROLOGY (MH512)

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **BASIC CONCEPT OF MEASUREMENT** | **10** |
| | Introduction, Methods of measurement, Standards, Calibration, General measurement system, Operational description of a measurement system, Accuracy and Precision, Types of errors, Sources of errors, Statistical analysis of data, Introduction, Static performance characteristics, Dynamic performance characteristics, input, types, Instruments types, transducers | |
| 2 | **MEASUREMENT OF PRESSURE AND TEMPERATURE** | **10** |
| | Measurement of Pressure: Introduction, Methods of measuring pressure, Dead weight gauge tester, McLeod gauge, Pressure measurement with elastic transducers, Electrical methods, Manometers, Measurement of Vacuum. | |
| | Measurement of Temperature: Introduction, Expression of Temperature, Expansion of thermometer, Change of state thermometer, Electrical methods, Pyrometry, Optical pyrometer, Calibration of temperature measuring instruments | |
| 3 | **FLOW MEASURMENT TECHNIQUES AND MISCELLANEOUS MEASUREMENT** | **10** |
| | Flow measurement: Introduction, Types of flow measuring instruments, Quantity meter, Obstruction meters, Ultrasonic flow meter, Flow measurement by drag effect (Rotameter), Pitot tube, Hot wire anemometers, Special methods, Flow visualization methods. | |
| | Miscellaneous measurements: Basic methods of force measurements, Torque measurement on rotating shaft, Prony brake, and eddy current dynamometers, Stress and strain measurements, Types of strain gauges, Electrical resistant strain gauges, Wheatstone bridge, Gauge factor of strain gauge, Rosettes, Speedometer and stroboscope, Ballast circuit, Vibration measurement using accelerometer | |
| 4 | **LINEAR AND ANGULAR MEASUREMENT** | **15** |
| | Introduction, Standards of Measurements, Line graduated measuring instruments, Steel Rule, Calipers, Surface plate, Angel plate, V block, Planner gauges, Radius gauges, Feeler gauges, Angel gauges, Vernier Caliper, Micrometers, Slip gauges, Vernier and Optical Bevel Protector, Sine Principle and Sine Bars, Dial gauges, Introduction of comparator, Characteristics of comparators, Uses of comparators, Advantages & Disadvantages of various types of comparators, Mechanical Optical Comparators, Pneumatic Comparators, Fluid Displacement Comparators, Optical Projector | |
| 5 | **LIMITS, FITS, GAUGE DESIGN AND MEASUREMENT OF GEOMETRIC SHAPES** | **10** |
| | Introduction, Tolerances, Interchangeability, Selection of fits, Tolerances and Geometry, Types of gauges, Taylor's principle of gauge design, Gauge tolerance, Allocation of gauge tolerance, Wear allowance, Positional tolerance, Straightness, Test for straightness by using Spirit level and Auto- collimator, Flatness Testing, Mathematical treatment of determination of straightness and flatness of surface, | |

Parallelism, Equidistance, Coincidence, Squareness, Measurement of circularity, Test for checking Rotation, Profile Measurement, Surface roughness measurement

| | | |
|---|---|---|
| **6** | **METROLOGY OF GEAR AND SCREW THREAD** | **05** |
| | Introduction, Screw thread terminology, Effect of pitch error, Measurement of various element of thread, Different types of gears, Basic elements of gear, Involute function, Relations between different gear elements of spur and helical gears, Virtual number of teeth, Methods of measuring the gear tooth thickness, | |
| | **Total Hours** | **60** |

**TEXT BOOKS**

1. Mechanical Measurements and Control by D. S. Kumar, Metropolitan, New Delhi
2. Metrology by M. Mahajan, Dhanpat Rai & Co
3. Mechanical Measurements and Instrumentation and Control by A. K. Sawhney & Puneet Sawhney, Dhanpat Rai & Co.
4. Engineering Metrology by R. K. Jain, Khanna publisher

**REFERENCE BOOKS**

1. Mechanical Measurement by R. S. Sirohi & H. C. Raha Krishna, Wiley Eastern Limited
2. Engineering Metrology by D. M. Anthony, Pergamon Press
3. The Metrology Hand Book by J. L. Bucher, American Society for Quality, 2004
4. Measurement Systems: Application and Design by E.O. Doeblein, McGraw Hill

**COURSE OUTCOMES**

After successful completion of the course, students will be able to;

CO1 Understand basic concepts of mechanical measurement and errors in measurement

CO2 Demonstrate appropriate pressure and temperature measuring devices for various application.

CO3 Apply various techniques for flow and miscellaneous measurements.

CO4 Learn methodology for linear and angular measuring instruments.

CO5 Design various gauges and selection of fits based on appropriate limits and tolerances.

CO6 Identify suitable metrological methods for gear and screw thread measurements.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | To measure linear dimensions of given specimen using different instruments. |
| 2 | To calibrate the micrometer with help of the slip gauges. |
| 3 | To measure angle of taper using sine bar and slip gauges. |
| 4 | To study characteristics of Linear Variable differential Transformer. |
| 5 | To calibrate pressure gauges with help of the dead weight pressure gauge tester. |
| 6 | To measure surface roughness of different surfaces with help of the surface roughness tester. |
| 7 | To measure temperature using RTD. |
| 8 | To measure applied force with the help of proving ring and strain gauge. |
| 9 | To measure the torque using strain gauge. |
| 10 | To measure gear tooth thickness using gear tooth Vernier caliper. |
| 11 | To measure principal strain on a thin-walled pressure vessel by using Rosette strain Gauge. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | - | - | - | - | 1 | 1 | 2 | - | 2 | 3 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 3 | 1 |
| CO3 | 3 | 2 | 2 | - | - | - | 1 | 1 | 2 | - | - | 2 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 1 | 1 | - | 2 | 1 | 2 | 2 | 1 | 2 | 3 | 3 | 2 |
| CO6 | 3 | 2 | 2 | - | 2 | - | 1 | 1 | 1 | 1 | - | 2 | 3 | 2 | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

## MACHINE DESIGN - I

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **INTRODUCTION AND DESIGN CONSIDERATIONS:** | 10 |
| | Design engineering, design engineering phases, basic requirements and procedure of design, design synthesis, use of standards in design, selection of preferred sizes, aesthetic and ergonomic considerations in design, concurrent engineering, Design considerations for manufacture and assembly of casting, forging, machining and welding | |
| 2 | **DESIGN AGAINST STATIC LOAD:** | 08 |
| | Design parts subjected to tension, compression, shear, bending, torsion, combined and eccentric axial static loads such as such as cotter joint, knuckle joint, levers | |
| 3 | **THREADED FASTENERS, POWER SCREW, RIVETED JOINTS:** | 14 |
| | Basic design concepts of threaded fasteners, eccentrically loaded threaded joint in shear, eccentric load perpendicular and parallel to axis of threaded fastener, design of turn buckle | |
| | Design of power screw, simple screw jack, toggle jack and C-clamp | |
| | Basic design concepts of riveted joints, design of longitudinal and circumferential riveted joints for boiler shell, Eccentrically loaded riveted joints | |
| 4 | **SHAFTS, KEYS AND COUPLINGS, MECHANICAL SPRINGS:** | 14 |
| | Types of shaft, material for shaft, shaft design based on strength and rigidity, A.S.M.E. code for shaft design, types of keys, design of sunk, saddle and Kennedy key, design of splines, types of couplings, design of flanged and bush-pin flexible couplings | |
| | Types, applications and materials for springs, stress and deflection equations for closely coiled helical compression springs, Wahl's factor and its use in spring design, end conditions, concentric springs, design of helical torsion, spiral and leaf springs | |
| 5 | **STATISTICAL CONSIDERATIONS IN DESIGN:** | 06 |
| | Statistics in design, Variance, standard deviation and standardized variables, normal distribution, confidence intervals, population combinations, design and natural tolerances, mechanical reliability, statistical considerations for factor of safety | |
| 6 | **DESIGN OF CLUTCHES AND BRAKES:** | 08 |
| | Function, classification and material selection, design of single plate, multiple plate, cone and centrifugal clutches, classification of brakes, design of band brake, External and internal shoe brakes, Internal expanding shoe brakes, calliper disc brake | |
| | **Total Hours** | **60** |

### TEXT BOOKS


1. Design of Machine Elements, V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd
2. Machine Design – I & II, Farazdak Haideri, Nirali Prakashan

**REFERENCE BOOKS**

1. Mechanical System Design, Farazdak Haideri, Nirali Prakashan
2. Machine Design, An integral approach - Robert L. Norton, Pearson Education Inc
3. Mechanical Engineering Design - J. E. Shigley, C. R. Mischke, McGraw-Hill Publishing Co. Ltd
4. A text book of Machine Design - P. C. Sharma, D. K. Aggarwal, S. K. Kataria & Sons
5. Engineering Design, George E. Dieter, McGraw-Hill Publishing Co. Ltd
6. Design Data (PSG College of Engg. & Tech.), DVP Printers

**COURSE OUTCOMES**

After successful completion of the course, students will be able to;

CO1 Understand design engineering, phases of design engineering and important design considerations related to forging, casting, machining and forming.

CO2 Design and analyze parts subjected to static loading for tension, compression, shear, bending, eccentric and combined loading.

CO3 Design important mechanical components like threaded fasteners, power screw, riveted joints.

CO4 Design and analyze shaft, keys, couplings

CO5 Design of Mechanical Springs, statistical considerations in mechanical engineering design

CO6 Design basic clutches and breaks used in various mechanical applications

**SUGGESTED LIST OF PRACTICALS**

The term work shall be based on above contents.

- Each drawing shall consist of two half imperial (A2) size sheets: One involves drawing of individual components and the other involves assembly drawing with a part list and overall dimensions.
- Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified so as to make the drawing as working drawing.
- Design report giving all necessary calculations of the design of components mentioned below should be submitted in a separate file.
- Design data book shall be used wherever necessary to achieve selection of standard components

**TERM WORK EXECUTION**

| Sr. No. | Title of the Assignment | Exercises for design report | Exercises for sketchbook | Exercises for Sheet | Physical / AutoCAD | Lab Hours |
|---|---|---|---|---|---|---|
| 1 | Design of Miscellaneous Components against static loading | 4 | --- | --- | --- | 2 |
| 2 | Design and drawing of Cotter Joint | 2 | 1 | 1 | Physical (1 Detail Sheet + 1 Assembly Sheet) | 4 |
| 3 | Design and drawing of Knuckle Joint | 2 | 1 | 1 | Physical (1 Detail Sheet + 1 Assembly | 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | Sheet) | |
| 4 | Design of levers | 3 | --- | --- | --- | 2 |
| 5 | Design of transmission shaft | 4 | --- | --- | --- | 2 |
| 6 | Design and drawing of coupling<br>Flanged coupling<br>Bush – pin flexible coupling | 2 | 1 | 1 | AutoCAD (1 Detail Sheet + 1 Assembly Sheet) | 2 |
| 7 | Design of Threaded Fasteners and Power screws | 4 | 1 | 1 | AutoCAD (1 Detail Sheet + 1 Assembly Sheet) | 4 |
| 8 | Design of spring | 4 | --- | --- | --- | 2 |
| 9 | Design of Clutches and brakes | 4 | --- | --- | --- | 2 |
| 10 | Statistical Considerations in Design | 4 | --- | --- | --- | 2 |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | - | - | - | - | 2 | 1 | 2 | - | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | - | 1 | - | - | 2 | 1 | 2 | - | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | - | 1 | - | - | 2 | 1 | 2 | - | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | - | 1 | - | - | 2 | 1 | 2 | - | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | - | 1 | - | - | 2 | 1 | 2 | - | 3 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 2 | - | 1 | - | - | 2 | 1 | 2 | - | 3 | 3 | 3 | 3 |

**1-Slightly; 2-Moderately; 3-Substantially**

# (MH610) CAD-CAM

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

## COURSE OBJECTIVES

CO1 To understand the fundamentals of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM).

CO2 To understand and use various geometric transformations like translation, rotation, scaling, shear, mirror etc for geometric modeling.

CO3 To understand and use different geometric modeling approaches like wire-frame modeling, solid modeling, surface modeling, feature based modeling, parametric modeling etc.

CO4 To develop a part program for CNC Turning centers and CNC machining centers.

CO5 To understand various aspects of CAM such as CAPP, CAQC, Group technology, FMC and FMS etc.

CO6 To create part models, assembly models and design drawings, and to generate part program for machining operations using CAD/CAM software.

## DETAILED SYLLABUS

| SR. NO. | TOPICS | HOURS |
|---|---|---|
| 1 | **INTRODUCTION**<br>Introduction, Reasons for implementing CAD system, Conventional design vs CAD. Advantages of CAD, Architecture of CAD workstation with technical specifications, CAD hardware: working principles of various input, output and memory devices. CAD software: Elements of computer programming, computer languages, CAD programming, Modules of CAD software, ICG system: Desirable features, Functions | 06 |
| 2 | **ALGORITHMS AND GEOMETRIC TRANSFORMATIONS**<br>Scan conversion, DDA algorithm of line and circle, Bresenham's algorithm of line. Geometric transformations: Scaling, Translation, Rotation, Reflection, Shear, Homogeneous coordinate system. | 09 |
| 3 | **GEOMETRIC MODELING**<br>Introduction, Types of geometric modeling: wireframe, surface and solid modelling, Curves used in wireframe modeling, Non Parametric and Parametric representation of curves, Analytic curves: line and circle,<br>Synthetic curves: Hermite cubic spline, Bezier curve, B- spline curve.<br>Surface modelling: Types of surfaces, analytical surfaces, synthetic surfaces such as Hermite cubic, Bezier, B-spline and coons patch.<br>Solid modelling: introduction, geometry and topology, solid modelling representation schemes such as pure primitive instancing, generalized sweeps, hierarchical, octree and cellular decomposition, B-rep, CSG etc. Feature based | 13 |

| | | |
|---|---|---|
| | modelling, Parametric modelling. | |
| **4** | **CAD STANDARDS** | |
| | Standards for graphics programming, GKS and its features, Need of CAD data exchange, CAD standards such as DXF, IGES, STEP, PDES | 02 |
| **5** | **COMPUTER AIDEDMANUFACTURING** | |
| | Introduction, historical background, role of computers in manufacturing, automation, Types of automation. | 04 |
| **6** | **FUNDAMENTALS OF NC AND CNC MACHINES** | |
| | Numerical Controls, types, evolution of controllers, components of NC/CNC system, specification of CNC system, classification of NC/CNC machines, transducers used, salient features, constructional details of CNC machines, axis designation, NC/CNC tooling. | 06 |
| **7** | **PART PROGRAMMING FOR CNC MACHINES** | |
| | Fundamentals of manual part programming, types of format, word address format manual part Programming for drilling, lathe and milling machine operations, subroutines, do-loops, canned Cycles<br>Computer Assisted Part Programming– APT language, types of statement, command and programming. | 14 |
| **8** | **ADVANCES IN CAM** | |
| | Group Technology and Cellular manufacturing: Introduction, Part families, parts classification and coding, production flow analysis, machine cell design. Computer aided process planning(CAPP):Types of process planning system introduction of flexible manufacturing system and computer aided quality control. | 06 |
| | **TOTAL CONTACT HOURS** | **60** |

**REFERENCE BOOKS**


1. CAD-CAM and Automation, Farazdak Haideri, Nirali Prakashan
2. Computer Aided Manufacturing, Rao, Tewari, Kundra, McGraw Hill
3. CNC Machines, Pabla B.S. &Adinathan, New Age publishers
4. Mastering CAD/CAM, Ibrahim Zeid, Mc Graw Hill international
5. Mathematical Elements of Computer Graphics, Roger and Adams, McGraw Hill
6. Computer Aided Design and Manufacturing, Sadhu Singh, Khanna Pub.
7. CAD/CAM, Zimmer & Groover P., Prentice Hall of India
8. CNC Programming, Sinha S. K., Galgotia Publications


## Course Outcomes:

After successful completion of the course, students should be able to:

CO1 Understand the fundamentals of Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM).

CO2 Understand and use various geometric transformations like translation, rotation, scaling, shear, mirror etc for geometric modeling.

CO3 Understand and use different geometric modeling approaches like wire-frame modeling, solid modeling, surface modeling, feature based modeling, parametric modeling etc.

CO4 Develop a part program for CNC Turning centers and CNC machining centers.

CO5 Understand various aspects of CAM such as CAPP, CAQC, Group technology, FMC and FMS etc.

CO6 Create part models, assembly models and design drawings, and to generate part program for machining operations using CAD/CAM software.

## Suggested List of Experiments

1. Introduction to CAD software (Solidworks) and its working environment.
2. Creating 2D sketches using sketch tools.
3. Part modeling using sketch-driven features (Extrude, Revolve).
4. Part modeling using sketch-driven features (Sweep, Loft, Boundary boss etc.).
5. Part modeling using sketch-independent features (hole, thread, rib, shell, fillet, chamfer etc.).
6. Part modeling using sketch-independent features (Mirror, pattern, wrap etc.).
7. Part modeling of machine parts.
8. Assembly modeling of machine/ mechanism/ equipment using different mates.
9. Motion study of any machine or mechanism.
10. Generating Detail and Assembly drawing.
11. NC/CNC Part Programming.

## Course Articulation Matrix:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | - | - | - | - | - | 1 | 1 | - | 2 | 3 | 2 | 2 |
| CO2 | 3 | 2 | 1 | - | 2 | - | - | - | 1 | 2 | - | 2 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 1 | - | 2 | - | - | - | 1 | 2 | - | 2 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 2 | - | 3 | - | - | - | 1 | 2 | - | 3 | 3 | 2 | 2 |
| CO5 | 2 | 1 | 2 | - | 2 | - | - | - | 1 | 2 | - | 3 | 3 | 2 | 2 |
| CO6 | 1 | 2 | 3 | - | 3 | - | - | - | 2 | 3 | - | 3 | 3 | 2 | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

**DHARMSINH DESAI UNIVERSITY, NADIAD**
**FACULTY OF TECHNOLOGY**
**MECHANICAL ENGINEERING DEPARTMENT**
**B.TECH. - SEMESTER VI**
**SUBJECT: (MH614) STEAM AND GAS TURBINES**

| Teaching Scheme (Hours/week) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 0 | 60 | 40 | ---- | ---- | 100 | 4 | 0 | 0 | 4 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **POWER GENERATION CYCLES**<br>Rankine cycle: Thermodynamics of Rankine cycle, Effect of increasing maximum pressure, Effect of reducing exhaust pressure, Modifications (Super heating, Reheat, Regenerative, water extraction, Binary vapour power cycle), ideal working fluid for vapour power cycle, Brayton cycle: Open and closed cycle arrangement, Modifications in ideal and actual cycle (Reheat, Regeneration, Intercooling and their combinations), combined cycle power plant. | 8 |
| 2 | **COMPRESSIBLE FLOW**<br>Stagnation properties, Speed of sound and Mach number, One-dimensional isentropic flow, Variation of fluid velocity and fluid pressure with area, Introduction to Shock waves. | 6 |
| 3 | **NOZZLE**<br>Introduction, Types of nozzle and diffuser, Critical pressure ratio and chocked flow, Flow in steam nozzle, Nozzle efficiency, Effect of back pressure in convergent divergent nozzle, Super saturated flow in nozzle. | 6 |
| 4 | **STEAM TURBINE**<br>Working principle of steam turbine, Types of steam turbine, Impulse and Reaction turbine (Velocity diagram, Diagram work, Diagram efficiency, Compounding of turbine, Effect of blade friction, optimum velocity ratio and maximum work done), Effectiveness of moving row in velocity compounding, Degree of reaction in reaction turbine, steam turbine governing, Energy losses in turbine, Back pressure and Pass out turbine, design of turbine blades in different stages, casing design and other design aspects. | 10 |
| 5 | **GAS TURBINE**<br>Combustion chamber: Combustion theory applied gas turbine, Factors affecting combustion chamber design and their performance, Requirements of combustion chamber, Process of combustion in Gas turbine, Combustion chamber geometry and its arrangement.<br>Turbine rotor: Rotor blade material and its selection, Blade fixing, Problems of high temperature operation, Blade cooling Pollution control in gas turbine plants, materials for gas turbine plants, different fuels used. | 10 |
| 6 | **INTRODUCTION OF JET PROPULSION**<br>Principle of Jet propulsion, Types of propulsion systems (Ramjet, Pulsejet, Turboprop, Turbojet, Turbofan), Thrust and thrust power, Propulsive power and efficiency, thermal and overall efficiency of jet, Specific fuel consumption. | 8 |
| | **Total Hours** | 48 |

**TEXT BOOKS**

1. Power Plant Engineering, P.K. Nag, Tata McGraw Hill Publication.
2. Gas Turbines, V. Ganeshan, McGraw Hill Publication.
3. Steam Turbine, R. Yadav, Khanna Publications.

**REFERENCE BOOKS**

1. Thermodynamics - An Engineering Approach, Yunus A. Cengel, McGraw Hill Publication
2. Fundamentals of Compressible Flow, S. M. Yahya, New Age International Publishers
3. Gas Turbine Theory,Cohn H. Rogers, GFC and H. I. H. Saravanamutto, Pearson Education Ltd
4. Gas Dynamics and Space Propulsion, M.C. Ramaswamy, Jaico Publishing House
5. Gas Dynamics, Rathakrishnan, Prentice Hall India
6. Steam Turbine Theory and Practice, William J. Kearton, CBS Publication

**COURSE OUTCOMES**

After successful completion of the course, students will be able to:

| | |
|---|---|
| CO1 | Understand, analyze and evaluate the thermodynamics involved in basic Rankine cycle, Brayton cycle and modifications in these cycles to improve thermal efficiency. |
| CO2 | Understand the fundamentals of compressible flow. Analyze and evaluate the effect of variations in the parameters like area of flow, velocity, pressure. |
| CO3 | Learn the basic concepts of flow through steam nozzles and types of nozzles and diffusers. Analyze the effects of backpressure, understand critical pressure ratio, chocked flow and supersaturated flow through steam nozzles. |
| CO4 | Learn about working principle, types, construction, compounding and governing of steam turbines. |
| CO5 | Understand the types and design of combustion chamber and turbines used in gas turbine power plant. Also, learn about the various aspects like requirement of combustion chamber, fuels used, materials and pollution. |
| CO6 | Understand principle of jet propulsion, types of propulsion systems and their analysis. |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 3 | 2 | 1 |
| CO2 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | 3 | 1 | 1 |
| CO4 | 3 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | 2 | 2 | 1 |
| CO5 | 3 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO6 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | 2 | 1 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

# (MH717) FINITE ELEMENT METHODS

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

**DETAILED SYLLABUS**

| SR. NO. | TOPICS | HOURS |
|---|---|---|
| 1 | **INTRODUCTION** | |
| | Introduction and basic concept of finite element method, General steps for finite element method, application of FEM, advantage of FEM, shape function, Types of elements, Potential energy approach, Rayleigh-Ritz method, principle of virtual work, stiffness matrix, stiffness matrix for spring element, direct stiffness method, boundary conditions. | 10 |
| 2 | **1D STRUCTURAL PROBLEM** | |
| | Natural and global co-ordinate systems, linear shape function, stress-strain and displacement relationship, stiffness matrix for bar element, load vector, Boundary condition, elimination approach and penalty approach, structural problems: Axial bar elements, Thermal effects in axial bar elements, Quadratic shape function, displacement, stress and strain for quadratic element, element stiffness matrix for quadratic element. | 15 |
| | Global stiffness matrix for bar arbitrarily oriented in the plane, stresses in truss element, truss element problems. | |
| 3 | **2D STRUCTURAL PROBLEM** | |
| | Principles for 2D problems- plane stress and plane strain, Constant Strain Triangular element – shape function, element stiffness matrix and equation, plane stress problem, Isoparametric formulation of quadrilateral element- shape function, element stiffness matrix, numerical integration method, examples | 07 |
| 4 | **DEVELOPMENT OF BEAM EQUATION** | |
| | Beam stiffness matrix on Euler Bernoulli's beam theory, distributed loading, work equivalence method, Beam element with nodal hinge, beam element problems | 06 |
| 5 | **DEVELOPMENT OF FRAME EQUATION** | |
| | Rigid plane frame, element stiffness matrix of frame element, plane frame examples | 04 |
| 6 | **SCALER FIELD PROBLEMES** | |
| | Steady state heat transfer, one dimensional heat conduction, and one dimensional heat transfer in thin fin element | 03 |
| | **TOTAL CONTACT HOURS** | **45** |

**TEXT BOOKS**

1. Introduction to Finite Elements in Engineering, Tirupathi K. Chandrupatla and Ashok D.Belegundu Prentice Hall of India Private Ltd.
2. A First Course in the Finite Element Method, D. L. Logan, Cengage Learning, Mc Graw Hill
3. CAD / CAM and Automation, Farazdak Haidery, Nirali Prakashan

**REFERENCE BOOKS**

1. "An Introduction to Finite Element Methods", J. N. Reddy, Mc Graw Hill.
2. "The finite element methods in Engineering", S.S. Rao, Pergamon, New York
3. "The Finite Element Method in Engineering science", O.C. Zienkowicz, Mc Graw Hill.
4. "Finite Element Analysis", P. Seshu,
5. "Finite Element Procedures in engineering analysis", K.J Bathe.

## Course Outcomes:

After successful completion of the course, students should be able to:

CO1 Understand fundamentals of Finite Element Methods (FEM)

CO2 Solve and analyse one dimensional structural problems using FEM.

CO3 Solve and analyse two dimensional structural problems using FEM.

CO4 Solve and analyse problems of beams using FEM.

CO5 Solve and analyse problems of planar frames using FEM.

CO6 Solve and analyse scalar field problems using FEM.

**SUGGESTED LIST OF PRACTICALS**

| Sr. No. | Title |
|---|---|
| 1 | Introduction to Finite Element Analysis. |
| 2 | Grid Independence Analysis |
| 3 | Stepped Bar Analysis |
| 4 | Planar Truss Analysis |
| 5 | Beam Analysis |
| 6 | Bicycle Frame Analysis |
| 7 | Plane Stress Analysis |

8 Plane Strain Analysis

9 Buckling Analysis

10 Conduction and Convection Analysis

11 Contact Analysis

**Course Articulation Matrix:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 1 |
| CO2 | 3 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 1 |
| CO3 | 3 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 1 |
| CO4 | 3 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 1 |
| CO5 | 3 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 1 |
| CO6 | 3 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – I (MECHANICAL ENGINERING - CAD/CAM)

## SUBJECT: ADVANCE MACHINE DESIGN (MM109)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 0 | 4 | 4 | 60 | 40 | - | - | 100 |

**DETAILED SYLLABUS**

| Sr. No. | TOPICS |
|---|---|
| 1 | **STRESSES AND STRAIN IN 3D**<br>Concept of continuum, homogeneity and isotropy, types of forces on a body, state of stress as a point, rectangular stress components, equality of cross shear, stress components on an arbitrary plane, principal planes and stresses, stress invariants, hydro-static stress and stress deviator, Mohr's circle for 3D state of stress, plane of maximum shear, octahedral stresses, differential equilibrium equation, stress transformation<br>Deformation, types of strain, rectangular strain components, concept of total strain, rigid body rotation, principle strain and axes, isotropic and shear strain, strain invariants, strain compatibility conditions, strain transformation, plane stress and plane strain, stress-strain relationship and generalized Hook's law, stress strain relationship for anisotropic, orthotropic and isotropic materials |
| 2 | **THEORIES OF ELASTIC FAILURES**<br>Concept of factor of safety, maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, maximum strain energy theory, maximum shear strain energy theory |
| 3 | **FRACTURE MECHANICS**<br>Introduction and overview of fracture mechanics, fracture mechanics approach to design, effect of material properties on fracture, linear elastic fracture mechanics (LEFM), atomic view of fracture, stress concentration effect, Grifith theory, energy release rate, instability and R-curve, stress analysis of cracks, stress intensity factor and different modes of loading, crack tip plasticity, fracture toughness, determination of plastic zone shape and size, stress intensity factor as a failure criteria |
| 4 | **ENGINEERING STATISTICS**<br>Introduction to experimental design, basic statistical concepts, sampling design, null hypothesis, alternate hypothesis, type I & type II errors - critical region, confidence interval, level of significance, hypothesis testing , design and analysis of single-factor experiments using ANOVA, Introduction to factorial designs, two factor factorial experiments using ANOVA |
| 5 | **FATIGUE FAILURE**<br>Introduction, types of fatigue failure, mechanism of fatigue failure, fatigue failure models, stress-life approach, strain-life approach, LEFM approach, fatigue loads, measuring fatigue failure criteria, fully reversed stresses, combined mean and alternating stress, creating S-N curve, estimating fatigue failure criteria, estimating theoretical endurance limit and actual endurance limit, correction factors, notches and stress concentration, designing for fully |

reversed stresses for finite and infinite life, designing for fluctuating stresses for finite and infinite life, designing for Soderberg, Goodman and Gerber criteria, creating modified Goodman diagram, designing for multi-axial stresses in fatigue

**6 SURFACE FAILURE**

Introduction, surface geometry, mating surfaces, friction: general estimation of coefficient of friction, effect of various factors on friction, types of wear: adhesive wear, abrasive wear, corrosion wear, surface fatigue, surface contact geometry: spherical contact, cylindrical contact, general contact, contact pressure, contact patch, static stress distribution, dynamic contact stresses, surface fatigue strength: design for N cycles

## REFERENCE BOOKS


1. Advanced Mechanics of Solids, L. S. Srinath, Tata McGraw Hill
2. Fracture Mechanics - Fundamentals and applications, T. L. Anderson, CRC Press
3. Elementary Engineering Fracture Mechanics, David Broek, Matrinus Nijhoff Publishers
4. Elements of Fracture Mechanics, Prashant Kumar, McGraw Hill
5. Design and analysis of experiments, D.C. Montgomery, John Wiley and sons
6. Research Methodology, C. R. Kothari, New Age International Pvt Ltd
7. Machine Design - An Integral Approach, Robert L. Norton, Pearson Prentice Hall
8. Design of Machine Elements, V. B. Bhandari, Tata McGraw Hill


## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Understand and analyse stresses and strain in 3D context and understand stress-strain relationship for different types of materials
CO2 Apply failure theories for the solution of engineering problems
CO3 Understand basic aspect of fracture mechanics and applications to mechanical engineering problems
CO4 Incorporate engineering statistics in mechanical design
CO5 Analyse and design components under dynamic loading conditions
CO6 Understand various surface failure types and design procedure for different types of surface contacts

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 2 | 1 | 1 | - | 2 | 2 | 1 | - | 1 | 3 | 1 | 2 |
| CO2 | 2 | 2 | 3 | 2 | 1 | 1 | - | 2 | 2 | 1 | - | 1 | 3 | 1 | 2 |
| CO3 | 2 | 2 | 3 | 2 | 1 | 1 | - | 2 | 2 | 1 | - | 1 | 3 | 1 | 2 |
| CO4 | 2 | 2 | 3 | 2 | 2 | 1 | - | 2 | 2 | 1 | - | 1 | 3 | 1 | 2 |
| CO5 | 2 | 2 | 3 | 2 | 1 | 1 | - | 2 | 2 | 1 | - | 1 | 3 | 1 | 2 |
| CO6 | 2 | 2 | 3 | 2 | 1 | 1 | - | 2 | 2 | 1 | - | 1 | 3 | 1 | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – I (MECHANICAL ENGINERING - CAD/CAM)

## SUBJECT: COMPUTER AIDED DESIGN (MM110)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 4 | 7 | 5 | 60 | 40 | 25 | 25 | 150 |

### DETAILED SYLLABUS

| Sr. No. | TOPICS |
|---|---|
| 1 | **FUNDAMENTALS OF CAD**<br>Introduction to CAD, Conventional design v/s Computer aided design, Interactive computer graphics, CAD workstation, Hardware used in CAD, CAD software, CAD programming |
| 2 | **COMPUTER GRAPHICS**<br>Scan conversion, Algorithms to generate various 2D geometries such as line, circle etc. |
| 3 | **GEOMETRIC TRANSFORMATION**<br>Various 2D geometric transformation, Homogeneous coordinate system, Inverse transformation, Composite transformation, Coordinate transformation, 3D geometric transformation, Projections of geometric model such as Orthographic Projections, Isometric Projections, Perspective Projections etc. |
| 4 | **GEOMETRIC MODELLING**<br>Introduction to geometric modeling, Wireframe modeling, Analytical and Synthetic curves, Representation of curves, Non-Parametric representation, Parametric representation, Parametric representation of analytical curves, Parametric representation of synthetic curves, Introduction to NURBS<br>Analytical and Synthetic surfaces, Parametric representation of surfaces<br>Geometry and topology data of solid model, Representation schemes of Solids-Generalized sweeps, Spatial Occupancy enumeration, Cellular decomposition, Constructive solid geometry (C-Rep), Boundary representation (B-Rep), etc. Feature based modeling, Parametric representation of solids<br>Assembly modelling – top down and bottom up modelling concept |
| 5 | **CAD STANDARDS**<br>Need of CAD data exchange, CAD standards such as IGES, PDES, STEP etc., CAD/CAM Integration trough data exchange standards |
| 6 | **COMPUTER AIDED DESIGN OF MACHINE COMPONENTS**<br>To develop computer programs using Programming language for some of the machine components such as shafts, springs, couplings, clutches, brakes, levers, gears, belts |

### REFERENCE BOOKS


1. "Computer Graphics" by Hearn Donald & Baker M. Pauline, , Prentice-Hall of India Pvt. Ltd., 2nd Edition, 1997.
2. "Mathematical Elements for Computer Graphics" by David F. Rogers & J. Alan Adams, McGraw Hill, 2nd Edition, 1990.
3. "CAD, CAM and Automation" by Haideri Farazdak, Nirali Prakashan, 2014.
4. "CAD/CAM" by Zimmer & Groover, Prentice Hall of India.
5. "Geometric modeling" by Mortenson, M. E., Industrial Press, 2006.

6. “CAD/CAM - Theory and Practice” by Zaid Ibrahim, McGraw Hill, International Edition, 1998.
7. “CAD/CAM: Principles and Applications” by Rao, P.N., McGraw Hill Publication, 2nd Edition, 2004.
8. “CAD/CAM/CIM” by S. Radhakrishan, New edge International (P) Ltd publisher

**COURSE OUTCOMES**

After successful completion of the course, student will be able to;

| | |
|---|---|
| CO1 | Understand importance of CAD in the field of desinging and also various devices used in CAD |
| CO2 | Describe the mathematical basis in the technique of representation of geometric entities including points, lines, and parametric curves, surfaces and solid. |
| CO3 | Apply different technique of transformation of geometric entities using transformation matrix |
| CO4 | Analyze and apply various methods for part modeling including surface modeling and solid modeling. |
| CO5 | Understand the importance of various CAD standards and CAD data exchange |
| CO6 | Create 3D models, assemblies and generative drawings of a given engineering part or product |

**SUGGESTED LIST OF PRACTICALS**

1. Introduction and importance of computer aided design laboratory
2. Introduction to SolidWorks software
3. Practice of various features of SolidWorks software
4. Part modeling by using SolidWorks software
5. Assembly modeling and conversion of solid model to 2D drawings
6. Motion animation for simple mechanism
7. Write a program for 2D line drawing using DDA algorithm
8. Write a program to draw a line using Bresenham’s algorithm
9. Write a program to draw a circle using Bresenham’s algorithm.
10. Write a program for 2 D transformation for given drawing.
11. Write a program to rotation of a line about point in a plane
12. Write a program to rotation of a 3D line about an arbitrary axis in a space.
13. Write a program for Orthographic projection to any arbitrary plane
14. Write a program for Perspective projection for given object
15. Write a program for Coordinate transformation
16. Generate IGES, STEP and DXF file for the geometric model.

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | 1 | - | - | - | - | - | - | 1 | 1 | 1 | 1 |
| CO2 | 2 | 2 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | 1 | 2 | 1 | 1 |
| CO3 | 2 | 2 | 3 | 2 | 3 | 1 | 1 | - | - | - | - | 1 | 2 | 1 | 1 |
| CO4 | 2 | 2 | 3 | 2 | 3 | 1 | 1 | - | - | 2 | 1 | 1 | 3 | 1 | 2 |
| CO5 | 2 | 2 | 1 | 2 | 1 | - | - | - | 1 | 2 | 1 | 1 | 2 | 2 | 2 |
| CO6 | 2 | 1 | 3 | 2 | 2 | 1 | 2 | - | 1 | 1 | - | 1 | 3 | 2 | 3 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – I (MECHANICAL ENGINERING - CAD/CAM)

## SUBJECT: COMPUTER AIDED PRODUCTION MANAGEMENT (MM111)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 2 | 5 | 4 | 60 | 40 | 25 | 25 | 150 |

### DETAILED SYLLABUS

| Sr. No. | TOPICS |
|---|---|
| 1 | **COMPUTER AIDED FORECASTING**<br>Nature and use of forecast, different forecasting methods, selection of forecasting technique, measurement of forecast Accuracy, Adoptive methods. |
| 2 | **COMPUTER AIDED FACILITY DESIGN**<br>Computerized relative allocation of facility technique, automated layout design program and computerized relationship layout planning for facility location and layout. |
| 3 | **COMPUTER AIDED PROCESS PLANNING**<br>Generative and variant types, backward and forward approach, feature based and CAD based CAPP |
| 4 | **MRP AND ERP**<br>Master Production Schedule (MPS), Materials Requirement Planning (MRP), Lot sizing in MRP Systems, Evolution from MRP to Manufacturing Resource Planning (MRP II). Introduction of ERP, main features, generic model of ERP system, selection of ERP, proof of concept approach, analytic hierarchy approach, ERP implementation |
| 5 | **PRODUCTION SCHEDULING**<br>Single Machine Scheduling, Flow Shop Scheduling, Job Shop Scheduling, Rules of Optimized Production Technique schedule, Use of Kanban for scheduling |
| 6 | **GROUP TECHNOLOGY**<br>Part family, Part classification and coding, Production flow analysis, ROC, SLCA, cellular manufacturing, quantitative analysis in cellular manufacturing, Holier Method-I, II. |

### REFERENCE BOOKS


1. Automation, Production Systems and Computer Integrated Manufacturing, by Mikell P. Groover, Prentice Hall of India, New Delhi.
2. Production and Operations Management by R. Panneerselvam, Prentice –Hall of India Private Limited, New Delhi.
3. Modern Production/Operations Management, by Elwood S. Buffa and Rakesh K. Sarin, John Wiley publication.
4. Facilities planning, by J. A. Tompkins and J. A. White, John Wiley publication.
5. Plant layout & Material Handling, by G. K. Aggarwal, Jain Publishers, New Delhi.

## COURSE OUTCOMES

After successful completion of the course, student will be able to;

| | |
|---|---|
| CO1 | Understand various methods of forecasting and forecasting errors. |
| CO2 | Create optimized plant layout design with relevant plant layout design algorithm. |
| CO3 | Understand the different techniques useful for computer aided process planning. |
| CO4 | Create a material procurement plan based on various input required and order sizing technique. |
| CO5 | Apply appropriate scheduling technique for given production scenario |
| CO6 | Understand key elements of Group Technology. |

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Exercise on quantitative techniques of Demand Forecasting on Minitab. |
| 2 | Exercise on Systematic Layout Planning algorithm –CORELAP. |
| 3 | Exercise on Systematic Layout Planning algorithm – ALDEP. |
| 4 | Exercise on Systematic Layout Planning algorithm – CRAFT. |
| 5 | Exercise on Material Requirement Planning Lot Sizing. |
| 6 | Exercise on Single Machine Scheduling algorithm on Matlab. |
| 7 | Exercise on Flow Shop Scheduling algorithm on Matlab. |
| 8 | Exercise on Job Shop Scheduling algorithm on Matlab. |
| 9 | Exercise on Production Flow Analysis in Group Technology on Matlab. |
| 10 | Exercise on Part Family classification algorithms. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | - | - | 2 | - | - | - | - | - | - | - | 2 | 2 | - |
| CO2 | 2 | 2 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | 1 | 1 |
| CO3 | 3 | 1 | 1 | - | 3 | - | - | - | - | - | - | - | 2 | - | - |
| CO4 | 2 | 2 | 2 | - | 3 | - | - | - | - | - | - | - | 3 | - | - |
| CO5 | 2 | 2 | 3 | 2 | 3 | - | - | - | - | - | - | - | 2 | 2 | - |
| CO6 | 2 | - | 3 | - | 3 | - | - | - | - | - | - | - | 3 | 2 | - |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – I (MECHANICAL ENGINERING - CAD/CAM)

## SUBJECT: ADVANCE MATERIALS & MANUFACTURING TECHNOLOGIES (MM112)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 0 | 4 | 4 | 60 | 40 | 0 | 0 | 100 |

### DETAILED SYLLABUS

| Sr. No. | TOPICS |
|---|---|
| 1 | **ADVANCED MATERIALS**<br>Properties and applications of - Special steels, Alloy cast iron, Super alloys, Ferro electric and piezoelectric materials, advanced magnetic materials, advanced engineering polymer materials, Advanced ceramic and composite materials, photo conducting and photovoltaic materials, electro-optic materials, Lasers, biomaterials, smart materials. Nano materials & technology: Classification, size effect on structural and functional properties, Processing and properties of nano-crystalline materials, thin films and multi-layered coatings, single walled and multi walled carbon nanotubes |
| 2 | **MATERIALS PROCESSING**<br>Conventional processing techniques for advanced materials, special processing techniques, use of computers in metal processing |
| 3 | **MECHANICAL BEHAVIOUR OF MATERIALS AND PERFORMANCE OF MATERIALS IN SERVICE**<br>Mechanical testing of materials, mechanisms of failures, fracture theory, service performance, corrosion and its control, performance of materials at high & low temperatures, radiation damage and recovery. |
| 4 | **METAL CASTING, FORGING AND EXTRUSION**<br>Appraisal of various casting processes, selection of casting process, general design considerations for casting, casting tolerances, use of solidification simulation in casting design product design rules for sand casting, design factors for Forging, Closed die forging design, parting lines of dies, general design recommendations, Design guidelines for extruded sections, design principles for Punching, Blanking, Bending, Deep Drawing |
| 5 | **METAL JOINING**<br>Appraisal of various welding processes, Factors in design of weldments, general design guidelines, pre and post treatment of welds, effects of thermal stresses in weld joints, cost estimation in welding and its examples |
| 6 | **MICRO AND NANO MANUFACTURING**<br>Introduction to Micro and Nano manufacturing technology, advantages and applications of nanotechnology, Overview of Nano Fabrication Methods: Top-down and bottom-up approaches, lithography, deposition, CVD, PVD, etching, and material modification methods, processes and equipment |

## REFERENCE BOOKS


1. Engineering Design- A Material and Processing Approach by George E. Dieter, McGraw Hill Intl., 2nd Edition, 2000
2. Product design and Manufacturing by A.K Chitale and R.C Gupta, Prentice Hall of India, New Delhi, 2003
3. Principles of Metal Casting by Heine, Loper and Rosenthal, TMH, New Delhi, 1995
4. Introduction toNanoscienceand Nanotechnology by Gabor L. Hornyak, H.F. Tibbals, Joydeep Dutta and John J. Moore, CRC Press, Boca Raton, 2009
5. Materials Science and Engineering-An Introduction by William D. Callister Jr., David G. Rethwisch, John Wiley and Sons, Inc., 2010
6. Design for Manufacture by John Cobert / Adisson Wesley, 1995
7. ASM Handbook, Vol.20
8. Design for Manufacturability by James Bralla, McGraw Hill
9. Design and Manufacturing by Surender Kumar & Goutham Sutradhar, Oxford &IBH Publishing Co. Pvt .Ltd., New Delhi, 1998
10. Metal Forming Processes by GR Nagpal, Khanna Publishers, New Delhi, 2000
11. Microfabrication and Nano manufacturing by Mark James Jackson, CRC Press, 2005
12. Nanofabrication by Z. Cui, , Springer, 2008


## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Know various advanced materials and their characteristics.

CO2 Understand conventional and special processing techniques.

CO3 Understand mechanical behaviour of materials and their performance under the real service conditions.

CO4 Analyze casting, forging and extrusion processes and understand design principles and their implementation.

CO5 Analyze and design the weldments, evaluate the cost of welding, understand pre and post treatments of welds and effects of thermal stresses on welds.

CO6 Understand various micro and nano manufacturing and fabrication technologies.

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | 1 | - | - | 2 | 1 | - | - | 1 | - | 2 | 2 | 1 | 1 |
| CO2 | 2 | 1 | - | - | - | 1 | - | 1 | - | - | - | 1 | 1 | 1 | 1 |
| CO3 | 2 | - | - | - | - | 1 | 1 | - | - | - | - | 1 | 2 | 1 | 1 |
| CO4 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO5 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO6 | 2 | - | - | - | - | 1 | - | - | - | - | - | 1 | 2 | 1 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – I (MECHANICAL ENGINERING - CAD/CAM)

## SUBJECT: OPTIMIZATION TECHNIQUES IN ENGINEERING

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUES** | 08 |
| | Introduction, Historical development, Engineering Application, Optimization Techniques, Classification. Basic Concepts of Optimization-Convex and Concave Functions, Necessary and sufficient conditions for Stationary Points; Optimization of one- dimensional Functions; Unconstrained Multivariable Optimization, Multivariable optimization with equality and inequality constraint. | |
| 2 | **LINEAR PROGRAMMING:** | 07 |
| | Introduction ,Linear Programming and its Applications; Simplex method Duality in linear programming, Decomposition Principle ,Quadratic Programming. | |
| 3 | **NONLINEAR PROGRAMMING** | 07 |
| | Introduction, One- Dimensional Minimization Methods-Elimination methods Unrestricted Search, Exhaustive Search, Dichotomous search, Fibonacci method, Golden Section Method, Interpolation methods. | |
| 4 | **UNCONSTRAINED OPTIMIZATION TECHNIQUES:** | 08 |
| | Introduction, Classification, Univariate method, Powell's pattern search method, Simplex Method, Cauchy's Method, Newton's Method. | |
| 5 | **CONSTRAINED OPTIMIZATION TECHNIQUES:** | 08 |
| | Introduction, Classification, Technique of variable transformation, Penalty functions- Exterior penalty function, Interior penalty function, Lagrange multipliers, Augmented Lagrange Multiplier Method. | |
| 6 | **UNCONVENTIONAL OPTIMIZATION:** | 07 |
| | Genetic Algorithms, Simulated Annealing, Particle swarm optimization, Ant colony Algorithms, Neural Network- Based Optimization, Fuzzy & Neuro-fuzzy algorithms technique. | |
| | **Total Hours** | **45** |

### TEXTBOOKS

1. Optimization theory & Applications / S.S. Rao / New Age International.
2. Optimization methods for engineers/ N.V.S. Raju/PHI publications.

### REFERENCE BOOKS

1. G..S.Beveridge and R.S.Schechter/ Optimization Theory and Practice.

2. G.V.Rekllaitis, A.Ravindran, and K.M.Ragsdell/ Engineering Optimization-Methods and Applications.
3. Deb Kalyanmoy/ Optimization for Engineering Design: Algorithms and Examples.
4. Unwubolu Godfrey C. and Babu B.V., “New Optimization Techniques in Engineering”.

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

| | |
|---|---|
| CO1 | Understand theory of optimization methods and algorithms developed for solving various types of optimization problems. |
| CO2 | Apply the various liner programming problem solving techniques |
| CO3 | Apply the various Non-liner programming problem solving techniques. |
| CO4 | Analyse the unconstrained optimization algorithms. |
| CO5 | Analyse the constrained optimization algorithms. |
| CO6 | Evaluate various recent non- conventional optimization algorithms. |

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Introduction to MatLab (Part-1) |
| 2 | Introduction to MatLab (Part-2) |
| 3 | Write MatLab code for solution of Interval halving method |
| 4 | Write MatLab code for solution of Exhaustive search method |
| 5 | Write MatLab code for solution of Dichotomous search method |
| 6 | Write MatLab code for solution of Fibonacci method |
| 7 | Write MatLab code for solution of Golden section method |
| 8 | Write MatLab code for solution of Cauchy method |
| 9 | Write MatLab code for solution of Newton Raphson method |
| 10 | Write MatLab code for Particle swarm optimization Algorithm. |
| 11 | Write MatLab code for Artificial Bee Colony Algorithm |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | - | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – I (MECHANICAL ENGINERING - CAD/CAM)

## SUBJECT: RESEARCH METHODOLOGY AND IPR (MM114)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 1 | 0 | 2 | 3 | 2 | 00 | 00 | 50 | 50 | 100 |

### DETAILED SYLLABUS

| Sr. No. | TOPICS |
|---|---|
| 1 | **Introduction to Research**<br>Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations |
| 2 | **Introduction to Literature Survey methods**<br>Effective literature studies approaches, analysis Plagiarism, Research ethics |
| 3 | **Report Writing and Research Paper Writing**<br>Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee |
| 4 | **Introduction to Intellectual Property Rights**<br>Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT |
| 5 | **Patenting & Licencing**<br>Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications |
| 6 | **Advancements in IPR**<br>New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Bio logical Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs |

### REFERENCE BOOKS


1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007
5. Mayall , “Industrial Design”, McGraw Hill, 1992
6. Niebel, “Product Design”, McGraw Hill, 1974
7. Asimov , “Introduction to Design”, Prentice Hall, 1962

8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in NewTechnological Age", 2016
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Develop understanding on various kinds of research, objectives of doing research, research process, research designs and sampling.

CO2 Have basic knowledge on qualitative research techniques.

CO3 Have adequate knowledge on measurement & scaling techniques as well as the quantitative data analysis.

CO4 Have basic awareness of data analysis-and hypothesis testing procedures.

CO5 Develop understanding of the basic framework of research process.

CO6 Understand about the Property Rights, Licensing and respective tools.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Introduction to Literature Review. |
| 2 | Developing Questionnaire for the Research. |
| 3 | Understanding Data Analysis methods |
| 4 | Demonstrate Report Writing |
| 5 | To study about IPR. |
| 6 | To study about Patenting |
| 7 | Introduction to Latex Writing tool. |
| 8 | To study about Bibliography |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | - | 1 | - | 1 | - | 1 | - | 1 | 1 | 1 | 1 | - |
| CO2 | 1 | 1 | - | - | 1 | - | - | - | 1 | - | - | 1 | 1 | 1 | - |
| CO3 | 3 | 2 | - | - | 1 | - | 1 | - | 2 | - | - | 2 | 2 | 2 | 1 |
| CO4 | 2 | 2 | 2 | 1 | - | 2 | - | - | - | 1 | - | 1 | 2 | 2 | - |
| CO5 | 2 | 2 | 1 | - | - | - | 2 | - | 1 | - | 3 | 1 | 2 | 2 | - |
| CO6 | 3 | 2 | 2 | - | - | 1 | - | - | 1 | - | - | 1 | 3 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – II (MECHANICAL ENGINERING - CAD/CAM)

### SUBJECT: FINITE ELEMENT METHODS (MM201)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 4 | 7 | 5 | 60 | 40 | 25 | 25 | 150 |

### DETAILED SYLLABUS

| Sr. No. | TOPICS |
|---|---|
| 1 | **INTRODUCTION** |
| | Introduction and basic concept of finite element method, General steps for finite element method, application of FEM, advantage of FEM, shape function, Types of elements, Potential energy approach, Rayleigh-Ritz method, Weighted residual method- Galerkin's method, principle of virtual work. Stiffness matrix, stiffness matrix for spring element, direct stiffness method, boundary conditions |
| 2 | **1D STRUCTURAL PROBLEM** |
| | Natural and global co-ordinate systems, linear shape function, stress-strain and displacement relationship, stiffness matrix for bar element, load vector, Boundary condition, elimination approach and penalty approach, structural problems: Axial bar elements, Thermal effects in axial bar elements, Quadratic shape function, displacement, stress and strain for quadratic element, element stiffness matrix for quadratic element. |
| | Transformation of vectors in two dimensions, Global stiffness matrix for bar arbitrarily oriented in the plane, stresses in truss element, truss element problems |
| 3 | **2D STRUCTURAL PROBLEM** |
| | Principles for 2D problems- plane stress and plane strain, Constant Strain Triangular element – shape function, element stiffness matrix and equation, plane stress problem, Isoparametric formulation of quadrilateral element- shape function, element stiffness matrix, numerical integration method, examples |
| 4 | **DEVELOPMENT OF BEAM EQUATION** |
| | Beam stiffness matrix on Euler Bernoulli's beam theory, distributed loading, work equivalence method, Beam element with nodal hinge, beam element problems |
| 5 | **DEVELOPMENT OF FRAME, GRID EQUATION AND AXISSYMMETRIC ELEMENT** |
| | Rigid plane frame, element stiffness matrix of frame element, plane frame examples, grid element equation and example ,formulation modeling and applications of axissymmetric element. |
| 6 | **SCALER FIELD PROBLEMES** |
| | Steady state heat transfer, one dimensional heat conduction, and one dimensional heat transfer in thin fin element |

## REFERENCE BOOKS


1. "A First Course in the Finite Element Method", D. L. Logan, Cengage Learning, Mc Graw Hill.
2. "CAD / CAM and Automation", FarazdakHaidery, Nirali Prakashan.
3. Introduction to Finite Elements in Engineering", Tirupathi K. Chandrupatla and Ashok D. Belegundu Prentice Hall of India Private Ltd.
4. "An Introduction to Finite Element Methods", J. N. Reddy, Mc Graw Hill.
5. "The finite element methods in Engineering", S.S. Rao, Pergamon, New York
6. "The Finite Element Method in Engineering science", O.C. Zienkowicz, Mc Graw Hill.
7. "Finite Element Analysis", P. Seshu
8. "Finite Element Procedures in engineering analysis", K.J Bathe.


## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 To understand fundamentals of Finite Element Methods (FEM)
CO2 To solve and analyse one dimensional structural problems using FEM.
CO3 To solve and analyse two dimensional structural problems using FEM.
CO4 To solve and analyse problems of beams using FEM.
CO5 To solve and analyse problems of planar frames and grid using FEM.
CO6 To solve and analyse scalar field problems using FEM.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Introduction to Finite Element Analysis. |
| 2 | Grid Independence Analysis |
| 3 | Stepped Bar Analysis |
| 4 | Planar Truss Analysis |
| 5 | Beam Analysis |
| 6 | Bicycle Frame Analysis |
| 7 | Plane Stress Analysis |
| 8 | Plane Strain Analysis |
| 9 | Buckling Analysis |
| 10 | Thermal Conduction and Convection Analysis |
| 11 | Contact Analysis |
| 12 | Vibration Analysis |
| 13 | Nonlinear Analysis |
| 14 | Heat Transfer Through the Furnace Wall |
| 15 | Steady State Thermal Analysis of Pipe Intersection |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 1 |
| CO2 | 3 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 1 |
| CO3 | 3 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 1 |
| CO4 | 3 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 1 |
| CO5 | 3 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 1 |
| CO6 | 3 | 3 | 1 | - | 2 | - | - | - | 1 | 1 | - | 1 | 2 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – II (MECHANICAL ENGINERING - CAD/CAM)

## SUBJECT: COMPUTER AIDED MANUFACTURING (MM-202)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

**DETAILED SYLLABUS**

**1 COMPUTER AIDED MANUFACTURING:**

CAM Concepts, Objectives & scope, Nature &Type of manufacturing system, Evolution, Benefits of CAM, Role of management in CAM.

**2 ESSENTIALS OF NC/CNC MACHINE TOOLS:**

Fundamentals and principles of NC/CNC Machine Tools: NC, CNC, DNC. Classification of NC/CNC Machine tools, Features of CNC Systems, Specification of CNC systems.

Components of NC/CNC system -Ball screws, Guideways, machine structure, drives and controls, Machine Control Unit, Transmission system, Drives and Feedback Devices, NC/CNC tooling etc.

Nomenclature of NC machine axes, CNC Control System, Automatic tool changer, Automatic Pallet Changer NC part programming, Punched tape and tape formats, NC words, Manual Part Programming for turning and machining centers.

**3 Flexible Manufacturing System (FMS) :**

Introduction of FMS, Need of FMS, General Considerations for FMS, Types of FMS, Flexibilities and their measurements, various mathematical techniques for flexibility

Measurements. Manufacturing cells, cellular v/s flexible manufacturing, Application of Just in Time and Group Technology to FMS.

**4 AUTOMATED MATERIAL HANDLING SYSTEMS :**

Type of Material Handling System, Configuration, Equipments, Elements Automated Guided Vehicle (AGV), Automated Storage and Retrieval System (ASRS), Carousal System, scheduling of AGVs,

**5 COMPUTER INTEGRATED MANUFACTURING (CIM) SYSTEMS :**

Introduction of CIM, nature and types of manufacturing system, evolution of CIM, hardware and software for CIM, benefits, scope and needs, CIM wheel, elements of CIM and their role, Computer technology and manufacturing, database requirement, fundamentals of communication, concurrent engineering.

CAD/CAM Integration: - Activities involved, case studies, software requirements, hardware requirements, factory automation, implementation

**6 Automatic Identification & Inspection :**

*Automatic Identification*

Shop floor control – Factory data collection system, Bar code techniques, Computer for

local area network.

*Automated inspection*

Basic principles and methods, Techniques for automated inspection– Contact and non contact inspection methods in processes, Automated measuring methods –machine vision, optical inspection methods.

## REFERENCE BOOKS


1. Numerical control and computer aided manufacturing – T.K. Kundra, P.N.Rao and N.K.Tewari –Tata McGraw Hill Publishing company Ltd.
2. CNC fundamentals and Programming, P.M.Agrawal and V.J.Patel, Charotar publishing house Pvt Ltd.
3. Mikell P. Grover, Automation., Production Systems and Computer Integrated Manufacturing, Prentice Hall of India Pvt Ltd, 1995
4. C.Ray Astaihe, Robots of Manufacturing automation, John Wiley and Sons, New York.
5. Computer numerical control machines –P.Radhakrishnan ,New Central Book Agency
6. Flexible Manufacturing Cells and System -William. W. Luggen Prentice Hall, England Cliffs, NJ.
7. CAD, CAM and CIM – P. Radhakrishan, S. Subramaniyam , New Age International.


## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Classify and distinguish NC, CNC and DNC systems, Understand CNC machine structures and system drives.

CO2 Explain the basic concepts of CNC programming and machining.

CO3 Generation of part programs for industrial components using CAM techniques. Skills to program and operate CNC machines.

CO4 Design automated material handling and storage systems for a typical production system.

CO5 Explain the concept of group technology, FMS, concurrent engineering, CIM systems.

CO6 Explain computer based integration between various functions - manufacturing, sales, design, and materials.

## SUGGESTED LIST OF PRACTICALS

1 Introduction to NC, CNC and DNC Systems of machine tools.

2 Classification of NC/CNC machine tools.

3 To study Constructional features of NC/CNC machine tool.

4 Manual part-programming for Turning center and Machining center.

5 Part-program generation for Machining centre using Mastercam .

6 Part-program generation Turning centre using Mastercam .

7 To study Flexible Manufacturing system.

8 To study Automated Material Handling system.

9 To study about Computer Aided Quality Control.

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 1 | 1 | | | | 1 | 1 | 1 | 1 | | 2 | 1 |
| CO2 | 2 | 3 | 1 | 2 | 1 | | | | 1 | 1 | 1 | 1 | 2 | 1 | 1 |
| CO3 | 1 | 2 | 1 | 2 | 2 | | | | 1 | 1 | | 1 | 1 | 2 | 1 |
| CO4 | 1 | 1 | 2 | | 1 | | | | 1 | | | 1 | | 1 | 1 |
| CO5 | 1 | 2 | 2 | | 1 | | | | 1 | | 1 | 1 | 1 | 2 | 1 |
| CO6 | 2 | 2 | 3 | 1 | 1 | | | | 1 | | 2 | 1 | 2 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – II (MECHANICAL ENGINERING - CAD/CAM)

## SUBJECT: RAPID PROTOTYPING AND TOOLING (MM204)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

### DETAILED SYLLABUS

| Sr. No. | TOPICS |
|---|---|
| 1 | **INTRODUCTION**<br>Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP. |
| 2 | **RAPID PRODUCT DEVELOPMENT- OVERVIEW**<br>Virtual prototyping and testing technology, Physical Prototyping and Rapid Manufacturing technologies and Synergic Integration Technologies |
| 3 | **LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS**<br>Stereo lithography Apparatus, Fused deposition Modeling, Laminated object manufacturing, Three dimensional printing: Working Principles, details of processes, Products, materials, advantages, limitations and applications - Case studies |
| 4 | **POWDER BASED RAPID PROTOTYPING SYSTEMS**<br>Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam melting (EBM): Processes, materials, products, advantages, applications and limitations – Case Studies. |
| 5 | **REVERSE ENGINEERING AND CAD MODELING**<br>Basic concept- Digitization techniques–Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and Contour data organization, direct and adaptive slicing, and Tool path generation. |
| 6 | **RAPID TOOLING**<br>Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect-Fabrication processes, Applications. Case studies - automotive, aerospace and electronics industries. |

### REFERENCE BOOKS


1. Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
2. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005.

3. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.
4. Kenneth G. Cooper, "Rapid Prototyping Technology: Selection and Application", CRC Press, 2001.
5. Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003.
6. Ghosh A., "Rapid Protopyping: A Brief Introduction".

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Identify and understand of basic concepts of rapid prototyping technologies.
CO2 Understand the importance of physical prototyping.
CO3 Understand the different rapid prototyping systems.
CO4 Understand the selection of manufacturing method.
CO5 Analyze the data requirement for geometric modelling.
CO6 Implement knowledge of rapid tooling for various applications.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | To study Prototypes, Prototyping and its comparison with traditional prototyping. |
| 2 | To study about Rapid Product Development. |
| 3 | To Study and practice of STL file format for 3d printing. |
| 4 | To study of Stereo Lithography process. |
| 5 | To study of Laminated Object Manufacturing process. |
| 6 | To study of Selective Laser Sintering process. |
| 7 | To study of Fused Deposition Modeling process. |
| 8 | To create surface model from the given point cloud data by using SOLIDWORKS software. |
| 9 | To Study and practice about Layer generation from STL file using Slice3r software. |
| 10. | To study about 3D scanner. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | - | 1 | - | - | - | 1 | - | - | 1 | 1 | 1 | - |
| CO2 | 1 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 1 | - |
| CO3 | 1 | 2 | - | - | 1 | - | - | - | 2 | - | - | 2 | 2 | 2 | 1 |
| CO4 | 1 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 | 2 | - |
| CO5 | 2 | 2 | 1 | - | - | - | - | - | 1 | - | - | 1 | 2 | 2 | - |
| CO6 | 1 | 2 | 2 | - | 2 | - | - | - | 1 | - | - | 1 | 3 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – II (MECHANICAL ENGINERING - CAD/CAM)

## SUBJECT: (MM209) – HYDRAULIC AND PNEUMATIC SYSTEMS (MM209)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 3 | 0 | 4 | 7 | 5 | 60 | 40 | 25 | 25 | 150 |

**DETAILED SYLLABUS**

| Sr. No. | TOPICS |
|---|---|
| 1 | **FLUID POWER SYSTEM, BASIC PRINCIPLES OF HYDRAULICS, HYDRAULIC FLUIDS**<br>Introduction, methods of power transmission, advantages of fluid power, applications of fluid power, types of fluid power system<br>Basic terms and definitions in hydraulics, Pascal's law application, continuity equation, Reynold number, laminar and turbulent flow, Darcy-Weisback's equation, losses in pipe and pipe fittings<br>Introduction, fluid properties, requirements of hydraulic fluids, types and selection of hydraulic fluids |
| 2 | **HYDRAULIC PUMPS AND ACTUATORS**<br>Introduction, basic elements of hydraulic system, pump classification, gear pump, vane pump, piston pump, pump performance, comparison of various hydraulic pumps<br>**LINEAR ACTUATORS:** Introduction, linear actuator classification, cylinder mounting methods, cylinder cushioning, cylinder force, velocity and power, cylinder dynamics, checklist for cylinder design<br>**ROTARY ACTUATORS:** Hydraulic motors, gear motor, vane motor, piston motor, motor performance |
| 3 | **HYDRAULIC CONTROL VALVES AND ACCUMULATOR**<br>**DIRECTION CONTROL VALVES:** Introduction and classification, ports and position, valve symbol, valve actuation methods, poppet valves, rotary spool valves, sliding spool valves, two and three position valves, center conditions, check valve, shuttle valve<br>**PRESSURE CONTROL VALVES:** Introduction, pressure relief valve - simple and compound type, pressure reducing valve - simple and compound type, Unloading valve, sequence valve, counterbalance valve, brake valve<br>**FLOW CONTROL VALVE:** Introduction, classification, fixed type flow control valve, adjustable type flow control valves, non-pressure compensated type and pressure compensated type flow control valve, speed control of a cylinder using flow control valve<br>**ACCUMULATOR:** Introduction and classification of hydraulic accumulators, dead weight type accumulator, spring loaded type accumulator, separator and non-separator type gas loaded accumulators, accumulator application circuits |
| 4 | **HYDRAULIC CIRCUIT DESIGN AND MAINTENANCE**<br>Design information required, selection of hydraulic cylinders, selection of hydraulic motors, selection of hydraulic control valves, selection of hydraulic filters, selection of hydraulic conduits, pump selection, reservoir, trouble shooting, maintenance and safety considerations in hydraulic circuits |
| 5 | **INTRODUCTION TO PNEUMATIC CONTROL, COMPRESSED AIR** |

**PREPARATION**

Introduction, characteristics of compressed air, selection criteria for pneumatic control system, advantages and disadvantages of pneumatic control, basic structure of pneumatic control system

Various types of compressors for air preparation, different types of air filters, compressed air regulator, compressed air lubricator

**6 PNEUMATIC ACTUATORS, CONTROL VALVES AND CONTROLLING OF PNEUMATIC CYLINDERS**

Single acting actuators, various double acting actuators like actuators with cushion, tandem actuators, rodless actuators, rotary actuators, cylinder seals

Use of directional control valves in pneumatics, symbolic representation of DCV, types of DCV, constructional details of DCV, selection criteria of DCV, flow control valves, quick exhaust valve, shuttle valve, two pressure valve, time delay valve

direct control of single acting cylinders, indirect control of single acting cylinders, methods of checking end positions, speed control of cylinders, coordinated motion control

**REFERENCE BOOKS**


1. Fluid Power with Applications, Anthony Esposito, Pearson Education
2. Oil Hydraulics Systems - Principles and Maintenance, Majumdar S.R., Tata McGraw-Hill
3. Hydraulic and Pneumatic controls, Srinivasan. R, Vijay Nicole Imprints Pvt. Ltd
4. Hydraulics and Pneumatics, Andrew Parr, Jaico Publishing House
5. Hydraulic and Pneumatic controls, Shanmugasundaram.K, S. Chand & Co
7. Pneumatics Systems - Principles and Maintenance, Majumdar S. R., Tata McGraw-Hill
8. Industrial Fluid Power, D. S. Pavaskar, P. D. Sonawane, P. M. Chanegaonkar, R. V.Shetty, Nishant Prakashan


**COURSE OUTCOMES**

After successful completion of the course, students will be able to;

CO1 Understand fluid power technologies, basic principles of fluid power and identify different applications, fluids and their important properties

CO2 Understand working principles of various types of hydraulic pumps and actuators and design pumps and actuators.

CO3 Understand hydraulic direction, flow and pressure control valves and select them for required applications and also understand construction and working of different types of hydraulic accumulators.

CO4 Design hydraulic circuit and understand maintenance, able to find the fault and suggest remedial action to solve the problems in hydraulic circuit.

CO5 Understand pneumatic control and compressed air preparation.

CO6 Apply various pneumatic control valves for controlling actuators.

**SUGGESTED LIST OF PRACTICALS**

| Sr. No. | Title |
|---|---|
| | **Hydraulics and Electro-Hydraulics** |
| 1 | Hydraulic pump characteristic curve of variable displacement pump |
| 2 | Single rod cylinder / pressure intensification |
| 3 | Single rod cylinder / using 4/2 DCV (Meter-in and Meter-out circuits |

4 Application of 4/3 DCV (Tandem and closed center)
5 Study of hydraulic motor with 4/3 DCV
6 Hydraulic Accumulator
7 Rapid speed / creep speed control

**Pneumatics and Electro-Pneumatics**

1 Direct control of double acting cylinder
2 Indirect control of double acting cylinder
3 Controlling a double acting cylinder using impulse valve and 2 push buttons.
4 Speed control of single acting cylinder-slow
5 speed extraction and rapid retraction
6 Position dependent control of a double acting with mechanical limit switches
7 Sequential control of two double acting cylinders without overlapping signals
8 Time dependent control of 1 double acting cylinder
9 Stop control of double-acting cylinder with 5/3 direction control valve under tensile load
10 Command variable control of a single- acting cylinder with spring return valve
11 Command-variable control of double-acting cylinder with spring return valve.
12 Holding-element control of a double-acting cylinder with impulse valves, directly controlled
13 Holding-element control of a double-acting
14 cylinder with impulse valves, relay
15 Basic circuit with AND function
16 Basic circuit with OR function

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 1 | 2 | 1 | - | - | - | 2 | - | - | 1 | 2 | 2 | 2 |
| CO2 | 1 | 1 | 1 | 2 | 1 | - | - | - | 2 | - | - | 1 | 2 | 2 | 2 |
| CO3 | 1 | 1 | 1 | 2 | 1 | - | - | - | 2 | - | - | 1 | 2 | 2 | 2 |
| CO4 | 1 | 1 | 1 | 2 | 1 | - | - | - | 2 | - | - | 1 | 2 | 2 | 2 |
| CO5 | 1 | 1 | 1 | 2 | 1 | - | - | - | 2 | - | - | 1 | 2 | 2 | 2 |
| CO6 | 1 | 1 | 1 | 2 | 1 | - | - | - | 2 | - | - | 1 | 2 | 2 | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – II (MECHANICAL ENGINERING - CAD/CAM)

### SUBJECT: ROBOTICS (MM211)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | TW | Prac | Total |
| 4 | 0 | 2 | 6 | 5 | 60 | 40 | 25 | 25 | 150 |

### DETAILED SYLLABUS

| Sr. No. | TOPICS |
|---|---|
| 1 | **INTRODUCTION TO ROBOTICS & CONTROL SYSTEM**<br>Basic concept, robot activation and feedback components, Positions and velocity sensors, Linear and rotary actuators and control valves, power transmission system. Automation and Robotics, Robot anatomy, robot configuration, motions joint notation, work volume, robot drive system, control system and dynamic performance, precision of movement. |
| 2 | **ROBOT CELL DESIGN, MOTION ANALYSIS AND CONTROL**<br>Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, safety in robotics, Work and control, Inter locks, Error detection, Work cell controller**.** Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller. |
| 3 | **ROBOT SENSORS & END EFFECTORS**<br>Desirable features, tactile, proximity and range sensors, uses sensors in robotics, Robotic vision system, Image grabbing, Image processing and analysis, Image segmentation, Pattern recognition, Training of vision system. Grippers-types, operation, mechanism, force analysis, tools as end effectors, consideration in gripper selection and design. |
| 4 | **ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS**<br>Methods of Robot Programming, Characteristics of task level languages lead through programming methods, Motion interpolation, Artificial intelligence, Basics, Goals of artificial intelligence, AI techniques, Problem representation in AI, Problem reduction and solution techniques, Application of AI and ES in Robots. |
| 5 | **ROBOT APPLICATIONS AND RECENT TRENDS**<br>Material transfer, Machine loading/unloading. Processing operation, Assembly and Inspection, Multi-axis robots, intelligent robots. |
| 6 | **PROGRAMABLE LOGIC CONTROLLER**<br>Introduction to PLC, Programming a PLC, Logic Functions, Input & Output Modules, PLC Processors, PLC Instructions, Documenting a PLC System, Timer & Counter Instructions, Comparison& Data Handling Instructions, Sequencing Instructions, Mask Data Representation, Typical PLC Programming Exercises for Industrial Applications. |

### REFERENCE BOOKS

1. Introduction to Robotics Analysis, Systems, Applications by Saeed B Niku PHI.

2. A Robot Engineering text book by Moshen Shahinpoor, Harper and Row Publishers, NY.
3. Industrial Robotics by Mikell Groover, McGraw Hill Publications.
4. Intro to Robotics, Mechanics and Control by John J Craig, Pearson Education.
5. Fundamentals of Robotics – Analysis and Control, Robert J Schilling, PHI.
6. Industrial Robots by Ganesh S Hegde – Laxmi Publications.
7. Robotic technology, Principles and practice – Werner G Holz book – Van Nostrand Reinhold Co.NY.
8. Robotic Engineering – An Integrated Approach by Richard D Klaffer, Thomas AChmielewski, Michael Negin – PHI.

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Understand Basics of Robotics & Control System.

CO2 Understand about designing aspect of robotic cell & motion control analysis.

CO3 Analyze about different types of sensors & end effectors.

CO4 Implement Artificial Intelligence & programming robot according to expert system data.

CO5 Analyze the application of Robotics in various fields.

CO6 Learn Hardware & software skills of PLC.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Creating a three link Robot in Simulation. |
| 2 | Create a Scara Robot in simulation. |
| 3 | Create a PUMA560 Robot. |
| 4 | To perform homogenous transformation in various type of robot sequence. |
| 5 | To Generate joint space trajectory between any two configuration. |
| 6 | To load PUMA560 Robot for Forward Kinematics for the arm & extend tool of robot by 200 mm. |
| 7 | To animate PUMA560 Robot & shift the base by 15 inches & slove for Forward Kinematics for the stretched state of robot. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 1 | - | - | - | - | 1 | 1 | - | 1 | 1 | 1 | - |
| CO2 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 1 | - |
| CO3 | 2 | 2 | 1 | 1 | 1 | - | - | - | 2 | - | - | 2 | 2 | 2 | 1 |
| CO4 | 2 | 2 | 2 | - | 1 | - | - | - | 1 | - | - | 1 | 1 | 1 | 1 |
| CO5 | 2 | 2 | 2 | - | 1 | - | - | - | 1 | - | - | 2 | 2 | 2 | - |
| CO6 | 2 | 2 | 2 | - | 2 | - | - | - | 1 | - | - | 1 | 2 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## NUMERICAL TECHNIQUES

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

## DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **ERROR ANALYSIS**<br>Significant figures, accuracy and precision, error definitions, round-off errors, truncation errors, Taylor series, total numerical error, blunders, formulation errors, and data uncertainty | 04 |
| 2 | **ROOTS OF EQUATIONS**<br>Introduction, bracketing methods: bisection method and false-position method, open methods: Newton-Raphson method, Secant and Modified Secant method, roots of polynomials | 06 |
| 3 | **ALGEBRAIC EQUATIONS**<br>Introduction, numerical solutions of linear algebraic equations: Cramer's rule, Gauss elimination method, numerical solution of nonlinear equations: Gauss-Jordan method, LU decomposition, special matrices: tridiagonal matrices analysis, Cholesky decomposition, Iterative methods: Gauss-Seidel method and Jacobi's method | 08 |
| 4 | **CURVE FITTING AND INTERPOLATION**<br>Introduction, least square regression: linear regression, polynomial regression<br>Introduction, Newton's forward and backward difference interpolation, Lagrange interpolation, inverse interpolation, spline interpolation | 08 |
| 5 | **NUMERICAL DIFFERENTIATION AND INTEGRATION**<br>Introduction, high accuracy differentiation formulas: forward, backward and central difference method, Richardson extrapolation, Newton-Cotes integration formulas: trapezoidal and Simpson's rule. | 07 |
| 6 | **NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS AND PARTIAL DIFFERENTIAL EQUATIONS**<br>Introduction, initial value problems: Euler's method, Heun's method, fourth order Runge-Kutta method, multistep methods: Milne's method and Adam's method<br>Elliptic equations: Laplace difference equation, Liebmann's iterative method, boundary conditions, parabolic equations: implicit method, explicit method, the Crank Nicolson method | 12 |
| | **Total Hours** | **45** |

## TEXT BOOKS

1. Numerical Methods for Engineers, Steven C. Chapra, Raymond P. Canale, Tata McGraw Hill
2. Numerical Methods, E Balagurusamy, Tata McGraw Hill

## REFERENCE BOOKS

1. Applied Numerical Analysis, Curtis F. Gerald, Patrick O. Wheatley, Addison Wesley, Pearson
2. Numerical Methods in Engineering and Science, Grewal. B.S. and Grewal. J.S., Khanna Publishers, New Delhi
3. Applied Numerical Methods Using MATLAB, W.Y. Yang, W. Cao, T.S. Chung and J. Morris, Wiley India Edition
4. Numerical Methods for Engineers, S. K. Gupta, New Age International Publishers

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

| | |
|---|---|
| CO1 | Understand the different types of error, their origin, propagation, and their effect on numerical computations. |
| CO2 | Apply the algorithms to determine the solution of nonlinear equations. |
| CO3 | Solve the system of linear equations using different direct and iterative methods with computing skills. |
| CO4 | Approximate the functions using different curve fitting and interpolation methods. |
| CO5 | Evaluate the integration and differentiation problems using numerical methods. |
| CO6 | Obtain the solution of ordinary and partial differential equations with initial boundary conditions. |

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Introduction to MATLAB part-I. |
| 2 | Introduction to MATLAB part-II. |
| 3 | MATLAB program for bracketing methods to find the root of nonlinear equations. |
| 4 | MATLAB program for open methods to find the root of nonlinear equations. |
| 5 | MATLAB program for Cramer's rule and Gauss elimination method to solve the linear algebraic equations. |
| 6 | MATLAB program for Gauss-Jordan method and iterative methods to solve the linear algebraic equations. |
| 7 | MATLAB program for tridiagonal matrices analysis.. |
| 8 | MATLAB program for interpolation. |
| 9 | MATLAB program for curve fitting. |
| 10 | MATLAB program for numerical integration. |
| 11 | MATLAB program for numerical solution of ordinary differential equations. |
| 12 | MATLAB program for numerical solution of partial differential equations. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 2 | 2 |
| CO2 | 2 | 3 | 2 | 2 | 3 | - | - | - | 1 | 1 | - | 2 | 2 | 2 | 2 |
| CO3 | 2 | 3 | 2 | 2 | 3 | - | - | - | 1 | 1 | - | 2 | 2 | 2 | 3 |
| CO4 | 2 | 2 | 2 | 2 | 3 | - | - | - | - | - | - | 2 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | 2 | 3 | 2 | 2 |
| CO6 | 2 | 3 | 2 | 2 | 3 | - | - | - | - | - | - | 2 | 3 | 2 | 3 |

**1-Slightly; 2-Moderately; 3-Substantially**

## B. TECH. SEMESTER – VI (MECHANICAL ENGINERING )

## OPTIMIZATION TECHNIQUES

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | T.W. | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 0 | 60 | 40 | 0 | 0 | 100 | 4 | 0 | 0 | 4 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **INTRODUCTION AND LINEAR PROGRAMMING**<br>Definition and concept of Operation Research (OR), History of OR, Methodology of OR, Applications of OR, Techniques used in OR. Introduction, Requirement of LP, Basic Assumptions, Formulation of LP, General Statement of LP, Solution techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big Mand Two Phase, Sensitivity Analysis, Primal and Dual Problems, Economic Interpretation | 08 |
| 2 | **TRANSPORTATION**<br>Transportation problems definition, Solution methods: North-west corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, stepping stone method, Modified Distribution method, Un-balanced problems and profit maximization problems, Transshipment Problems | 08 |
| 3 | **ASSIGNMENT AND QUEUING THEORY**<br>Assignment problems definition, Hungarian method for solution, variation of assignment problem-non square matrix, restriction on assignments, maximization problem, travelling salesman problem. Terms used in queuing theory, Kendall's notation, classification of queuing models- model 1 single server unlimited queue (M/M/1) : (α/FCFS), model 2 (M/M/1) : (N/FCFS) | 07 |
| 4 | **INVENTORY CONTROL**<br>Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with deterministic demands, ABC analysis | 06 |
| 5 | **REPLACEMENT MODELS AND GAMES THEORY**<br>Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy. Introduction, Characteristics of Game Theory, Two Person-Zero sum games, Pure strategy, Mixed strategies (2x2, mx2, 2xn), Arithmetic, Dominance theory, Sub game, Algebraic and graphical methods, Linear programming method to solve game | 08 |
| 6 | **CPM AND PERT**<br>Terms used in network analysis, Network or arrow diagram, Fulkerson's rule, Programme evaluation and review technique (PERT), Critical path method (CPM), Crashing of network | 08 |
| | **Total Hours** | 45 |

**TEXT BOOKS**


1. Operation Research -Gupta P. &Hira D.S., S. Chand & Company Ltd.
2. Quantitative Techniques in Management – N D Vohra, Tata McGrawHill


**REFERENCE BOOKS**


3. Operations Research: An Introduction by HamdyTaha, Pearson
4. Operations Research by R. Paneerselvam, Prentice Hall of India Pvt. Ltd.

5. Quantitative Techniques for Managerial Decisions – J. K. Sharma, MacMillan India Ltd.
6. Optimization Methods for Engineers by N.V.S. Raju- PHI Publication.

**COURSE OUTCOMES**

After successful completion of the course, students will be able to:

**CO1** Understand theory of optimization methods and Apply the various liner programming problem solving techniques
**CO2** Analyse the transportation problems using various OR methods.
**CO3** Analyse the assignment and queuing theory problems.
**CO4** Analyse the inventory control problems.
**CO5** Analyse the replacement models and game theory models
**CO6** Analyse the project management techniques.

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 3 | 3 |

**1-Slightly; 2-Moderately; 3-Substantially**

# SUBJECT – POWER PLANT ENGINEERING (MH511)

| Teaching Scheme (Hours) | | | Marks | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Ext | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | --- | 2 | 5 |

## DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **INTRODUCTION:** | 08 |

**Introduction**- Introduction to various power plants, General layout of thermal power plant, Criteria for Site selection
**Thermodynamic cycles for power plants**- Rankine Cycle and its modification (Super heating, Reheating, Regeneration), Brayton Cycle and its modification (Reheating, Regeneration, intercooling), types of fuels.
**Economics of Power Generation**- Load curves, Load duration curves, Base load and peak load power plants, Connected load, Demand, Maximum demand/ Peak load, Demand factor, Load factor, Plant capacity factor, Plant use factor, Diversity factor, Cost of power plant, Performance and operating characteristics of power plant, Tariff for electric energy

| | | |
|---|---|---|
| 2 | **STEAM GENERATOR:** | 08 |

Heat balance sheet for Boiler, High pressure boilers, Supercritical boiler, Supercharged boiler, Boiler Mountings: Safety Valve, Water level indicator, Pressure gauge, Steam stop valve, Feed check valve, Blow off cock, Fusible plug, Attachment for inspector's test gauge, man hole; Boiler Accessories: Super-heaters, Economizers, Air pre-heaters; Methods of superheat temperature control; Pollution and its control

| | | |
|---|---|---|
| 3 | **MATERIAL HANDLING SYSTEM IN POWER PLANT:** | 07 |

**Coal Handling Systems-** Introduction, conveyor systems, Out-plant handling of the coal, Storage of coal at plant site, In-plant handling of the coal, Pulverized fuel handling systems (Unit and central systems)
**Fuel Burning Equipment-**Introduction, Stoker firing, Types of stokers their working, Pulverized mills, Pulverized coal burners, Oil burners, Fluidized bed combustion systems
**Ash Handling Systems-**Introduction, Layout of Ash handling system, Different types of ash handling systems (Mechanical, Hydraulic, Pneumatic and steam-jet), Basics of dust collection, Mechanical dust collector and Electrostatic precipitator (ESP)

| | | |
|---|---|---|
| 4 | **BOILER DRAUGHT AND FEED WATER TREATMENT:** | 06 |

**Boiler Draught**- Introduction, losses in air-gas loop system, Natural draught and design of chimney, Maximum discharge condition, Artificial draught (Forced, Induced and balanced), Power requirement by fans
**Feed water treatment**- Introduction, Necessity of feed water treatment, Effect of impurities, Internal & external water treatment system

| | | |
|---|---|---|
| 5 | **CONDENSERS AND COOLING TOWERS:** | 07 |

Necessity of condenser in power plant, Elements of steam condensing plant, Types of condensers, Selection of condenser, Sources of air in condenser, Effects of air leakage in condenser, Methods for obtaining maximum vacuum in condenser, Vacuum efficiency,

Condenser efficiency, Dalton's law of partial pressure used for condenser analysis, Determination of mass of cooling water required in condenser, Necessity of cooling ponds and cooling towers, Condenser water cooling systems, Types of cooling towers, Cooling ponds

**6 NUCLEAR POWER PLANT: 06**

Nuclear fusion and fission, Chain reaction, Nuclear fuels, Components of nuclear reactor, Classification of reactors, Pressurized water reactor, Boiling water reactor, Gas cooled reactor, CANDU reactor, Fast breeder reactor, Nuclear waste and its disposal

## TEXTBOOKS

1. Power Plant Engineering, Arora, S.C. and Domkundwar, S., Dhanpat Rai & Co. Delhi.
2. Power Plant Engineering, R.K. Rajput, Laxmi Publication, Delhi

## REFERENCE BOOKS

1. Power Plant Engineering, P.K. Nag, Tata McGraw-Hill Co., Delhi
2. Power Plant Technology, Wakil M. M., McGraw Hill, 1985.
3. Power Plant Engineering, F. T. Morse, Affiliated East-West Press Pvt. Ltd; New Delhi

## COURSE OUTCOMES

After successful completion of the course, students will be able to

CO1 Understand and analyze the basic thermodynamics cycles of thermal power plant and illustrate various tariff methods.
CO2 Describe the construction and working of various high-pressure boilers and its mountings and accessories.
CO3 Explain the working of various material handling system of thermal power plant.
CO4 Identify the system components of boiler draught and feed water treatment and discuss the working of related systems.
CO5 Recognize the condenser components and illustrate the working of various condenser types.
CO6 Recall the function of nuclear power plant components and explain the working of various nuclear reactors.

## SUGGESTED LIST OF PRACTICALS

| Sr. No | Title |
|---|---|
| 1. | Study of general layout of thermal power plant and Simple Rankine cycle. |
| 2. | Study of boiler mountings. |
| 3. | Study of fuel handling system in coal-based power plant. |
| 4. | Study of impurities in feed water and its effect. |
| 5. | Study of internal feed water treatment. |
| 6. | Study of external feed water treatment. |
| 7. | Study of air pollution by thermal power plant. |
| 8. | Study of water pollution by thermal power plant. |
| 9. | To prepare heat balance sheet of boiler. |
| 10. | To find out isentropic efficiency of turbine. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **-** | **-** |
| CO2 | **2** | **-** | **-** | **3** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **3** | **-** |
| CO3 | **2** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **3** | **-** |
| CO4 | **2** | **-** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **-** |
| CO5 | **3** | **2** | **3** | **-** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **1** | **-** |
| CO6 | **2** | **-** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **1** | **-** | **1** | **3** | **-** | **-** |

**1-Slightly; 2-Moderately; 3-Substantially**

## PRODUCTION PLANNING AND CONTROL (MH711)

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 0 | 60 | 40 | 0 | 0 | 100 | 3 | 0 | 0 | 3 |

### DETAILED SYLLABUS

| Sr. No. | Contents |
|---|---|
| 1 | **PLANT LOCATION SELECTION AND LAYOUT**<br>Types of Production System; Introduction, Objectives and Functions of Production Planning & Control; Importance of Plant Location; Choice of site for selection; Introduction to Plant Layout; Types of Plant Layout – Product, Process, Fixed Position and Cellular. |
| 2 | **FORECASTING MODELS**<br>Nature and use of forecast, Different forecasting methods: Qualitative and Quantitative. |
| 3 | **AGGREGATE PLANNING AND MATERIAL PLANNING**<br>Introduction to Aggregate planning strategies, Aggregate planning methods, Master production plan; Master Production Schedule (MPS); Materials Requirement Planning (MRP); Lot sizing in MRP Systems. |
| 4 | **PRODUCTION SCHEDULING**<br>Techniques of Scheduling: Gantt Chart, Sequencing, Single Machine Scheduling, Flow Shop Scheduling, Job Shop Scheduling. |
| 5 | **WORK STUDY**<br>Method Study: Objectives and procedure for methods analysis, recording techniques, Micro motion and macro-motion study; Principles of motion economy, Work Measurement: Objectives, Work measurement – time study, Determination of time standards: Observed time, basic time, normal time, rating factors, allowances, and standard time. |
| 6 | **LINE BALANCING AND STAISTICAL QUALITY CONTROL**<br>Concept of mass production system, Objective of assembly line balancing, Rank positional weight method. SQC Concept, variable and attributes, introduction of control charts, and acceptance sampling. |

### TEXT BOOKS


1. Industrial Engineering and Production Management, M. Mahajan, Dhanpat Rai Publication.
2. Industrial Engineering and Production Management, Martand Telsang, S. Chand Publication.
3. Industrial Engineering, L. C. Jhamb, Everest Publishing House.
4. Production and Operation Management, R. Paneerselvam, PHI Publication

## REFERENCE BOOKS


1. Modern Production Management, Buffa, John Willey Publication.
2. Theory and Problems in Production and Operation Management, S. N. Chary, Tata-McGraw Hill Publication.
3. Introduction to Work Study, G. Kanawaty, ILO Geneva
4. Industrial Engineering, V. Deshpande, M. Gor and J. Ravalji, Ria Publishing House


## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Understand various functions of Production Planning and Control, types of production system, and types of plant layout.
CO2 Apply suitable method for demand forecasting.
CO3 Evaluate various strategies for aggregate planning and material planning.
CO4 Apply suitable scheduling technique for given production process flow and time.
CO5 Understand tools of method study and time study for productivity improvement.
CO6 Remember important terms for Line Balancing problem and basic of Statistical Quality Control tools.

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | - | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO2 | 2 | - | - | 3 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 3 | - |
| CO4 | 2 | - | - | 3 | - | - | - | - | - | - | - | - | - | 2 | - |
| CO5 | 3 | 2 | 2 | - | - | 3 | - | - | - | - | - | - | 3 | - | - |
| CO6 | 2 | - | 3 | - | - | - | - | - | - | - | - | - | 3 | - | - |

**1-Slightly; 2-Moderately; 3-Substantially**

# QUALITY MANAGEMENT AND RELIABILITY (MH-617)

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 4 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 4 | 0 | 1 | 5 |

## DETAILED SYLLABUS

| Sr. No. | Contents |
|---|---|
| 1 | **INTRODUCTION**<br>Quality – Concept, Different Definitions and Dimensions, Inspection, Quality Control, Quality Assurance and Quality Management, Views of different Quality Gurus, 7QC Tools, Introduction, Definitions and Principles of Operation, Tools and Techniques of TQM, 7 New Quality Improvement Tools. |
| 2 | **STATISTICAL QUALITY CONTROL (SQC) AND QUALITY SYSTEMS**<br>SQC Concept, variable and attributes, charts for variable and attributes and their applications and interpretation (analysis) process capability, Acceptance sampling, sampling plans, OC curves and AOQ curves. Need for ISO 9000, ISO 9000-2000 Quality System – Elements, Documentation, ISO 14000 – Concepts, Requirements and Benefits. |
| 3 | **RECENT TRENDS IN QUALITY MANAGEMENT**<br>5s, Poka-Yoke, Kaizen, Lean manufacturing, Agile Manufacturing, World Class Manufacturing, JIT, Kanban, Cost of Quality, TPM, OEE, Single Piece Flow, Visual Management, SMED, Advantages and Limitation of all as applicable. |
| 4 | **DESIGNING FOR QUALITY**<br>Introduction to Six Sigma, Quality Function Deployment (QFD), Failure Mode and Effect Analysis (FMEA) – Concept, Methodology and Application. |
| 5 | **INTRODUCTION TO DESIGN OF EXPERIMENTS**<br>Introduction, Methods, Taguchi approach, Achieving robust design, Steps in experimental design |
| 6 | **INTRODUCTION TO PROBABILITY THEORY AND RELIABILITY CONCEPTS**<br>Fundamental laws of probability, Random variables; Probability distribution function; Discrete and continuous distribution; Histogram and Normal distribution curve, Mean variance and standard deviation of a distribution function. Reliability Engineering Fundamentals, Basic Elements of Reliability, Measurement of Reliability, Maintenance and Reliability, Quality and Reliability, System Reliability |

## TEXT BOOKS


1. Statistical Quality Control by M. Mahajan, Dhanpat Rai Publication
2. Total Quality Management by P. M. Charantimath, Pearson Education
3. Total Quality Management by S. Ramasamy, Tata McGraw Hill


## REFERENCEBOOKS


1. Quality Management: A process improvement approach by M. A. Fryman, Cengage Learning
2. Total Quality Management by P. N. Mukherjee, Prentice-Hall of India
3. Total Quality Management- Principles and Practices, Tools and Techniques by K. Suri, Katson Books Publication

4. Taguchi Techniques for Quality Engineering by P. J. Ross, Tata McGraw Hill

**COURSE OUTCOMES**

After successful completion of the course, student will be able to;

CO1 Remember basics of quality and quality improvement tools.
CO2 Understand the concepts of statistical quality control and quality assurance system.
CO3 Understand the modern practices in quality management.
CO4 Understand the concept and techniques of design for quality.
CO5 Apply design of experiment knowledge for quality planning.
CO6 Understand the fundamental knowledge of statistics, probability and reliability concepts

**LIST OF EXPERIMENTS**

1. Exercise on Histogram, Scatter Diagram, Check-Sheet and Pareto Analysis.
2. Exercise on Cause-and-Effect Diagram, Flow Chart, Control Chart
3. Exercise on 7- New Quality Management Tools – I
4. Exercise on 7- New Quality Management Tools – II
5. Exercise on 5S implementation
6. Exercise on Basic Data Analysis Techniques
7. Case study on implementation of Six Sigma
8. Exercise on QFD analysis
9. Exercise on FMEA
10. Exercise on Design of Experiments

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **2** | **3** | **1** | **-** | **3** | **-** | **-** | **-** | **2** | **1** | **-** | **3** | **-** | **2** | **2** |
| CO2 | **3** | **-** | **2** | **-** | **3** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **2** | **-** | **-** |
| CO3 | **1** | **-** | **-** | **-** | **-** | **3** | **2** | **-** | **-** | **-** | **-** | **3** | **-** | **3** | **2** |
| CO4 | **2** | **1** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **-** | **-** | **-** | **2** | **2** | **3** |
| CO5 | **3** | **3** | **3** | **3** | **3** | **2** | **-** | **-** | **-** | **1** | **-** | **-** | **2** | **2** | **2** |
| CO6 | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** |

**1-Slightly; 2-Moderately; 3-Substantially**

# MH-713 REFRIGERATION AND AIR-CONDITIONING

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | -- | 2 | 60 | 40 | 25 | 25 | 150 | 3 | -- | 1 | 4 |

**SYLLABUS**

| Sr. No. | Topics | Hrs. |
|---|---|---|
| 1 | **FUNDAMENTALS OF REFRIGERATION**<br>Reversed Carnot cycle, maximum coefficient of performance, methods of producing cooling effect | 04 |
| 2 | **REFRIGERATION SYSTEM**<br>• **VAPOUR COMPRESSION REFRIGERATION SYSTEM**<br>Factors affecting the performance of the system, actual cycle considering different losses, methods of improving COP.<br>**Single load system:** single evaporator with multi expansion valves & flash chambers, compound compression system with flash intercooler with single expansion valve concept of Variable Refrigerant Flow/Volume (VRF or VRV) technology<br>• **VAPOR ABSORPTION REFRIGERATION SYSTEM**<br>Aqua-ammonia system and its analysis, (Li-Br)-Water system, advantages of absorption system over compression refrigeration system, electrolux refrigerator<br>• **AIR-REFRIGERATION SYSTEM**<br>Bell-Coleman refrigeration cycle and its analysis, aircraft refrigeration system and its classification, advantages of air cycle for aircraft refrigeration, DART | 16 |
| 3 | **PSYCHROMETRY & AIR-CONDITIONING**<br>Psychrometric properties, Adiabatic saturation and Thermodynamics wet bulb temperature, psychrometric chart, psychrometer, application of first law to psychrometric process, mixing process, working substance in air-conditioning, basic process in conditioning of air, psychrometric process in air conditioning equipment, sensible heat factor (SHF) and its use, Grand sensible heat factor (GSHF) and apparatus dew point (ADP), Effective sensible heat factor (ESHF), Cooling towers, Indoor air quality | 16 |
| | | |

| | | |
|---|---|---|
| **4** | **TRANSMISSION AND DISTRIBUTION OF AIR**<br>Introduction, pressure drop in ducts, pressure drop by graphical method, Economic duct dimensions, methods of duct design | **4** |
| **5** | **AIR-CONDITIONING SYSTEMS**<br>Classification, All year air-conditioning system, Winter air-conditioning, residential, commercial and industrial applications. | **2** |
| **6** | **THERMAL INSULATION AND REFRIGERANTS**<br>**Insulations:** Desired properties and classification, thickness of insulation,<br>**Refrigerants:** thermodynamic, chemical & physical requirements, different types of refrigerants, including eco-friendly refrigerants, Refrigerant mixtures | **3** |
| | **Total Hours** | **45** |

**Learning Resources:**

**TEXT BOOKS**

1. Refrigeration and Air Conditioning, C. P. Arora, Tata McGraw-Hill New Delhi
2. A course in Refrigeration and Air-Conditioning, S. C. Arora & S. Domkundwar,Dhanpat Rai & Co.
3. Refrigeration and Air Conditioning, Manohar Prasad, Wiley Eastern Ltd.

**REFERENCE BOOKS**

1. Refrigeration and Air Conditioning, W. F. Stocker and J.W.Jones, McGraw-Hill
2. Principles of Refrigeration, Roy. J Dossat, Pearson Education
3. Refrigeration & air conditioning technology, Whitman, W. C., Johnson, W. M., & Tomczyk, J. Delmar

SUGGESTED LIST OF PRACTICALS:

| Sr. No. | Title |
|---|---|
| 1 | Evaporator |
| 2 | Condenser and Cooling Towers |
| 3 | Split Air-Conditioning Systems |
| 4 | Compressor |
| 5 | Expansion Devices |
| 6 | Heat Pump |
| 7 | Cold Storage |
| 8 | Vapour Absorption Refrigeration System |
| 9 | Ice Plant |
| 10 | Mini Air-Conditioning Tutor |

**Course Outcomes:**

| | |
|---|---|
| CO1 | Understand and apply the fundamentals of refrigeration systems. |
| CO2 | Understand different refrigeration systems, evaluate their performance and identify the methods of performance improvement in vapour compression refrigeration systems. |
| CO3 | Understand and analyze the psychrometric properties and processes. |
| CO4 | Understand and apply the various duct design methods. |
| CO5 | Understand and evaluate the various air-conditioning systems. |
| CO6 | Understand the basics of refrigerants and insulations used in refrigeration and air-conditioning systems. |

**Course Articulation Matrix:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 | 1 |
| CO2 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | 1 |
| CO4 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO5 | 3 | 3 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO6 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M. TECH. SEMESTER – III (MECHANICAL ENGINERING - CAD/CAM)

### DISSERTATION - I (MM301)

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 0 | 0 | 20 | --- | --- | 125 | 225 | 350 | --- | --- | 10 | 10 |

The students are required to do their dissertation work in their field of interest. The students will go through this work for full semester. They are supposed to submit a dissertation report and give presentation on their work progress at the end of the semester.

## M. TECH. SEMESTER –IV (MECHANICAL ENGINERING - CAD/CAM)

### DISSERTATION - II (MM401)

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 0 | 0 | 20 | --- | --- | 150 | 300 | 450 | --- | --- | 10 | 10 |

The students are required to carry forward their dissertation work done in semester III in their field of interest. The students will go through this work for full semester. They are supposed to submit a final dissertation report and give presentation on their completed dissertation work at the end of the semester.

## APPLIED THERMODYNAMICS

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

## DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **EXERGY: WORK POTENTIAL OF ENERGY**<br>Overview of laws of thermodynamics, exergy associated with kinetic and potential energy, reversible work and irreversibility, second law efficiency<br>**THERMODYNAMIC RELATIONS**<br>Maxwell relations, Clapeyron equation, Clausius-Clapeyron equation | 05 |
| 2 | **GAS POWER CYCLE**<br>Basic considerations in the analysis of power cycles, air-standard cycles: assumptions, Otto cycle, diesel cycle, dual cycle and their comparison, simple Brayton cycle and its modification-intercooling, reheating and regeneration | 09 |
| 3 | **VAPOUR POWER CYCLES**<br>The Carnot vapour power cycle, simple Rankine cycle and its energy analysis, modified Rankine cycle: superheating, reheating and regeneration | 09 |
| 4 | **FUELS AND COMBUSTIONS**<br>Calorific values of fuel, requirements of good fuel, proximate and ultimate analysis of fuel, theoretical determination of calorific value using Dulong's formula, air requirement for combustion, boiler performance | 06 |
| 5 | **REFRIGERATION CYCLE**<br>Reversed Carnot cycle, Joule-Thompson effect, analysis of ideal vapour compression refrigeration cycle, actual vapour Compression refrigeration cycle, refrigerants and its properties, selection, air refrigeration (Bell-Coleman) cycle | 09 |
| 6 | **PSYCHROMETRY AND AIR-CONDITIONING**<br>Psychrometric properties and processes, adiabatic saturation temperature, psychrometric chart, human comfort and industrial air-conditioning | 07 |
| | **Total Hours** | **45** |

**TEXT BOOKS**

1. Thermodynamics- An engineering approach, Yunus A. Cengel, Michael A. Boles., Tata McGraw Hill publishing co. ltd.
2. Engineering Thermodynamics, P.K. Nag, Tata McGraw Hill publishing co. ltd.

**REFERENCE BOOKS**

1. Fundamental of thermodynamics, Sonntag. R.E., Borgnakke C. and Van Wylen G.J, John Wiley and Sons.
2. Fundamentals of engineering thermodynamics, Moran M.J. and Shapiro H.N., John Wiley and Sons.

**COURSE OUTCOMES**

After successful completion of the course, students will be able to;

| | |
|---|---|
| CO1 | Obtain fundamental knowledge of exergy and thermodynamic relations. |
| CO2 | Understand and analyze gas power cycles. |
| CO3 | Analyze vapour power cycles. |
| CO4 | Understand and evaluate calorific values of fuel, air required for combustion and performance of boilers. |
| CO5 | Analyze refrigeration cycles, understand the properties of refrigerants and select refrigerants for different applications. |
| CO6 | Understand and evaluate psychrometric properties, processes and air-conditioning systems. |

**SUGGESTED LIST OF PRACTICALS**

| Sr.No. | Title |
|---|---|
| 1 | Study of engine performance parameters. |
| 2 | Performance testing of 4-stroke SI Engine. |
| 3 | Performance testing of 4-stroke CI Engine. |
| 4 | To determine dryness fraction of steam using ‘separating and throttling’ calorimeter. |
| 5 | Study of boiler performance parameters. |
| 6 | Boiler performance analysis using test rig. |
| 7 | To determine isentropic efficiency of steam turbine using a test rig. |
| 8 | To determine Coefficient Of Performance (COP) of Split air-conditioning unit using test rig. |
| 9 | To carry out sensible heating, cooling and dehumidification processes on test rig and plot them on psychrometric chart. |
| 10 | To carry out sensible heating and humidification process on test rig and plot it on psychrometric chart. |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | 1 | - |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 1 | 3 | 1 | - |
| CO3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 1 | 3 | 1 | - |
| CO4 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 1 | - |
| CO5 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 1 | - |
| CO6 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 3 | 1 | - |

**1-Slightly; 2-Moderately; 3-Substantially**

## DYNAMICS OF MACHINES

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Theory** | **Sess.** | **TW** | **Prac** | **Total** | **Lect** | **Tut** | **Prac** | **Total** |
| 3 | 1 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 1 | 1 | 5 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **STATIC FORCE ANALYSIS**<br>Introduction, conditions of static equilibrium, equilibrium of different members, free body diagrams, principle of super position, static force analysis of various mechanism, principle of virtual work, static force analysis with friction | 08 |
| 2 | **DYNAMIC FORCE ANALYSIS**<br>Introduction, D–Alembert's principle, equivalent offset inertia force, dynamic analysis of simple mechanisms, combined static and inertia force analysis of different mechanisms, dynamic force analysis of reciprocating engine: inertia of reciprocating mass and connecting rod, dynamically equivalent system | 08 |
| 3 | **FLYWHEEL**<br>Introduction, function, turning-moment diagrams, fluctuation of energy, dimensions of flywheel rims | 05 |
| 4 | **BALANCING**<br>Introduction, static balancing, dynamic balancing of several masses in different planes, balancing of reciprocating and rotary masses | 09 |
| 5 | **GOVERNORS**<br>Introduction, different types of governors, various terminologies, effort and power of a governor, controlling force | 07 |
| 6 | **GYROSCOPE**<br>Concept of gyroscope, angular velocity, angular acceleration, gyroscopic couple, gyroscopic effect on aviation, marine and automobiles | 08 |
| | **Total Hours** | **45** |

### TEXT BOOKS


1. Theory of Machines, S S Rattan, Tata McGraw Hill.
2. Theory of Machines, R. S. Khurmi and J. K. Gupta, S. Chand and Company Ltd.


### REFERENCE BOOKS


1. Theory of Machines and Mechanisms, Joseph Shigley and John Uicker, Jr., McGraw Hill.
2. Theory of Mechanisms & Machines, Amitabha Ghosh & Ashok Mallik, Affiliated East-West Press Pvt. Ltd.
3. Kinematics & Dynamics of Machinery, Charles Wilson & J. Peter Sadler, Pearson Education.
4. Dynamics of Machinery, Farazdak Haideri, Nirali Publication.
5. Mechanism and Machine Theory, J.S. Rao and R.V. Dukkipati, New Age International Publisher

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Understand the conditions of the static equilibrium and free body diagrams and implement the knowledge of static force analysis in existing mechanisms.

CO2 Implement the knowledge of dynamic force analysis in existing mechanisms.

CO3 Analysis of flywheel considering turning moment diagrams.

CO4 Apply the concept of balancing for rotating and reciprocating unbalanced masses.

CO5 Understand different terminologies of governor and analyze various types of governors.

CO6 Analyze the stability of automobile, airplane, naval ship and other related devices considering gyroscopic effect.

## SUGGESTED LIST OF PRACTICALS

| **Sr. No.** | **Title** |
|---|---|
| 1 | To study static force analysis of different mechanisms. |
| 2 | To study dynamic force analysis on different mechanisms. |
| 3 | To perform an experiment on Watt's governor. |
| 4 | To perform an experiment on Porter governor. |
| 5 | To perform an experiment on Proell governor. |
| 6 | To perform an experiment on Hartnell governor. |
| 7 | To determine the gyroscopic couple on a motorized gyroscope. |
| 8 | To perform the experiment of dynamic balancing of rotating shaft on dynamic balancing apparatus. |
| 9 | To study dynamic balancing of rotary and reciprocating machinery. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | - | 1 | 1 | - | - | - | - | 2 | 3 | 2 | 1 |
| CO2 | 3 | 3 | 2 | 1 | - | 2 | 1 | - | - | - | - | 2 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 2 | - | - | 1 | 1 | - | - | - | - | 2 | 3 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 1 | - | 2 | 1 | - | - | - | - | 2 | 3 | 2 | 1 |
| CO5 | 3 | 2 | 2 | 1 | - | 2 | 1 | - | - | - | - | 2 | 3 | 2 | 1 |
| CO6 | 3 | 2 | 2 | - | - | 2 | 1 | - | - | - | - | 2 | 3 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

**B. TECH. SEMESTER - I (ICT)**

**SUBJECT: ENGINEERING GRAPHICS AND DESIGN**

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lect** | **Tut** | **Prac** | **Theory** | **Sess.** | **TW** | **Prac** | **Total** | **Lect** | **Tut** | **Prac** | **Total** |
| 1 | -- | 4 | -- | -- | 100 | -- | 100 | 1 | -- | 2 | 3 |

**COURSE OBJECTIVES**

| | |
|---|---|
| CO1 | To Understand the drawing importance in Engineering. |
| CO2 | To Describe the 3-Dimensional object into different 2-Dimensional view. |
| CO3 | To Develop skills in Reading and Interpretation of Engineering Drawings. |
| CO4 | To enhance drawing skills through hands-on training in a CAD lab using engineering software. |

**DETAILED SYLLABUS**

| Sr. No | Topics | Hours |
|---|---|---|
| 1 | **Introduction to Engineering Drawing:**<br>Introduction & Types of lines, letterings & Dimensioning | 1 |
| 2 | **Engineering Curves:**<br>Theory & Examples of ellipse<br>Theory & examples of cycloidal curves-cycloid<br>Theory of involutes curves and Examples of involutes curves<br>Theory & examples of Archimedean spiral curves | 2 |
| 3 | **Projections of points, straight lines & planes:**<br>Projection of Points<br>Projection of Straight line – Introduction<br>Orientation of St. line with examples<br>Examples of straight lines<br>Projection of Planes – Introduction and Orientation of planes w.r.t. H.P. & V.P.<br>Examples on projections of planes | 2 |
| 4 | **Projection of Solid:**<br>Projection of solids – Introduction<br>Orientation of solids w.r.t. H.P. & V.P.<br>Examples on projections of solids | 2 |
| 5 | **Theory of Projection and Orthographic Projection**:<br>Introduction to projection, types of planes, methods of projection, quadrants-basics of projection.<br>Orthographic Projections, first angle method & illustrative examples.<br>Third angle method of projections & illustrative examples.<br>Examples of first angle and third angle method. | 2 |

| | | |
|---|---|---|
| **6** | **Sectional Orthographic Projection:**<br>Sectional Orthographic projections-introduction to sectioning, cutting planes, types of sections, rules of sectioning.<br>Full sectional & half sectional front & top views with examples.<br>Examples of sectional orthographic views | **2** |
| **7** | **Isometric Projection:**<br>Isometric Representation-introduction, isometric plane, isometric drawing, isometric view, isometric projection, isometric scale<br>Method of drawing isometric projection and isometric drawing<br>Examples of isometric projection and isometric drawing. | **2** |
| **8** | **Development of Surfaces:**<br>Introduction to development of surfaces and method for developing cube.<br>Method for development of prism and cylinder<br>Examples based on developments of regular solids | **1** |
| **Total Hours** | | **(14)** |

## COURSE OUTCOMES

After successful completion of the course, students should be able to:

| | |
|---|---|
| OC1 | Prepare and Understand the Engineering Drawings. |
| OC2 | Identify Various curves used in Engineering Drawing and Its application. |
| OC3 | Use the Principles of Orthographic and Sectional Projections. |
| OC4 | Practical Exposure in a computer aided design using engineering software for the new challenges. |

## TEXT BOOKS

1. Engineering Drawing, N. D. Bhatt, Charotar Publication
2. Engineering Drawing Vol.1 & Vol. 2., P. J. Shah

## REFERENCE BOOKS

1. Fundamentals of Engineering Drawing, Luzadder
2. A Text Book of Geometrical Drawing, P. S. Gill, S. K. Kataria Publication
3. A Text Book of Machine Drawing, P. S. Gill, S. K. Kataria Publication

## FLUID MECHANICS

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **FLUID PROPERTIES AND PRESSURE MEASUREMENT** | **09** |
| | Properties of fluid: Mass Density, specific weight, specific gravity and specific volume, Types of fluid, Newton's law of viscosity, continuum concept of a fluid, viscosity, surface tension and capillarity, vapor pressure, cavitation, compressibility, Pressure, Pascal's law, hydrostatic law, hydrostatic paradox, absolute and gauge pressures, measurement of pressure, manometers: simple and differential manometers | |
| 2 | **FLUID STATICS** | **05** |
| | Total pressure force and center of pressure, hydrostatic force on submerged surfaces -horizontal, inclined, vertical and curved surfaces, buoyancy, stability of floating body and submerged body, metacenter, analytical method to determine meta-centric height | |
| 3 | **FLUID KINEMATICS** | **08** |
| | Langrangian approach and Eulerian approach, types of flow, streamline, stream tube, path line and streak line, continuity equation, continuity equation in differential form for cartesian coordinate system, local and convective acceleration, translation, rotation and deformation of fluid element, rotation and vorticity, stream function and velocity potential function, stream lines and equipotential lines, relation between stream function and velocity potential, flow nets | |
| 4 | **FLUID DYNAMICS** | **11** |
| | Newton's Laws of Motion, Euler's Equation, Bernoulli's Equation, venturimeter, orifice meter and pitot tube, impulse-momentum equation and its application, moment of momentum equation, vortex flow, forced and free vortex flow, equation of motion for vortex flow, equation of forced and free vortex flow, dimensionless parameters and their significance, Dimensional analysis. | |
| 5 | **VISCOUS FLOW** | **06** |
| | Concepts of laminar and turbulent flows, Reynolds number and Reynold's experiment, exact solution of Navier -Stokes equation for simple flows, relation between shear stress and pressure gradient, concept of developing and fully developed flow, Flow of viscous fluid in circular pipes - Hagen-Poiseuille law, laminar flow between parallel plates for moving and stationary plates | |
| 6 | **FLOW THROUGH PIPES** | **06** |
| | Loss of energy in pipes, friction factor, Moody's Chart, Darcy Weisbach Equation, major and minor losses in pipes, hydraulic gradient lines and total energy line, pipes connected in series and parallel, equivalent pipe, branched pipes, flow through orifices and mouthpieces | |
| | **Total Hours** | **45** |

## TEXT BOOKS

1. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Prakashan
2. Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S. K. Kataria & Sons
3. Fluid Mechanics, Yunus A. Cengel, McGraw Hill Publication

## REFERENCE BOOKS

1. Fluids Mechanics, F.M. White, McGraw-Hill Inc
2. Fluid Mechanics and Hydraulic Machines, Sukumar Pati, McGraw-Hill Inc
3. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som., G. Biswas, Tata McGraw Hill Co. Pvt. Ltd

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Recognize fluid properties and determine pressure with manometers.

CO2 Compute hydrostatics forces acting on a submerged body and meta-centric height of a floating body.

CO3 Application of continuity equation, calculation of velocity and acceleration in flow field and understanding of kinematics of fluid element.

CO4 Application of Bernoulli's equation in flow problems and understanding the significance of dimensional analysis.

CO5 Understanding of viscous flow characteristics in the various fluid domains.

CO6 Design simple pipe flow systems to deliver fluids under specific conditions.

## SUGGESTED LIST OF PRACTICALS

| **Sr. No.** | **Title** |
|---|---|
| 1 | Redwood Viscometer |
| 2 | Study of Capillary Effect in Fluid |
| 3 | Reynold's Experiment |
| 4 | Metacentric Height |
| 5 | Flow through Orifices and Mouthpieces |
| 6 | Bernoulli's Theorem |
| 7 | Flow Measurement by Venturi meter |
| 8 | Flow Measurement by Orifice meter |
| 9 | Pitot - static tube |
| 10 | Study of Losses in Pipe Flow - Major Losses and Minor Losses |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 2 | 1 |
| CO2 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO3 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 2 | 2 | 1 |
| CO4 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO5 | 3 | 3 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO6 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## KINEMATICS OF MACHINES

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 1 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 1 | 1 | 5 |

## DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **MECHANISM AND MACHINES** | **08** |
| | Terminology and definitions, mechanism & machines. rigid and resistance body, link, kinematic pair types of motion, degrees of freedom, classification of Kinematic pairs, kinematic chain, linkage, kinematic inversions of single and double slider crank chain, four bar chain mechanism with lower pairs, straight line mechanism and approximate straight line mechanism, quick return mechanisms, Steering gear mechanisms | |
| 2 | **VELOCITY ANALYSIS** | **08** |
| | Vectors, displacement of a rigid body, relative displacement, definition of velocity, angular velocity, rotation of a rigid body, translation and rotation of a rigid body, relative velocity method, instantaneous axes of motion, properties of instantaneous centers, the Aronhold Kennedy theorem of three centers, velocity analysis by instantaneous centers. | |
| 3 | **ACCELERATION ANALYSIS** | **06** |
| | Definition of acceleration, angular acceleration, a general case of acceleration, radial and transverse components of acceleration, the Coriolis component of acceleration, examples of Acceleration analysis, acceleration diagrams | |
| 4 | **BELTS, ROPES & CHAIN DRIVES** | **08** |
| | Introduction, belt and rope drives, open and crossed belt drives, velocity ratio, slip, materials for belt and ropes, law of belting, length of belt, ratio of friction tensions, power transmitted, centrifugal effect on belts, maximum power transmitted by a belt, initial tension, creep, chain drive-chain length, angular speed ratio, classification of chains | |
| 5 | **GEARS & GEAR TRAINS** | **10** |
| | Introduction, classification of gears, gear terminology, law of gearing, velocity of sliding, forms of teeth, cycloidal profile teeth, involute profile teeth, comparison of cycloidal and involute tooth forms, birth of contact, arc of contact, number of pairs of teeth in contact, interference in involute gears, minimum number of teeth, interference between rack and pinion, undercutting, introduction to helical, spiral, worm and bevel gears | |
| 6 | **CAMS** | **05** |
| | Introduction, types of cams, types of followers, cam terminology, displacement diagrams, motions of the follower, graphical construction of cam profile | |
| | **Total Hours** | **45** |

## TEXTBOOKS

1. Theory of Machines, S. S. Rattan, Tata McGraw-Hill Publishing Co. Ltd New Delhi
2. Theory of Machines, P. L. Ballaney, Khanna Publishers, New Delhi

## REFERENCE BOOKS

1. Theory of Machines and Mechanisms, Joseph Shigley and John Uicker, Jr., McGraw Hill
2. Theory of Mechanisms & Machines, Amitabha Ghosh & Ashok Mallik, Affiliated East-West Press Pvt. Ltd
3. Theory of Machines, Thomas Bevan, CBS publishers and distributors
4. Theory of Machines, Sadhu Singh, Pearson Education
5. Mechanism and Machine Theory, J.S. Rao and R.V. Dukkipati, New Age International Publisher
6. Kinematics & Dynamics of Machinery, Charles Wilson & J. Peter Sadler, Pearson Education

## COURSE OUTCOMES

After successful completion of the course, student should be able to:

CO1 Understand the various mechanisms and calculate the degree of freedom of mechanisms.

CO2 Analyze planar mechanisms for displacement and velocity by graphical and analytical methods.

CO3 Implement the knowledge of velocity analysis to solve the problems of planar mechanisms for acceleration by graphical methods.

CO4 Evaluate the required length and size of the belt, rope and chain drives considering required power transmission and centrifugal effect.

CO5 Understand various concepts and working principles of Gears and gear trains.

CO6 Analyze the kinematic requirements and shape of the Cam and follower mechanism..

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Kinematic chains and their inversions |
| 2 | Mechanisms with lower pair |
| 3 | Slip phenomena in flat belt drive |
| 4 | Involute gear tooth profile generation |
| 5 | Velocity analysis |
| 6 | Acceleration analysis |
| 7 | Construction of cam profile |
| 8 | Epicyclic gear train |
| 9 | Cam analysis |
| 10 | Coriolis component of acceleration |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 |
| CO2 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 2 | - |
| CO3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 2 | - |
| CO4 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 2 | - |
| CO5 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 2 | 1 |
| CO6 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## MACHINE DRAWING AND INDUSTRIAL DRAFTING

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 0 | 0 | 4 | 0 | 0 | 25 | 25 | 50 | 0 | 0 | 2 | 2 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| | **PART A: MACHINE DRAWING** | |
| 1 | **FUNDAMENTALS OF MACHINE DRAWING**<br>Introduction to Machine drawing, conventional representations of various machine elements such as threaded parts, bearing, gears, spring, etc. conventional representation of part materials, standard abbreviations. | 03 |
| 2 | **DETACHABLE FASTNERS**<br>Introduction, screw thread nomenclature, forms of thread, thread designation, drawing representations of threads: normal, schematic and conventional. part drawing exercises of threaded fasteners such as bolts, nuts, screws, studs, nut locking arrangements | 07 |
| 3 | **PERMANENT FASTNERS**<br>Rivets and riveted joints, BIS symbols for riveted joints. types of welded joints, BIS symbols for welded joints. drawing exercises for representation of riveted joints and welded joints | 08 |
| 4 | **ASSEMBLY DRAWING**<br>Detail drawing of machine components. assembly drawings of various machines, mechanisms and equipment such as cotter joint, knuckle joint, flange coupling, universal coupling, screw jack etc. from detail drawings, sketches and actual machine components | 09 |
| 5 | **PRODUCTION DRAWING**<br>Introduction to limits, fits, dimensional tolerance, surface roughness and their drawing representation. Geometric dimensioning and tolerancing: basic terminology, indication of geometric tolerance in drawing | 03 |
| | **Total Hours – Part A** | **30** |

## PART B: COMPUTER AIDED DRAFTING

| | | |
|---|---|---|
| **1** | **DRAWING OBJECTS** | **07** |
| | Starting with AutoCAD, AutoCAD dialog boxes, co-ordinate Systems, drawing line, circle, arc, rectangle, ellipse, polygons | |
| **2** | **EDITING SKETCHED OBJECTS** | **05** |
| | Editing sketches, moving, copying, pasting, offsetting, scaling, chamfering, trimming, mirroring. filleting, sketched objects | |
| **3** | **DIMENSIONING** | **02** |
| | Giving dimensions and annotations to drawings, creating linear, rotated, angular, aligned, base line dimensions, modifying dimensions, showing surface roughness symbols, weld symbols, dimensional tolerances, geometric tolerances | |
| **4** | **PLOTTING** | **01** |
| | Plotting the drawings in AutoCAD, plotting drawing using the plot dialog box, adding plotters and using plot styles, plotting sheets | |
| **5** | **DRAWING EXERCISES WITH AUTOCAD:** | **13** |
| | Orthographic drawing and Isometric drawing of objects, drawing of machine parts, detail and assembly drawing of machines | |
| **6** | **3D MODELING:** | **02** |
| | Creating a 3D model of any object using AutoCAD, generating drawings from the 3D model. | |
| | **Total Hours – Part B** | **30** |
| | **Total Hours** | **60** |

**TEXT BOOKS**


1. Machine Drawing, K. L. Narayana, P. Kannaiah, K. Venkata Reddy, 3rd edition, New age international (P) Ltd.
2. Machine Drawing, Basudeb Bhattacharyya, Oxford University Press
3. Machine Drawing, N. D. Junnarkar, Pearson Education Pvt. Ltd


**REFERENCE BOOKS**


1. Machine Drawing - P.S. Gill, S.K. Kataria & Sons New Delhi.
2. Machine Drawing - N. Sidheshwar, P. Kannaiah. McGraw-Hill India.
3. Engineering Drawing Practice for Schools and Colleges SP 46: 2003- BIS (Bureau of Indian Standards).
4. AutoCAD 2017 for Engineers & Designers- Prof. Sham Tickoo. Dreamtech Press.
5. Design of Machine Elements - V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd.
6. A text book of Machine Design - P. C. Sharma, D. K. Aggarwal, S. K. Kataria & Sons.
7. PSG Design data book.

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Understand conventional representation of machine parts, representation of part materials, meaning of drawing abbreviations in machine drawing.

CO2 Create drawings of threaded fasteners such as bolts, nuts, screws, studs, nut locking arrangements.

CO3 Create drawings of permanent fasteners such as riveted joints and welded joints.

CO4 Visualize machine parts, and create detail drawing and assembly drawing of various machines, mechanisms or structures by following rational approach.

CO5 Understand and represent surface roughness symbols, dimensional and geometric tolerances in production drawing.

CO6 Use a computer aided drafting software for preparation of machine drawings.

## SUGGESTED LIST OF PRACTICALS

| **Sr. No.** | **Title** |
|---|---|
| 1 | Drawing sheet 1: Detachable and permanent fasteners |
| 2 | Drawing sheet 2: Detail drawings of any machine/mechanism/structure/equipment. |
| 3 | Drawing sheet 3: Assembly drawing of any machine/mechanism/structure/equipment. |
| 4 | Drawing sheet 4: Isometric drawing otherwise 3D modeling of any object using AutoCAD |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | - | 1 | - | - | - | 1 | 3 | - | 2 | 2 | - | 1 |
| CO2 | 3 | 2 | 2 | - | 3 | - | - | - | 1 | 3 | 1 | 2 | 3 | 1 | 1 |
| CO3 | 3 | 2 | 2 | - | 3 | - | - | - | 1 | 3 | 1 | 2 | 3 | 1 | 1 |
| CO4 | 3 | 2 | 2 | - | 3 | - | - | - | 1 | 3 | 1 | 2 | 3 | 1 | 1 |
| CO5 | 3 | 2 | 2 | - | 3 | - | - | - | 1 | 3 | 1 | 2 | 3 | 1 | 1 |
| CO6 | 2 | 1 | 1 | - | 3 | - | - | - | 1 | 3 | 1 | 2 | 3 | 1 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## MANUFACTURING TECHNOLOGY - I

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 4 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 2 | 5 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **SAND CASTING PROCESS** | **11** |
| | Principal of casting process, different types of patterns, pattern materials, pattern allowances, pattern colours, types of sand, moulding materials and core, moulding processes, melting practice and metal pouring, gating system design, fatteling process and casting defects | |
| 2 | **SPECIAL CASTING PROCESSES** | **04** |
| | Gravity die casting, pressure die casting, centrifugal casting, investment casting, continuous casting, vacuum casting, squeeze casting, comparison with conventional sand casting process | |
| 3 | **LATHE MACHINE** | **08** |
| | Function, working principle, classification, specifications, main parts, feed mechanism, lathe accessories, lathe operations, cutting tool materials, tool geometry of single point cutting tool, cutting Parameters: speed, feed and depth of cut, machining time, material removal rate, specification of lathe machine, capstan and turret lathe, working principle, parts | |
| 4 | **MILLING, SHAPER AND PLANNER MACHINE** | **12** |
| | Working principle, main parts, classification of milling machines, specification, milling machine mechanism, work holding devices, cutter holding devices, different milling cutters, tool geometry of plain milling cutter, milling operations, cutting parameters, machining time, milling attachments, principle of indexing, types of indexing | |
| | Function of shaper, working principle, classification, main parts, driving mechanism of shaper, feed mechanism of shaper, different operations on shaper machine, cutting parameters: speed, feed and depth of cut, machining time, specification of shaper machine | |
| | Working principle of planer, classification, difference between shaper and planer, planner operations, specification of planner machine | |
| 5 | **DRILLING, BORING AND GRINDING MACHINE** | **08** |
| | Working principle of drilling, classification, main parts, specification, different operations on drilling, machining time | |
| | Working principle & types of boring machines, boring tools | |
| | Working principle, main parts, classification of grinding machines, specification, Grinding operations, types of grinding wheels, wheel marking, truing, glazing, loading | |
| 6 | **INTRODUCTION TO ADDITIVE MANUFACTURING** | **02** |
| | Additive manufacturing – basics, processes and applications | |
| | **Total Hours** | **45** |

## TEXTBOOKS

1. Element of Workshop Technology, S. K. Hajra Choudhury,Vol. 1, Media Promoters and publishers Pvt.
2. Element of Workshop Technology, S. K. Hajra Choudhury,Vol. 2, Media Promoters and publishers Pvt.
3. Foundary Technology, O. P. Khanna, Dhanpat Rai Publication

## REFERENCE BOOKS

1. A course in Workshop Technology, B.S.Raghuwanshi, Dhanpat Rai & Sons, Delhi
2. Elements of Lathe work, B.Brushtein and V.Dementyev, Peace Publishers, Moscow
3. Manufacturing Engg. And Technology, S. Kalpakajain, PHI/Pearson
4. H.M.T, "Production Technology", Tata McGraw Hill
5. Manufacturing Processes for Engineering Materials, Kalpakjain S. and Schmid Steven R., Pearson Publication
6. Workshop Technology Vol. I, II & III, Chapman
7. Manufacturing Technology – 1 Foundary, Forming and Welding,P. N. Rao

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Interpret foundry practices like pattern making, mould making, core making and inspection of defects.

CO2 Understand various advanced casting processes.

CO3 Select machining process (es), cutting tool(s) and machine tool(s) to produce a given part.

CO4 Understand the characteristics of different machine tools.

CO5 Analyze the sequence of machining operation to produce the part using machine tools.

CO6 Implement knowledge of machining processes for making different jobs.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Introduction to the Lathe machine. |
| 2 | To study about operations performed on lathe machine and various work holding devices. |
| 3 | Introduction to the Milling machine. |
| 4 | To study about operations performed on milling machine, types of milling cutters and various work holding devices. |
| 5 | Introduction to Drilling machine. |
| 6 | Introduction to the Shaper machine. |
| 7 | Introduction to the Grinding machine. |
| 8 | Introduction to Additive Manufacturing. |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | - | 1 | - | - | - | 1 | - | - | 1 | 1 | 1 | - |
| CO2 | 1 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | 1 | 1 | - |
| CO3 | 3 | 2 | - | - | 1 | - | - | - | 2 | - | - | 2 | 2 | 2 | 1 |
| CO4 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 | 2 | - |
| CO5 | 2 | 2 | 1 | - | - | - | - | - | 1 | - | - | 1 | 2 | 2 | - |
| CO6 | 3 | 2 | 2 | - | - | - | - | - | 1 | - | - | 1 | 3 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

# (MH509) MANUFACTURING TECHNOLOGY - II

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 3 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1.5 | 4.5 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **FUNDAMENTALS OF WELDING AND ARC WELDING PROCESSES**<br>Fundamentals of welding system, Advantages & Disadvantages of welding, Classification of welding processes.<br>Fundamentals of arc welding, Arc Welding Processes: Carbon arc welding, Manual metal arc welding, Tungsten inert gas welding, Metal inert gas welding, Metal active gas welding and Submerged arc welding.<br>**Welding equipment its specification and Welding Consumables**:<br>Arc welding power sources (AC and DC type), other accessories for arc welding.<br>Welding Electrode and fluxes, Selection of electrodes, Electrode coating, Care & storage of welding electrode, Classification and coding of electrodes as per IS system. | 12 |
| 2 | **RESISTANCE WELDING PROCESSES AND GAS WELDING PROCESS:**<br>Fundamentals of Electric Resistance welding, Spot welding, Projection welding, Seam welding.<br>Oxy fuel Gas welding Processes, Oxyacetylene welding: Principle, Methods, Applications Other Joining Processes, Gas cutting, Principles of gas cutting, equipment used in gas welding, different types of gas welding torches. | 09 |
| 3 | **WELDING DEFECTS AND ALLIED METAL JOINING PROCESSES**<br>Various types of welding defects, Causes and remedies, introduction to Inspection and Testing of welds.<br>Soldering, Brazing, Adhesive Bonding and its application. | 05 |
| 4 | **ADVANCED WELDING PROCESSES**<br>Introduction to Electron beam welding, Electroslag welding, Underwater welding, and Narrow gap welding. | 04 |

| | | |
|---|---|---|
| **5** | **HOT WORKING AND COLD WORKING OF METALS** | **09** |
| | Plastic Deformation, Rolling, Extrusion, Pipe & tube manufacture, Merits and demerits of the hot working and cold working process, Wire drawing, Metal spinning.<br>Introduction to super finishing operations: Grinding, Lapping, Horning, Buffing, Burnishing. | |
| **6** | **PRESS WORKING** | **06** |
| | Presses & drive mechanism for presses, Feed mechanism, Clearance and its importance, Press tool operations, Shearing, cutting off, parting, blanking, piercing, notching, slitting, slitting, Nibbling Trimming, Lancing, Bending & forming types of dies, die materials, stock layout, compound and progressive dies and punches, construction details of die set, auxiliary equipment, safety devices. | |
| | **Total Hours** | **45** |

**TEXT BOOKS**

1. Welding technology, O.P. Khanna ,Dhanpatrai & Co.(p) ltd, New Delhi
2. Production Technology, O.P. Khanna ,Dhanpatrai & Co.(p) ltd, New Delhi

**REFERENCE BOOKS**

1. Welding processes and technology, R. S. Parmar, Khanna publishers
2. Manufacturing Technology- Foundry, Forming and Welding, P. N. Rao, Tata McGraw Hill
3. Introduction to Manufacturing Processes, Schey J., Tata McGraw Hill
4. Welding Technology, Richard Little
5. Production Technology, P.C.Sharma, S. Chand
6. Manufacturing Engineering and Technology, S. Kalpakajain, PHI/Pearson

**COURSE OUTCOMES:**

After successful completion of the course, students will be able to;

| | |
|---|---|
| CO1 | Understand the principles and procedure of fusion welding as well as solid state welding processes. |
| CO2 | Select an appropriate fusion welding as well as solid state welding processes for specific applications. |
| CO3 | Acquire knowledge of advanced welding processes, awareness about allied metal joining process and cause and remedial action of welding defects. |
| CO4 | Understand principle steps of various extrusion and pipe and tube manufacturing processes. |
| CO5 | Understand the principle, procedure and applications of bulk metal forming and sheet metal forming processes. |
| CO6 | Outline tooling and equipment required for important metal forming processes and sheet metal forming processes. |

**SUGGESTED LIST OF PRACTICALS**

| Sr. No. | Title |
|---|---|
| 1 | To study about welding symbol. |
| 2 | To study about manual metal arc welding process. |
| 3 | To study about TIG welding process. |
| 4 | To study about MIG welding process. |
| 5 | To study about SAW welding process. |
| 6 | To study about gas welding process. |
| 7 | To study about resistance welding processes. |
| 8 | To study about rolling process. |
| 9 | To study about manual press and mechanical press. |
| 10 | To study about strip layout for press working resulting minimum wastage. |

**COURSE ARTICULATION MATRIX:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | 3 | 1 | - |
| CO2 | 2 | 3 | 2 | 1 | 1 | - | - | - | 2 | - | - | 2 | 2 | 3 | 1 |
| CO3 | 1 | 2 | 1 | 1 | - | - | - | - | 1 | - | - | 1 | 2 | 1 | 1 |
| CO4 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | - |
| CO5 | 3 | 2 | 1 | - | 1 | - | - | - | 2 | - | - | 2 | 2 | 1 | 1 |
| CO6 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | - |

**1-Slightly; 2-Moderately; 3-Substantially**

## MATERIAL SCIENCE & METALLURGY

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **STRUCTURE OF MATERIALS** | 05 |
| | Crystalline structure of solids, crystalline materials vs amorphous materials, concept of unit cell and space lattice, lattice parameters, Miller indices, crystal structure of ferrous and non-ferrous metals, crystal imperfections, atomic packing factors for various cubic systems, Bragg's law | |
| 2 | **MECHANICAL PROPERTY AND MEASUREMENTS** | 05 |
| | Tensile, compression and torsion test, Young's modulus, relations between true and engineering stress-strain curves, generalized Hook's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery, Hardness: Rockwell, Brinell and Vickers and their relation to strength | |
| 3 | **PHASE DIAGRAM AND IRON-CARBON EQUILIBRIUM DIAGRAM** | 10 |
| | Alloys, substitutional and interstitial solid solutions, phase diagrams, interpretation of binary phase diagrams and microstructure development, eutectic, peritectic, peritectoid, and monotectic reactions. Iron- Iron carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite, cast iron | |
| 4 | **STEELS AND HEAT TREATMENTS** | 10 |
| | Introduction and purpose of heat treatments, classification of heat treatment processes, annealing, tempering, normalising and spheroidising, isothermal transformation diagram for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructure and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening. Property variation with microstructure, classification and application of steels, transformation product of austenite, TTT and CCT curves, critical cooling rate. Introduction and applications of various case hardening and surface hardening treatments | |
| 5 | **FERROUS-NON-FERROUS ALLOYS, COMPOSITES & OTHER NON-METALS** | 08 |
| | Classification of steels, alloying of steels, properties of various stainless steels and tool steels, designation of steels. Cast irons; grey, white, malleable and spheroidal cast irons. Copper and copper alloys, brasses, equivalent zinc in brasses, season cracking of brasses, aluminium bronzes, tin bronzes, beryllium bronzes, silicon bronzes, copper nickel alloys, aluminium and aluminium alloys, nickel and nickel alloys, bearing materials, Ceramic materials, polymers, composites, particles-reinforced composites, fiber reinforced composites, Material standards and its equivalency (ISO, ASTM, DIN, JIS). | |

| | | |
|---|---|---|
| **6** | **NON DESTRUCTIVE TESTING** | **07** |
| | Introduction to non-destructive testing, radiography testing, dye penetration testing, magnetic particle testing, ultrasonic testing, Jominy end quench test, macro-examination, spark test, macro-etching, microscopic examinations, electron microscopy, magnetic testing, chemical analysis of steel and iron, NDT certification and its applicability to industry. | |
| | **Total Hours** | **45** |

**TEXT BOOKS**

1. Material Science & Engineering, V. Raghvan, PHI Learning Pvt Ltd.
2. Introduction to Physical Metallurgy, Sidney H Avner, Tata Mcgraw-Hill
3. Material Science and Engineering, W. Callister, Willey Publication

**REFERENCE BOOKS**

1. The science and engineering of Materials, Donald Askland and Pradeep Phule, Wadsworth Publishing.
2. Material Science and Metallurgy for Engineers, V.D. Kodgire, Everest Publishing House
3. Elements of Material Science and Engineering, Lawrence Vlack, PEARSON
4. Physical Metallurgy for Engineers, Donald S Clark & Wilbur R Varney, East-west press pvt Ltd.

**COURSE OUTCOMES**

After successful completion of the course, students will be able to:

CO1 Correlate crystal structure with its mechanical properties and select the proper material based on applications.

CO2 Identify material testing methods to measure desired mechanical properties for different machine elements.

CO3 Distinguish between phases present in the Iron-Iron Carbide diagram and its effect on mechanical properties.

CO4 Understand the application of heat treatments to achieve various mechanical properties in steels.

CO5 Distinguish between various engineering materials and select the appropriate material based on the application.

CO6 Basic use of NDT method and applied appropriate NDT method to find out defect in engineering component.

**SUGGESTED LIST OF PRACTICALS**

| **Sr. No.** | **Title** |
|---|---|
| 1 | Study of Metallurgical Microscope |
| 2 | Specimen Preparation for Optical Microscope |
| 3 | Measurement of Indentation Hardness |
| 4 | To Study Behaviour of Metal |
| 5 | To Study Impact Test |
| 6 | Introduction to Various Heat Treatment Processes |
| 7 | Jominy End-Quench Test |
| 8 | Study of Liquid Penetrant Test |
| 9 | Study Magnetic Particle Inspection Test |
| 10 | Study of Ultrasonic Inspection Technique |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | 1 | - | - | - | 2 | - | - | 1 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 2 | 2 | - | - | - | 3 | - | - | 3 | 3 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 3 | - | - | 2 | 2 | 2 | 1 |
| CO4 | 3 | 3 | 2 | 1 | 2 | - | - | - | 3 | - | - | 3 | 3 | 3 | 1 |
| CO5 | 2 | 1 | 2 | 1 | - | | | | - | | | 1 | 2 | 2 | 2 |
| CO6 | 2 | 2 | 2 | 1 | - | | | | - | | | 2 | 3 | 2 | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

## MECHANICAL VIBRATIONS (MH710)

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TWO | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **UNDAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS**<br>Introduction, Basic terminologies, Simple harmonic motion, Degrees of freedom, Derivations of differential equations, Solution of a differential equation, Rayleigh's energy method, Torsional vibrations, Equivalent stiffness of spring combinations: spring in series, spring in parallel, inclined springs. | 08 |
| 2 | **DAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS**<br>Introduction, Different types of damping, over-damped system, critically-damped system, under-damped system, logarithmic decrement, Viscous dampers: Fluid Dashpot, Eddy current damping, Dry friction damping, Solid damping, Slip damping. | 07 |
| 3 | **FORCED VIBRATIONS OF SINGLE-DEGREE OF FREEDOM SYSTEMS**<br>Introduction, Forced vibration with constant harmonic excitation, Force vibration with rotating and reciprocating unbalance, Forced vibrations due to excitation of support, Absolute amplitude, Relative amplitude, Energy dissipated by damping, Vibration isolation and transmissibility, Force transmissibility, Motion transmissibility. | 07 |
| 4 | **TWO DEGREE OF FREEDOM SYSTEMS**<br>Introduction, Principle modes of vibration, Two masses fixed on a tightly stretched string, Double pendulum, Torsional system, Systems with damping, Undamped forced vibration with harmonic excitation, Generalized coordinates and co-ordinate coupling, vibration absorbers, vibration isolation, Introduction to multi-degree of freedom systems. | 10 |
| 5 | **CRITICAL SPEED OF SHAFTS**<br>Introduction, Critical speed of a single disc with and without damping, Secondary critical speed, Lateral vibrations. | 06 |
| 6 | **VIBRATION MEASURING INSTRUMENTS AND APPLICATIONS**<br>Vibrometer, velocity pick-ups, accelerometer, and frequency measuring instruments, Introduction to proximeter. | 07 |
| | **Total Hours** | **45** |

### TEXTBOOKS


1. Mechanical Vibrations by Grover, G.K., 8th Ed., Nem Chand and Brothers, 2003
2. Mechanical Vibrations by Singh, V.P., Dhanpat Rai & Co.


### REFERENCE BOOKS

3. Mechanical Vibration by Singiresu S. Rao, 5th Ed., Pearson Publication.
4. Mechanical Vibrations by Shrikant Bhave, Pearson Publication.
5. Theory of Vibration with Applications by Thomson W. T., 5th Ed., Pearson Publication.
6. Principles of Vibration by Benson H. Tongue, Oxford University Press.
7. Theory of Machines & Mechanisms by P.L.Ballaney, Khanna Publishers, Delhi.

## COURSE OUTCOMES

After successful completion of the course, students will be able to:

CO1 Model single degree of freedom vibrating system to derive equation of motion and determine the natural frequency.
CO2 Understand types of damping and formulate governing differential equation and solution for damped free vibrations.
CO3 Formulate governing differential equation and solution for force vibrations.
CO4 Evaluate the natural frequency and mode shapes of two-degree and multi-degree freedom vibratory systems.
CO5 Determine the critical speed of the rotating machinery.
CO6 Understand the application and importance of various vibration measuring instruments.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | To determine the natural frequency of undamped free vibration of a simple pendulum. |
| 2 | To determine the natural frequency of undamped free vibration of a single-degree spring-mass system. |
| 3 | To determine the frequency and damping coefficient of damped free torsional vibration of single degree shaft rotor system. |
| 4 | To analyze the response of undamped forced vibration of an equivalent spring-mass system. |
| 5 | To analyze the response of damped forced vibration of an equivalent spring-mass system. |
| 6 | To determine the natural frequencies and node point of free longitudinal vibration of a two-degree freedom system. |
| 7 | To determine the natural frequencies and node point of free torsional vibration of a two-degree freedom system. |
| 8 | To determine the natural frequencies and mode shapes of an oscillating double pendulum. |
| 9 | To determine the whirling speed of the shaft. |
| 10 | To perform the vibration measurement using measuring instruments. |
| 11 | To understand the importance of the FFT analyzer in vibration analysis. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 2 | | | | 2 | | | 1 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | | | | 2 | | | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | 3 | 2 | 2 |
| CO5 | 3 | 2 | 3 | 2 | 2 | | | | 2 | | | 2 | 3 | 2 | 2 |
| CO6 | 3 | 3 | 3 | 3 | 3 | | | | 2 | | | 2 | 3 | 3 | 2 |

**1-Slightly; 2-Moderately; 3-Substantially**

## PRODUCTION TECHNOLOGY

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

**DETAILED SYLLABUS**

| Sr. No | Contents | Hrs |
|---|---|---|
| 1 | **THEORY OF METAL CUTTING**<br>Principles of metal machining, cutting tools and tool materials, tool signature, mechanics of chip removal, cutting forces and parameters effecting it, cutting fluids, tool wear, tool life, economics of machining. Multi point cutting tools, temperature measurement at tool-work interface and its effects | 10 |
| 2 | **GEAR AND THREAD MANUFACTURING**<br>Different types of Threads manufacturing methods, and tools involved, Different gear forming and generating methods with their special features, Gears finishing processes | 08 |
| 3 | **JIGS & FIXTURES**<br>Definition, its usefulness in mass production, design principles, locating systems and types of locators & clamps, jig bushes, design of jigs and fixtures for various machining operations | 08 |
| 4 | **UNCONVENTIONAL MACHININIG**<br>Process principle, process equipment for various un- conventional machining processes like - EDM, wire cut EDM, ECM, ECG, CM, AJM, USM, PAM,IBM, LBM | 08 |
| 5 | **DRIVE AND CONTROLS IN MACHINE TOOLS**<br>Introduction to drives in machine tools, classification of machine tool drives, selection of maximum and minimum speeds and feeds, stepped regulators and stepless regulators for spindle drive | 05 |
| 6 | **SEMI AUTOMATS AND AUTOMATS:**<br>Classification of automats, specifications, Capstan and turret lathes, tooling equipment, bar stock feeding methods, tool layout for turret, capstan and automats, single spindle and multi spindle automats, bar type and chucking type machines their principles of working constructional details and tool setting, transfer machines | 06 |
| | **Total Hours** | 45 |

**TEXT BOOKS**

1. A Textbook of Production Engineering, P. C. Sharma , S. Chand & Company Limited

2. Modern Machining Processes, P. C. Pandey and H. S. Shan, Tata McGraw Hill

## REFERENCE BOOKS

1. Production Technology, HMT, Tata McGraw-Hill Education Pvt Limited
2. Production engineering and science, P. C. Pandey and C. K. Singh, Standard Publishers Distributors
3. Jigs and Fixtures, P. H. Joshi, Tata McGraw Hill Education Private Limited
4. A Textbook of Production Technology, P. C. Sharma , S. Chand & Company Limited
5. Manufacturing Science, A. Ghosh and A. K Mallik, East West Press Pvt Ltd
6. Metal Cutting principles, M C Shaw, Oxford University press .

## COURSE OBJECTIVES

After successful completion of the course, students will be able to;

CO1 To understand Mechanics of chip formation, types of chips and Analyze the stresses, cutting forces in Metal cutting.

CO2 To understand Different types of Gear & Thread Manufacturing Processes.

CO3 To understand Design principles for Jigs & Fixtures.

CO4 To interpret and compare different non traditional machining processes for material removal application.

CO5 To understand about machine tool drives and controls for speed and feed.

CO6 To understand and differentiate semi-automats and automats machines.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | To study about single point cutting tool geometry and to ground angle for the given tool material. |
| 2 | To study about various types of chips formed during machining. |
| 3 | To study about gear manufacturing methods. |
| 4 | To study about thread manufacturing methods and to make thread on given material by using lathe machine. |
| 5 | To study about meaning and importance of jigs & fixtures and 3-2-1 principle for location. |
| 6 | To study about types of locating and clamping devices. |
| 7 | To study about basics of non-traditional machining methods and parameters for the same. |
| 8 | To study about EDM process. |
| 9 | To study about ultrasonic machining and water jet machining. |
| 10 | To study about capstan and turret lathe machine. |

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 1 | | 1 | 1 | | | | | 2 | 3 | 2 | 1 |
| CO2 | 3 | 2 | 2 | 1 | | 2 | 1 | | | | | 2 | 3 | 2 | 1 |
| CO3 | 3 | 2 | 2 | 1 | | 1 | 1 | | | | | 2 | 3 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 1 | | 2 | 1 | | | | | 2 | 3 | 2 | 1 |
| CO5 | 3 | 2 | 2 | 1 | | 2 | 1 | | | | | 2 | 3 | 2 | 1 |
| CO6 | 3 | 2 | 2 | 1 | | 2 | 1 | | | | | 2 | 3 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## ELECTRICAL MACHINES AND DRIVES

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

**DETAILED SYLLABUS**

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **TRANSFORMERS & ITS SWITCHGEARS** | **08** |
| | General aspects, basic definition, working principle of transformer, types of transformers, transformer construction: core/shell/spiral transformers, transformers on no load & on load, vector diagrams, equivalent circuit, losses and condition for maximum efficiency, all day efficiency, Sumpner's test, conditions for parallel operation, introduction to 3-phase transformer, construction, instrument transformers, Relay, circuit breaker and isolator, fuses | |
| 2 | **ALTERNATOR** | **07** |
| | Introduction, constructional details, types, armature winding, EMF equation, factor affecting size of alternator, alternator operation on load, voltage regulation, losses and efficiency, parallel operation of alternators, armature reaction, damper winding | |
| 3 | **DC GENERATOR** | **07** |
| | Classification, working principle of generator, construction of DC Machines, types of DC generator, open circuit characteristic, external characteristic and internal characteristic of DC generator, efficiency and power stages with example, condition for maximum efficiency | |
| 4 | **DC MOTORS** | **08** |
| | Construction, types, principle of operation, torque equation, losses and efficiency, speed torque characteristics of shunt, series and compound motor, D.C. shunt motor 3–point starter, speed control of D.C. shunt and series motors, Stepper motor, Single line diagrams of DC motors | |
| 5 | **SINGLE PHASE, THREE-PHASE INDUCTION MOTOR & ITS SWITCHGEARS** | **10** |
| | Construction, principle of operation, production of magnetic field, comparison between three phase and single-phase induction motors, speed and slip, rotor current, relation between rotor copper loss and rotor input, torque of an induction motor, torque slip curve, losses and efficiency, starters for three phase induction motor, speed control of three phase induction motor, single line diagram of induction motor | |
| 6 | **INTRODUCTION TO DRIVES** | **05** |
| | Introduction to Thyristor, Insulated Gate Bipolar transistors (IGBTs), Power MOSFET, general configuration of a motor drive, matching power electronic converter and motor, thyristor controlled single phase and three phase converter drive, modes of operation, block diagram and DC drive examples | |
| | **Total Hours** | **45** |

## TEXT BOOKS

1. Power systems, V. K. Mehta, S. Chand publication
2. Principles of power systems, V.K. Mehta, S. Chand publication
3. Electrical Technology- Vol. II, B. L. Theraja, S. Chand publication

## REFERENCE BOOKS

1. A course in power systems, J. B. Gupta, S. K. Kataria Publication
2. Electrical power systems, S. L. Upal, Khanna Publishers
3. A course in Electrical Power, P. V. Gupta, M. L. Soni, U. S. Bhatnagar, Dhanpat Rai & Co.
4. Theory & Performance of Electrical Machines, J. B. Gupta, Katson books
5. Power Electronics, P.S. Bimbhra, Khanna Publishers

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Understand working, principle & operation of Transformers.

CO2 Understand basic operation of Alternator & analyze the effect of armature reaction and different types of voltage regulation.

CO3 Analyze construction & application of DC generator using various characteristics & its examples.

CO4 Evaluate performance of DC motors based on its characteristics.

CO5 Analyze constructional features & principle of operation of single phase & three phase induction motor along with its speed control & starting methods.

CO6 Carryout analysis on different types of motor drives based on applications.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Transformer Open Circuit Test & Short Circuit Test |
| 2 | Load Test on Single Phase Transformer |
| 3 | Transformer Sumpner's Test |
| 4 | To find out Regulation of Alternator by using Synchronous Impedance method. |
| 5 | Study of DC Generator |
| 6 | Load Test on DC Shunt Generator |
| 7 | Load Test on DC Series Generator |
| 8 | Load Test on DC Compound Generator |
| 9 | Study of DC & AC Starter |
| 10 | No load & Block rotor test on 3-phase Squirrel Cage Induction motor |
| 11 | Load Test on 3-phase Squirrel Cage Induction Motor |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 2 | 2 | - | 2 | - | - | - | 1 | 3 | 3 | 2 | 1 |
| CO2 | 2 | 2 | 2 | 2 | 2 | - | 2 | - | - | - | 1 | 3 | 3 | 2 | 1 |
| CO3 | 2 | 2 | 2 | 2 | 2 | - | 2 | - | - | - | 1 | 3 | 3 | 2 | 1 |
| CO4 | 2 | 2 | 2 | 2 | 2 | - | 2 | - | - | - | 1 | 3 | 3 | 2 | 1 |
| CO5 | 2 | 2 | 2 | 2 | 2 | - | 2 | - | - | - | 1 | 3 | 3 | 2 | 1 |
| CO6 | 1 | 1 | - | - | 1 | - | 1 | - | - | - | 1 | 2 | 2 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

# THERMODYNAMICS

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 3 | 0 | 2 | 60 | 40 | 25 | 25 | 150 | 3 | 0 | 1 | 4 |

## DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **INTRODUCTION**<br>Macroscopic versus microscopic view point, thermodynamic systems and control volume, thermodynamic properties, processes and cycles, homogeneous and heterogeneous systems, thermodynamic equilibrium, quasi-static process, pure substance, concept of continuum, temperature and zeroth law of thermodynamics, ideal gas and gas laws. | 05 |
| 2 | **ENERGY AND ENERGY TRANSFER**<br>Forms of energy, energy transfer by heat and work, mechanical forms of work, first law of thermodynamics, energy conversion efficiencies. | 05 |
| 3 | **PROPERTIES OF PURE SUBSTANCES**<br>Pure substance, phases and phase change process, thermodynamic properties, property diagrams, ideal gas equation of state, van der waal equation, virial equation of state. | 06 |
| 4 | **ENERGY ANALYSIS OF A CLOSED SYSTEM**<br>PdV work in various quasi-static processes, energy balance, specific heats, internal energy, enthalpy and specific heats of solids, liquids and ideal gases. | 06 |
| 5 | **ENERGY ANALYSIS OF A OPEN SYSTEM**<br>Conservation of mass, flow work and energy of a flowing fluid, energy analysis of steady and unteady flow systems. | 06 |
| 6 | **SECOND LAW OF THERMODYNAMICS**<br>Introduction to second law, thermal energy reservoir, heat engine, refrigerator and heat pump, Clausis and Kelvin-Plank statement, perpetual motion machines, reversible and irreversible processes, Carnot and reversed Carnot cycle, , entropy principle and isentropic process, Tds and Maxwell relation. | 07 |
| 7 | **STEAM BOILERS**<br>Introduction, classification, mountings and accessories, classification and comparison of boiler draught systems. | 03 |
| 8 | **APPLICATIONS OF THERMODYNAMICS**<br>Construction and working of pumps, compressors, IC engine- Otto and Diesel engines, vapour compression refrigeration system, vapour absorption refrigeration system. | 04 |

| | |
|---|---|
| **Total Hours** | **42** |

## TEXT BOOKS

1. Yunus A. Cengel, Michael A. Boles., "Thermodynamics- An engineering approach", Tata McGraw Hill publishing co. ltd.
2. Nag P.K., "Engineering Thermodynamics", Tata McGraw Hill publishing co. ltd.
3. Smith J.M., Van Ness H.C., Abbott M.M, "Introduction to chemical engineering thermodynamics", McGraw Hill publishing co. Ltd.

## REFERENCE BOOKS

1. Sonntag. R.E., Borgnakke, C. and Van Wylen G.J.,"Fundamental of thermodynamics", John Wiley and Sons.
2. Moran M.J. and Shapiro H.N., "Fundamentals of engineering thermodynamics", John Wiley and Sons.

## COURSE OUTCOMES

After successful completion of the course, students will be able to:

| Co Number | Cognitive Level / Bloom's Taxonomy | Statement |
|---|---|---|
| CO1 | Analyse | Analyse heat, work and energy interaction for different processes. |
| CO2 | Understand | Discuss basic terminology of thermodynamics systems and Interpret steady flow process. Describe applied machines. |
| Co3 | Remember | Describe fundamentals of the first and second laws of thermodynamics and explain their significance to a wide range of systems. |
| Co4 | Evaluate | Evaluate entropy changes in a various processes and determine the reversibility or irreversibility of a process. |
| CO5 | Apply | Use different thermodynamics relations to obtain Maxwell relations to interpret various processes. |

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Study of modern steam boilers. |
| 2 | Study of boiler mountings and accessories. |
| 3 | Calorific values of fuel and its measurement. |
| 4 | Study of reciprocating and centrifugal pumps. |
| 5 | Study of reciprocating and centrifugal compressors. |
| 6 | Study of 4-stroke petrol engine (Otto cycle). |
| 7 | Study of 4-stroke diesel engine (Diesel cycle). |
| 8 | Study of vapour compression and vapour absorption refrigeration system. |

9 Study of industrial piping system.
10 Study of basic flow regulating devices.

**COURSE ARTICULATION MATRIX**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | 1 | 1 | | | | | 2 | 1 | 2 | |
| CO2 | 3 | 3 | 1 | | 1 | | | | | | | 1 | 3 | 1 | 1 |
| CO3 | 3 | 2 | | 1 | 2 | | 1 | 1 | | | 2 | 2 | 3 | 2 | |
| CO4 | 2 | 1 | 1 | | 2 | | | | | | | 1 | 2 | | |
| CO5 | 1 | 1 | | | 1 | | | | | | | 1 | 1 | 1 | |

**1-Slightly; 2-Moderately; 3-Substantially**

## WORKSHOP PRACTICE - II

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 0 | 0 | 3 | 0 | 0 | 50 | 0 | 50 | 0 | 0 | 1.5 | 1.5 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **FITTING SHOP** | **09** |
| | Introduction to fitting tools: files, vice, chisels, punch, scriber, hammers, surface plate, angle plate, try square, calipers etc., demonstration of fitting operations such as marking, punching, sawing, filling, grinding, drilling, tapping, Work practice for fitting job | |
| 2 | **BLACKSMITHY SHOP** | **09** |
| | Introduction to smithy tools like hammer, anvil, swage block, flatteners etc. demonstration of Smithy operations such as upsetting, drawing down, bending, setting down, fork cutting, punching and fullering etc., Safety rules, work practice for cold smithy job | |
| 3 | **CARPENTRY SHOP** | **09** |
| | Introduction to carpentry tools: saws, planner, chisels, hammers, marking gauge, vice, try square, rule etc., demonstration of carpentry operations such as marking, sawing, planning, chiseling, grooving, boring, joining, type of woods, safety precaution. Work practice for carpentry job | |
| 4 | **FABRICATION SHOP** | **09** |
| | Introduction to welding process, classification of welding, basic electric arc welding process, arc welding machine and it's accessories, welding electrodes, types of weld joints, safety requirement during working with fabrication shop, etc. demonstration of arc welding process. work practice for welding job | |
| 5 | **MACHINE SHOP** | **06** |
| | Introduction and demonstration of machine tools: Lathe, Milling, Drilling, Grinding, etc. | |
| 6 | **ELECTRONIC WORKSHOP** | **03** |
| | Introduction and application of basic electronics components. to understand use of digital multimeter in electronics, basic exercise related to series and parallel connection with the use of breadboard | |
| | **Total Hours** | **45** |

### REFERENCE BOOKS


1. Work shop technology, A. K. Hajrachaudhari & S. K. Hajrachaudhari
2. ITB Hand book, Engineering industry training board
3. Work shop Technology Vol. I & II, Gupta & Kaushik
4. Basic Electrical, Electronics and Computer Engineering, R. Muthusubramanian, S. Salivahanan, K. A. Muraleedharan, Tata McGraw Hill

## COURSE OUTCOMES

After successful completion of the course, students will be able to;

CO1 Understand use of basic workshop tools for carpentry, fitting, Fabrication, black smithy and other machine tools.

CO2 Identify and apply suitable tools for different trades of Engineering workshop.

CO3 Remember, analyze and apply theoretical and practical knowledge for prototype development by completing workshop assignments and jobs.

CO4 Produce simple models in fitting, black smithy, carpentry, and welding shops.

CO5 To provide Pre Requisite Hands on Experience for Engineering Laboratories

CO6 Enhance their creativity by performing various practical tasks in different workshop trade.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Demonstration of Carpentry tools and it's exercise. |
| 2 | To make a job 1 of Carpentry shop. |
| 3 | To make a job 2 of Carpentry shop. |
| 4 | Demonstration of fitting shop tools and its application. |
| 5 | To make a job of fitting shop. |
| 6 | Demonstration of welding and it's exercise. |
| 7 | To make a job in welding shop. |
| 8 | Demonstration of blacksmithy tools and it's exercise. |
| 9 | To make a job of blacksmithy shop. |
| 10 | Introduction and demonstration of machine tools. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 | 2 | 2 | 1 |
| CO2 | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 | 2 | 2 | 1 |
| CO3 | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 | 2 | 2 | 1 |
| CO4 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | 2 | 2 | 1 |
| CO5 | 2 | 1 | 1 | - | - | - | - | - | 1 | - | - | 2 | 2 | 2 | 1 |
| CO6 | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 | 2 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## WORKSHOP PRACTICE - I

| Teaching Scheme (Hours) | | | Examination Scheme | | | | | Credit Structure | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Theory | Sess. | TW | Prac | Total | Lect | Tut | Prac | Total |
| 0 | 0 | 2 | 0 | 0 | 50 | 0 | 50 | 0 | 0 | 1 | 1 |

### DETAILED SYLLABUS

| Sr. No. | Contents | Hrs. |
|---|---|---|
| 1 | **HOUSEKEEPING AND SAFETY** | **04** |
| | Definition of housekeeping in industry or workplace, rules of safety (Personnel hygiene, Behavior in workshop, carrying, hazards associated with hand tools and power tools Electrical hazards, etc) to be followed while working with workshop | |
| 2 | **FAMILIARIZATION WITH WORKSHOP** | **04** |
| | Introduction to workshop, basic types of workshops, various departments of training workshop and utilization of tools and accessories at workplace | |
| 3 | **CARPENTRY SHOP** | **08** |
| | Introduction to carpentry tools: saws, planner, chisels, hammers, marking gauge, vice, tri-square, rule etc., demonstration of carpentry operations such as marking, sawing, planning, chiseling, grooving, boring, joining, type of woods, safety precaution, work practice for carpentry job | |
| 4 | **PLUMBING SHOP** | **07** |
| | Introduction to plumbing, demonstration of plumbing tools and accessories, application of plumbing in domestic as well as in industry, demonstration of thread making on pipe. Work practice for plumbing job | |
| 5 | **TIN SMITHY SHOP** | **07** |
| | Introduction and demonstration of tin smithy tools, mechanical properties of tin material, SWG for Sheet thickness measurement, work practice for tin smithy job | |
| | **Total Hours** | **30** |

### REFERENCE BOOKS


1. Work shop technology, A. K. Hajrachaudhari & S. K. Hajrachaudhari
2. ITB Hand book, Engineering industry training board
3. Work shop Technology Vol. I & II, Gupta & Kaushik

## COURSE OUTCOMES

After successful completion of the course, students should be able to:

CO1 Understand basic housekeeping and safety requirements while working in a workshop.

CO2 Identify and use tools / Accessories of different workshop departments which could result in skill improvement of students.

CO3 Remember, analyze and apply theoretical and practical knowledge for prototype development by completing workshop assignments and jobs.

CO4 Produce simple models in carpentry, plumbing and tin smithy trades.

CO5 Understand basics of material removal from the work piece surface to attain specific shape.

CO6 Enhance their creativity by performing various practical tasks in different workshop trades.

## SUGGESTED LIST OF PRACTICALS

| Sr. No. | Title |
|---|---|
| 1 | Introduction to Housekeeping and Safety requirements in Workshop. |
| 2 | Introduction to workshop and basic types of workshop. |
| 3 | Understanding the “5 S” concept for implementation in the workplace. |
| 4 | Demonstration of Carpentry tools and it’s exercise. |
| 5 | To make a job 1 of Carpentry shop. |
| 6 | To make a job 2 of Carpentry shop. |
| 7 | Demonstration of Plumbing shop tools and it’s accessories. |
| 8 | To make a job of Plumbing shop. |
| 9 | Demonstration of Tin smithy shop. |
| 10 | To make a job of Tin smithy shop. |

## COURSE ARTICULATION MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 | 2 | 2 | 1 |
| CO2 | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 | 2 | 2 | 1 |
| CO3 | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 | 2 | 2 | 1 |
| CO4 | 2 | 1 | - | | | - | - | - | - | | - | 2 | 2 | 2 | 1 |
| CO5 | 2 | 1 | - | | | - | - | - | - | | - | 2 | 2 | 2 | 1 |
| CO6 | 2 | 1 | 2 | - | - | 2 | 1 | 1 | 2 | - | - | 2 | 2 | 2 | 1 |

**1-Slightly; 2-Moderately; 3-Substantially**

## M.PHARM. SEMESTER – I (MPH)

## SUBJECT: MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES - THEORY (MPH101T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | -- | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

**Objectives:** After completion of course student is able to know about

1. Chemicals and excipients
2. The analysis of various drugs in single and combination dosage forms
3. Theoretical and practical skills of the instruments

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **a. UV-Visible spectroscopy**: Introduction, Theory, Laws,Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy.<br>**b. IR spectroscopy**: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier -Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation.<br>**c. Spectroflourimetry**: Theory of Fluorescence, Factors affecting fluorescence (Characterestics of drugs that can be analysed by flourimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.<br>**d. Flame emission spectroscopy and Atomic absorption spectroscopy**: Principle, Instrumentation, Interferences and Applications. | 11 | CO1<br>CO2<br>CO5 |
| [2] | **NMR spectroscopy**: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy | 11 | CO1<br>CO2<br>CO5 |
| [3] | **Mass Spectroscopy**: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. | 11 | CO1<br>CO2<br>CO5 |
| [4] | **Chromatography**: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:<br>● Thin Layer chromatography<br>● Paper Chromatography<br>● Ion exchange chromatography<br>● Column chromatography | 11 | CO3<br>CO4<br>CO5 |

| | | | |
|---|---|---|---|
| | ● Gas chromatography<br>● High Performance Liquid chromatography<br>● Affinity chromatography | | |
| [5] | **a. Electrophoresis**: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following:<br>a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing<br>**b. X ray Crystallography**: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction. | 11 | CO5 |
| [6] | Immunological assays : RIA (Radio immuno assay), ELISA, Bioluminescence assays. | 05 | CO5 |

## C. TEXT BOOKS


1. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..
2. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis.*; Pearson: New Delhi, 2009.


## D. REFERENCE BOOKS


1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds.*; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
8. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
9. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.
10. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand remember and Evaluate | To understand the fundamentals of various spectroscopic techniques |
| CO2 | Understand Apply and Evaluate | To apply the fundamentals of spectroscopy in single and combination drug analysis |
| CO3 | Understand remember and Evaluate | To understand the Basic chromatographic separation fundamentals |
| CO4 | Understand Apply and Evaluate | To apply the fundamentals of various chromatographic techniques in single and combination drug analysis |
| CO5 | Understand Apply and Evaluate | To learn theoretical and practical aspects of various Sophisticated analytical instrumental techniques. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | |
| CO2 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | |
| CO3 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | |
| CO4 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | |
| CO5 | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | |
| Avg | 3 | 2.6 | 2.6 | 2.6 | 1 | 2.6 | 1 | 2 | 2 | 1.6 | 2.6 | 2.6 | 2.6 | 2.6 | 2 | |

## M. PHARM. SEMESTER – I (MPH)
## SUBJECT: DRUG DELIVERY SYSTEMS (MPH102T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | - | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

**Objectives:** Upon completion of the course, student shall be able to understand

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of delivering system
- The formulation and evaluation of Novel drug delivery systems

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | Sustained Release (SR) and Controlled Release (CR) formulations: Introduction & basic concepts, advantages/ disadvantages, factors influencing, Physicochemical & biological approaches for SR/CR formulation, Mechanism of Drug Delivery from SR/CR formulation. Polymers: introduction, definition, classification, properties and application Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, And Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy. | **10** | CO5<br>CO2 |
| [2] | Rate Controlled Drug Delivery Systems: Principles & Fundamentals, Types, Activation; Modulated Drug Delivery Systems; Mechanically activated, pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems Feedback regulated Drug Delivery Systems; Principles & Fundamentals. | **10** | CO5<br>CO2 |
| [3] | Gastro-Retentive Drug Delivery Systems: Principle, concepts advantages and disadvantages, Modulation of GI transit time approaches to extend GI transit. Buccal Drug Delivery Systems: Principle of muco adhesion, advantages and disadvantages, Mechanism of drug permeation, Methods of formulation and its evaluations. | **10** | CO1<br>CO3<br>CO4 |
| [4] | Occular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers. | **06** | CO1<br>CO3<br>CO4 |
| [5] | Transdermal Drug Delivery Systems: Structure of skin and barriers, Penetration enhancers, Transdermal Drug Delivery Systems, Formulation and evaluation. | **10** | CO1<br>CO3<br>CO4 |
| [6] | Protein and Peptide Delivery: Barriers for protein delivery. Formulation and Evaluation of delivery systems of proteins and other macromolecules. | **08** | CO1<br>CO3<br>CO4 |
| [7] | Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines. | **06** | CO1<br>CO3<br>CO4 |

## C. TEXT BOOKS

1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002

## D. REFERENCE BOOKS

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker,Inc., New York, 1992.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York, Chichester/Weinheim

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | To understand the various approaches for development of novel drug delivery system |
| CO2 | Learn | To learn the criteria for selection of drugs and polymers for the development of delivery system |
| CO3 | Learn | To learn the formulation and evaluation of Novel drug delivery systems. |
| CO4 | Analyse | Analyse various evaluation parameters for oral, parenteral, topical etc. drug delivery systems |
| CO5 | Understand and analyse | Explain the principles and technology used in the design of sustained release and controlled release drug delivery systems |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | - | 2 | - | 2 | 2 | 3 | 1 | 3 | 3 | 2 | 2 |
| CO2 | 3 | 2 | 2 | 2 | - | 3 | - | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 3 | - | 2 | - | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 3 | - | 2 | - | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | - | 2 | - | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |
| Avg | 3 | 2 | 2.4 | 2.4 | - | 2.2 | - | 2.4 | 2 | 2.4 | 2.2 | 2.8 | 3 | 2.2 | 2.4 |

## M. PHARM. SEMESTER – I (MPH)
## SUBJECT: MODERN PHARMACEUTICS (MPH103T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | - | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: Course designed to impart advanced knowledge and skills required to learn various aspects and concepts at pharmaceutical industries.

**Objectives:** Upon completion of the course, student shall be able to understand

- The elements of preformulation studies.
- The Active Pharmaceutical Ingredients and Generic drug Product development
- Industrial Management and GMP Considerations.
- Optimization Techniques & Pilot Plant Scale Up Techniques
- Stability Testing, sterilization process & packaging of dosage forms.

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | a. Preformation Concepts – Drug Excipient interactions - different methods, kinetics of stability, Stability testing. Theories of dispersion and pharmaceutical Dispersion (Emulsion and Suspension, SMEDDS) preparation and stability Large and small volume parental – physiological and formulation consideration, Manufacturing and evaluation.<br>b. Optimization techniques in Pharmaceutical Formulation: Concept and parameters of optimization, Optimization techniques in pharmaceutical formulation and processing. Statistical design, Response surface method, Contour designs, Factorial designs and application in formulation | **20** | CO1<br>CO4 |
| [2] | Validation: Introduction to Pharmaceutical Validation, Scope & merits of Validation, Validation and calibration of Master plan, ICH & WHO guidelines for calibration and validation of equipments, Validation of specific dosage form, Types of validation. Government regulation, Manufacturing Process Model, URS, DQ, IQ, OQ & P.Q. of facilities. | **10** | CO2<br>CO3 |
| [3] | cGMP & Industrial Management: Objectives and policies of current good manufacturing practices, layout of buildings, services, equipments and their maintenance Production management: Production organization, , materials management, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control, industrial and personal relationship. Concept of Total Quality Management. | **10** | CO2<br>CO3 |
| [4] | Compression and compaction: Physics of tablet compression, compression, consolidation, effect of friction, distribution of forces, compaction profiles. | **10** | CO5 |
| [5] | Study of Solubility parameters, Diffusion parameters, Dissolution parameters and Pharmacokinetic parameters, Heckle plots, Similarity factors – f2 and f1, Higuchi and Peppas plot, Linearity Concept of significance, Standard deviation, Chi square test, students T-test, ANOVA test. | **10** | CO5 |

## C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013

## D. REFERENCE BOOKS


1. Lieberman, H. A. *Pharmaceutical Dosage Forms Tablets, Vol. 1-3*; New York, Dekker, 1990.
2. Lieberman, H. A.; Rieger, M. M.; Banker, G. S. *Pharmaceutical Dosage Forms-- Disperse Systems. Volume 1-2*; Dekker: New York, 1998.
3. Avis, K. E.; Lieberman, H. A.; Lachman, L. *Pharmaceutical Dosage Forms: Parenteral Medications VOL 1-3*; M. Dekker: New York, 1992.
4. Banker, G. S.; Rhodes, C. T. *Modern Pharmaceutics*; Dekker: New York, 1996.
5. Remington, J. P.; Gennaro, A. R. *Remington's Pharmaceutical Sciences*; Mack Pub. Co: Easton, Pa., 1990.
6. Bean, H. S.; Carless, J. E.; Arnold Heyworth Beckett. *Advances in Pharmaceutical Sciences*; Academic Press: London, 1964.
7. Sinko, P. J.; Martin, A. N. *Martin's Physical Pharmacy Pharmaceutical Sciences: Physical Chemical Principles in the Pharmaceutical Sciences.*; Lippincott Williams & Wilkins: Philadelphia, 2006.
8. Arthur Owen Bentley; Ernest Alexander Rawlins. *Bentley's Textbook of Pharmaceutics.*; All India Traveller Book Seller: New Delhi, 2002.
9. Willig, S. H. *Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control from Manufacturer to Consumer*; Marcel Dekker, Inc: New York, N.Y., 2001.
10. Kohli, D. P. S.; Shah, D. H. *Drug Formulations Manual*; Business Horizons: New Delhi, 2012.
11. Sharma, P.P. *How to practice GMPs*. Vandana publication, 2001.
12. Berry, I. R.; Nash, R. A. *Pharmaceutical Process Validation*; Marcel Dekker: New York, 1993.
13. James Robert Evans. *Applied Production and Operations Management*; Info Access & Distribution: Singapore, 1994.
14. Swarbrick, J. *Encyclopedia of Pharmaceutical Technology*; Marcel Dekker: New York, Ny, 2004.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Learn | Learn the elements of preformulation studies. |
| CO2 | Understand | Understand validations of processes and equipments used in Pharmaceutical Industry |
| CO3 | Learn | Learn Industrial Management and GMP Considerations. |
| CO4 | Understand and Remember | Understand and remember Optimization Techniques & Statistical designs |
| CO5 | Understand and analyse | Understand physics of tablet compression and analyse dissolution & diffusion parameters |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | - | 2 | - | 2 | 2 | 2 | 1 | 3 | 2 | 1 | 1 |
| CO2 | 3 | 2 | 2 | 3 | - | 2 | - | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 2 |
| CO3 | 3 | 1 | 2 | 2 | - | 3 | - | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | - | 2 | - | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | - | 2 | - | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 3 |
| Avg | 3 | 2 | 2.4 | 2.6 | - | 2.2 | - | 2.2 | 2 | 2.4 | 2 | 3 | 2.2 | 2.6 | 2.2 |

## M.PHARM. SEMESTER – I (MPH)
## SUBJECT: REGULATORY AFFAIRS - THEORY (MPH104T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | -- | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: Course designed to impart advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in different countries, different phases of clinical trials and submitting regulatory documents : filing process of IND, NDA and ANDA

- To know the approval process of
- To know the chemistry, manufacturing controls and their regulatory importance
- To learn the documentation requirements for
- To learn the importance and

**Objectives:** Upon completion of the course, it is expected that the students will be able to understand

1. The Concepts of innovator and generic drugs, drug development process
2. The Regulatory guidance's and guidelines for filing and approval process
3. Preparation of Dossiers and their submission to regulatory agencies in different countries
4. Post approval regulatory requirements for actives and drug products
5. Submission of global documents in CTD/ eCTD formats
6. Clinical trials requirements for approvals for conducting clinical trials
7. Pharmacovigilence and process of monitoring in clinical trials.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **a. Documentation in Pharmaceutical industry**: Master formula record, DMF (Drug Master File), distribution records. Generic drugs product development Introduction , Hatch- Waxman act and amendments, CFR (CODE OF FEDERAL REGULATION) ,drug product performance, in-vitro, ANDA regulatory approval process, NDA approval process, BE and drug product assessment, in –vivo, scale up process approval changes, post marketing surveillance, outsourcing BA and BE to CRO.<br>**b. Regulatory requirement for product approval**: API, biologics, novel, therapies obtaining NDA, ANDA for generic drugs ways and means of US registration for foreign drugs | 15 | CO1<br>CO2<br>CO3 |
| [2] | CMC, post approval regulatory affairs. Regulation for combination products and medical devices.CTD and ECTD format, industry and FDA liaison. ICH - Guidelines of ICH-Q, S E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries. | 15 | CO2<br>CO3 |
| [3] | **Non clinical drug development**: Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier, dossier (IMPD) and investigator brochure (IB). | 15 | CO1<br>CO2<br>CO4 |
| [4] | **Clinical trials**: Developing clinical trial protocols. Institutional review board/ independent ethics committee Formulation and working procedures | 15 | CO1<br>CO2<br>CO5 |

| | | | |
|---|---|---|---|
| | informed Consent process and procedures. HIPAA- new, requirement to clinical study process,<br>• pharmacovigilance safety monitoring in clinical trials. | | |

## C. TEXT BOOKS


1. Berry, I. R.; Martin, R. P. *The Pharmaceutical Regulatory Process*; Informa Healthcare: New York, 2008.
2. Guarino, R. A. *New Drug Approval Process*; Informa Healthcare, Cop: New York, 2009.


## D. REFERENCE BOOKS


1. Kanfer, I.; Shargel, L. *Generic Drug Product Development : Solid Oral Dosage Forms*; Marcel Dekker: New York, 2005.
2. Weinberg, S. *Guidebook for Drug Regulatory Submissions*; Wiley: Hoboken, N.J., 2009.
3. Pisano, D. J. *FDA Regulatory Affairs : A Guide for Prescription Drugs, Medical Devices, and Biologics*; Informa Healthcare Usa: New York, 2008.
4. Rozovsky, F. A.; Adams, R. K. *Clinical Trials and Human Research : A Practical Guide to Regulatory Compliance*; Jossey-Bass: San Francisco, 2003.
5. Administration, A. G. D. of H. T. G. TGA basics http://www.tga.gov.au/tga-basics
6. Your gateway to the European Union http://europa.eu/index_en.htm.
7. ICH Official web site : ICH http://www.ich.org/.
8. Commissioner, O. of the. U.S. Food and Drug Administration http://www.fda.gov/.

## 1. E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remeber | To understand the Concepts of innovator and generic drugs, drug development process |
| CO2 | Understand and Evaluate | To understand the Regulatory guidance's and guidelines for filing and approval process |
| CO3 | Understand and remember | To understand Preparation of Dossiers and their submission to regulatory agencies in different countries and Submission in CTD/ eCTD formats |
| CO4 | Understand and remember | To aquire knowledge about Non clinical drug development |
| CO5 | Understand and remember | To aquire knowledge about Clinical trials requirements, Pharmacovigilence and process of monitoring in clinical trials. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | |
| CO2 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | |
| CO3 | 3 | 2 | 2 | 2 | 1 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | |
| CO4 | 3 | 2 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | |
| CO5 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | |
| Avg | 3 | 2.6 | 2.6 | 2.2 | 1 | 2.6 | 3 | 3 | 2.6 | 2 | 2.8 | 2.4 | 3 | 2.8 | 2.6 | |

## M. PHARM. SEMESTER – I (MPH)
## SUBJECT: PHARMACEUTICS PRACTICAL – I (MPH105P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 12 | 12 | 6 | 100 | 30 | 20 | - | 150 |

## A. COURSE OVERVIEW

**Scope**: This subject is designed to impart basic knowledge and skills on analytical techniques and development of various NDDS dosage forms

**Objectives:** objectives of the course is to make students able to

- Understand, learn and application of various spectrophotometric and chromatographic analytical methods in analysis of drugs and drug products.
- Application of preformulation concepts in Preparation, characterization and evaluation of conventional and novel drug delivery systems

## B. COURSE CONTENT

| NO | TOPIC | P (Hrs) | COs |
|---|---|---|---|
| [1] | 1. Analysis of pharmacopoeial compounds and their formulations by UV Vis-spectrophotometer<br>1. Simultaneous estimation of multi component containing formulations by UV spectrophotometry<br>2. Experiments based on HPLC<br>3. Experiments based on Gas Chromatography<br>4. Estimation of riboflavin/quinine sulphate by fluorimetry<br>5. Estimation of sodium/potassium by flame photometry | **90** | CO1<br>CO2 |
| [2] | 1. To perform In-vitro dissolution profile of CR/ SR marketed formulation<br>2. Formulation and evaluation of sustained release matrix tablets<br>3. Formulation and evaluation osmotically controlled DDS<br>4. Preparation and evaluation of Floating DDS- hydro dynamically balanced DDS<br>5. Formulation and evaluation of Muco adhesive tablets.<br>6. Formulation and evaluation of trans dermal patches.<br>7. To carry out preformulation studies of tablets.<br>8. To study the effect of compressional force on tablets disintegration time.<br>9. To study Micromeritic properties of powders and granulation.<br>10. To study the effect of particle size on dissolution of a tablet.<br>11. To study the effect of binders on dissolution of a tablet.<br>12. To plot Heckal plot, Higuchi and peppas plot and determine similarity factors. | **90** | CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS

## D. REFERENCE BOOKS

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Assessment | Assessment of the drug/s using various spectroscopic and chromatographic techniques |
| CO2 | Learn | Handling and operations of various analytical instruments |
| CO3 | understand | Preparation and evaluation of modified release drug delivery systems |
| CO4 | Understand and Remember | To understand effect of various excipients and process parameters on various dosage forms |
| CO5 | Understand and apply | application of the various model dependent and model independent approaches for the assessment of dosage forms |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 1 | 2 | 1 | 2 | 2 | 2 | 1 | 3 | 1 | 1 | 1 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 2.6 | 2.6 | 1.4 | 2.2 | 1.2 | 2.4 | 2 | 2.6 | 2 | 3 | 2.4 | 2.2 | 2.2 |

## M. PHARM. SEMESTER – II (MPH)
## SUBJECT: MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY & TARGETED DDS) (NTDS) (MPH201T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | - | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

**Objectives:** Upon completion of the course, student shall be able to understand

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of delivering system
- The formulation and evaluation of novel drug delivery systems

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | Targeted Drug Delivery Systems: Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery. | 12 | CO5 |
| [2] | Targeting Methods: introduction preparation and evaluation.<br>Nano Particles & Liposomes: Types, preparation and evaluation. | 12 | CO5<br>CO3 |
| [3] | Micro Capsules / Micro Spheres: Types, preparation and evaluation, Monoclonal Antibodies; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes. | 12 | CO2<br>CO3 |
| [4] | Pulmonary Drug Delivery Systems : Aerosols, propellents, Containers Types, preparation and evaluation,<br>Intra Nasal Route Delivery systems; Types, preparation and evaluation. | 12 | CO1<br>CO2 |
| [5] | Nucleic acid based therapeutic delivery system : Gene therapy, introduction (ex-vivo & in-vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and nonviral gene transfer). Liposomal gene delivery systems. Biodistribution and Pharmacokinetics. knowledge of therapeutic antisense molecules and aptamers as drugs of future. | 12 | CO4 |

## C. TEXT BOOKS


1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002


## D. REFERENCE BOOKS


1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker,Inc., New York, 1992.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York, Chichester/Weinheim

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | To understand the various approaches for development of novel drug delivery systems. |
| CO2 | Learn | To learn the criteria for selection of drugs and polymers for the development of NDDS |
| CO3 | Understand | To understand the concepts of formulation and evaluation of Nano carrier-based drug delivery systems. |
| CO4 | learn | To learn the nucleic acid-based drug delivery systems. |
| CO5 | Understand and analyse | To understand concepts and methods of targeted drug delivery systems. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | - | 2 | - | 2 | 2 | 3 | 1 | 3 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | - | 2 | - | 2 | 2 | 2 | 1 | 2 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 2 | - | 2 | - | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 2 | 2 | - | 2 | - | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 2 | - | 2 | - | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |
| Avg | 3 | 2.2 | 2.4 | 2.2 | - | 2 | - | 2.4 | 2 | 2.4 | 2.2 | 2.4 | 3 | 2.2 | 2.4 |

## M. PHARM. SEMESTER – II (MPH)
## SUBJECT: ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS (MPH202T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 3 | 1 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course is designed to impart knowledge and skills necessary for dose calculations, dose adjustments and to apply biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of biopharmaceutics and pharmacokinetics are provided to help the students to clarify the concepts.

**Objectives:** Upon completion of this course it is expected that students will be able understand,

- The basic concepts in biopharmaceutics and pharmacokinetics. The use raw data and derive the pharmacokinetic models and parameters the best describe the process of drug absorption, distribution, metabolism and elimination.
- The critical evaluation of biopharmaceutic studies involving drug product equivalency.
- The design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.
- The potential clinical pharmacokinetic problems and application o basics of pharmacokinetic

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | **Drug Absorption from the Gastrointestinal Tract:** Gastrointestinal tract, Mechanism of drug absorption, Factors affecting drug absorption, pH–partition theory of drug absorption. Formulation and physicochemical factors: Dissolution rate, Dissolution process, Noyes–Whitney equation and drug dissolution, Factors affecting the dissolution rate. Gastrointestinal absorption: role of the dosage form: Solution (elixir, syrup and solution) as a dosage form, Suspension as a dosage form, Capsule as a dosage form, Tablet as a dosage form, Dissolution methods ,Formulation and processing factors, Correlation of in vivo data with in vitro dissolution data. Transport model: Permeability-Solubility-Charge State and the pH Partition Hypothesis, Properties of the Gastrointestinal Tract (GIT), pH Microclimate Intracellular pH Environment, Tight-Junction Complex. | **12** | CO1 CO2 |
| [2] | **Biopharmaceutic considerations in drug product design and In Vitro Drug Product Performance:** Introduction, biopharmaceutic factors affecting drug bioavailability, rate-limiting steps in drug absorption, physicochemical nature of the drug formulation factors affecting drug product performance, in vitro: dissolution and drug release testing, compendial methods of dissolution, alternative methods of dissolution testing, meeting dissolution requirements, problems of variable control in dissolution testing performance of drug products. In vitro–in vivo correlation, dissolution profile comparisons, drug product stability, considerations in the design of a drug product. | **12** | CO1 CO2 |
| [3] | **Pharmacokinetics:** Basic considerations, pharmacokinetic models, compartment modeling: one compartment model- IV bolus, IV infusion, | **12** | CO3 |

| | | | |
|---|---|---|---|
| | extra-vascular. Multi compartment model: two compartment - model in brief, non-linear pharmacokinetics: cause of non-linearity, Michaelis – Menten equation, estimation of kmax and vmax. Drug interactions: introduction, the effect of protein binding interactions, the effect of tissue-binding interactions, cytochrome p450-based drug interactions, drug interactions linked to transporters. | | |
| **[4]** | **Drug Product Performance, In Vivo:** Bioavailability and Bioequivalence: drug product performance, purpose of bioavailability studies, relative and absolute availability. Methods for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, crossover study designs, evaluation of the data, bioequivalence example, study submission and drug review process. Biopharmaceutics classification system, methods. Permeability: In-vitro, in-situ and In-vivo methods. Generic biologics (biosimilar drug products), clinical significance of bioequivalence studies, special concerns in bioavailability and bioequivalence studies, generic substitution. | **12** | CO4 |
| **[5]** | **Application of Pharmacokinetics:** Modified-Release Drug Products, Targeted Drug Delivery Systems and Biotechnological Products. Introduction to Pharmacokinetics and pharmacodynamic, drug interactions. Pharmacokinetics and pharmacodynamics of biotechnology drugs. Introduction, Proteins and peptides, Monoclonal antibodies, Oligonucleotides, Vaccines (immunotherapy), Gene therapies. | **12** | CO5 |

## C. TEXT BOOKS


1. Jaiswal, Sunil B., and Brahmankar, D. M.. Biopharmaceutics and Pharmacokinetics: A Treatise. India, Vallabh Prakashan, 2005.


## D. REFERENCE BOOKS


1. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics. India: Pharmamed Press. 2005.
2. Yu, Andrew B.C., and Shargel, Leon. Applied Biopharmaceutics & Pharmacokinetics, Seventh Edition. Singapore, McGraw-Hill Education, 2015.
3. Gibaldi, Milo, and Perrier, Donald. Pharmacokinetics., 2nd edition, Marcel Dekker Inc., New York, 1982
4. Swarbrick. J. Current Concepts in the Pharmaceutical Sciences: Biopharmaceutics. United States: Lea & Febiger. 1970.
5. Malcolm Rowland and Thom N. Tozer. Clinical Pharmacokinetics, Concepts and Applications. 3rd edition. Lea and Febiger, Philadelphia, 1995
6. Abdou. H.M, Dissolution, Bioavailability and Bioequivalence, Mack Publishing Company, Pennsylvania 1989
7. Robert. E. Notari. Biopharmaceutics and Clinical Pharmacokinetics, An Introduction, 4th edition, Marcel Dekker Inc, New York and Basel,1987.
8. John. G Wagner and M. Pemarowski. Biopharmaceutics and Relevant Pharmacokinetics, 1st edition, Drug Intelligence Publications, Hamilton, Illinois, 1971.
9. James Swarbrick, James. G. Boylan. Encyclopedia of Pharmaceutical Technology, Vol 13, Marcel Dekker Inc, New York, 1996.
10. Sunil S Jambhekar and Philip J Breen. Basic Pharmacokinetics, 1st edition, pharmaceutical press, RPS Publishing, 2009.
11. Alex Avdeef. Absorption and Drug Development- Solubility, Permeability, and Charge State, John Wiley & Sons, Inc, 2003.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand | Understand basic concepts and factors affecting of absorption of drugs form GIT and bioavailability. |
| CO2 | Understand and Apply | Understand and apply biopharmaceutic considerations and in-vitro dissolution in drug product design. |
| CO3 | Understand and Utilize | Understand and utilize the pharmacokinetic models for the determination of pharmacokinetic parameters. |
| CO4 | Understand, Analyze and Evaluate | Understand and analyze the bioavailability of a drug and evaluate the bioequivalence between drug products. |
| CO5 | Remember and Understand | Remember and Understand applications of biopharmaceutics and apply in designing dosage forms |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 3 | 2 | 2 | 3 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 3 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 2 | 1 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 3 | 2 | 3 | 3 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| Avg | 2.8 | 1.6 | 2.4 | 2.4 | 1 | 2.2 | 1.6 | 1.6 | 2.2 | 1.8 | 2.4 | 2.8 | 2.6 | 3 | 2.2 |

## M. PHARM. SEMESTER – II (MPH)
## SUBJECT: COMPUTER AIDED DRUG DEVELOPMENT (MPH203T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | - | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** This course is designed to impart knowledge and skills necessary for computer Applications in pharmaceutical research and development who want to understand the application of computers across the entire drug research and development process. Basic theoretical discussions of the principles of more integrated and coherent use of computerized information (informatics) in the drug development process are provided to help the students to clarify the concepts.

**Objectives:** Upon completion of this course it is expected that students will be able to understand,

- History of Computers in Pharmaceutical Research and Development
- Computational Modeling of Drug Disposition
- Computers in Preclinical Development
- Optimization Techniques in Pharmaceutical Formulation
- Computers in Market Analysis
- Computers in Clinical Development
- Artificial Intelligence (AI) and Robotics
- Computational fluid dynamics (CFD)

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | **a. Computers in Pharmaceutical Research and Development:** A General Overview: History of Computers in Pharmaceutical Research and Development. Statistical modeling in Pharmaceutical research and development: Descriptive versus Mechanistic Modeling, Statistical Parameters, Estimation, Confidence Regions, Nonlinearity at the Optimum, Sensitivity Analysis, Optimal Design, Population Modeling<br>**b. Quality-by-Design in Pharmaceutical Development:** Introduction, ICH Q8 guideline, Regulatory and industry views on QbD, Scientifically based QbD - examples of application. | **12** | CO1<br>CO2 |
| [2] | **Computational Modeling of Drug Disposition:** Introduction, Modeling Techniques: Drug Absorption, Solubility, Intestinal Permeation, Drug Distribution, Drug Excretion, Active Transport; P-gp, BCRP, Nucleoside Transporters, hPEPT1, ASBT, OCT, OATP, BBB-Choline Transporter. | **12** | CO3<br>CO4 |
| [3] | **Computer-aided formulation development:** Concept of optimization, Optimization parameters, Factorial design, Optimization technology & Screening design. Computers in Pharmaceutical Formulation: Development of pharmaceutical emulsions, microemulsion drug carriers Legal Protection of Innovative Uses of Computers in R&D, The Ethics of Computing in Pharmaceutical Research, Computers in Market analysis | **12** | CO1<br>CO2 |

| | | | |
|---|---|---|---|
| [4] | **a. Computer-aided biopharmaceutical characterization:** Gastrointestinal absorption simulation. Introduction, Theoretical background, Model construction, Parameter sensitivity analysis, Virtual trial, Fed vs. fasted state, In vitro dissolution and in-vitro-in-vivo correlation, Biowaiver considerations<br>**b. Computer Simulations in Pharmacokinetics and Pharmacodynamics:** Introduction, Computer Simulation: Whole Organism, Isolated Tissues, Organs, Cell, Proteins and Genes.<br>**c. Computers in Clinical Development:** Clinical Data Collection and Management, Regulation of Computer Systems | **12** | CO3<br>CO4 |
| [5] | **Artificial Intelligence (AI), Robotics and Computational fluid dynamics:** General overview, Pharmaceutical Automation, Pharmaceutical applications, Advantages and Disadvantages. Current Challenges and Future Directions. | **12** | CO5 |

## C. TEXT BOOKS

1. Ekins, S. Computer Applications in Pharmaceutical Research and Development Ekins/Computer Applications in Pharmaceutical Research and Development; Hoboken, Nj, USA John Wiley & Sons, Inc, 2006.

## D. REFERENCE BOOKS

1. Jelena Djuris. Computer-Aided Applications in Pharmaceutical Technology; Woodhead Publishing: Oxford, 2013.
2. Swarbrick, J. Encyclopaedia of Pharmaceutical Technology; Vol 1-3; Marcel Dekker: New York, Ny, 2004.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Apply | To know role of computers and application of statistical modeling in pharmaceutical research. |
| CO2 | Understand and Apply | To understand application of QbD and optimization techniques in pharmaceutical product development. |
| CO3 | Understand | To know computational modeling techniques of drug disposition and biopharmaceutical process. |
| CO4 | Understand and Remember | To know and understand application of computers modeling techniques in pharmacokinetic and pharmacodynamic of drugs. |
| CO5 | Understand and Remember | To understand artificial intelligence in development of drug product. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 3 | - | - | - | - | 2 | - | 3 | - | 3 | 0 | 3 |
| CO2 | 3 | 2 | 3 | 3 | - | - | 3 | 3 | 2 | - | 3 | - | 3 | 1 | 3 |
| CO3 | 3 | 2 | 2 | 3 | - | - | 3 | 3 | 3 | - | 3 | - | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | - | - | 3 | 3 | 3 | - | 3 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 1 | 2 | 3 | - | - | 3 | 2 | 2 | - | 3 | 3 | 3 | 0 | 3 |
| Avg | 3 | 1.6 | 2 | 3 | - | - | 2.4 | 2.2 | 2.4 | - | 3 | 1 | 3 | 1.4 | 3 |

## M. PHARM. SEMESTER – II (MPH)
## SUBJECT: COSMETIC AND COSMECEUTICALS (MPH204T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | - | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course is designed to impart knowledge and skills necessary for the fundamental need for cosmetic and cosmeceutical products.

**Objectives:** Upon completion of the course the student shall be able to

- Key ingredients used in cosmetics and cosmeceuticals.
- Key building blocks for various formulations.
- Current technologies in the market
- Various key ingredients and basic science to develop cosmetics and cosmeceuticals.
- Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | Cosmetics – Regulatory : Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labeling of cosmetics Regulatory provisions relating to import of cosmetics., Misbranded and spurious cosmetics. Regulatory provisions relating to manufacture of cosmetics – Conditions for obtaining license, prohibition of manufacture and sale of certain cosmetics, loan license, offences and penalties. | 12 | CO3 |
| [2] | Cosmetics - Biological aspects : Structure of skin relating to problems like dry skin, acne, pigmentation, prickly heat, wrinkles and body odor. Structure of hair and hair growth cycle. Common problems associated with oral cavity. Cleansing and care needs for face, eye lids, lips, hands, feet, nail, scalp, neck, body and under-arm. | 12 | CO1<br>CO4<br>CO5 |
| [3] | Formulation Building blocks: Building blocks for different product formulations of cosmetics/cosmeceuticals. Surfactants – Classification and application. Emollients, rheological additives: classification and application. Antimicrobial used as preservatives, their merits and demerits. Factors affecting microbial preservative efficacy. Building blocks for formulation of a moisturizing cream, vanishing cream, cold cream, shampoo and toothpaste. Soaps and syndet bars. Perfumes; Classification of perfumes. Perfume ingredients listed as allergens in EU regulation. Controversial ingredients: Parabens, formaldehyde liberators, dioxane. | 12 | CO1<br>CO2<br>CO3<br>CO4<br>CO5 |
| [4] | Design of cosmeceutical products: Sun protection, sunscreens classification and regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor., dandruff, dental cavities, bleeding gums, mouth odor and sensitive teeth through cosmeceutical formulations. | 12 | CO1<br>CO2<br>CO4<br>CO5 |
| [5] | Herbal Cosmetics: Herbal ingredients used in Hair care, skin care and oral care. Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers. Challenges in formulating herbal cosmetics. | 12 | CO1<br>CO2<br>CO4<br>CO5 |

## C. TEXT BOOKS

1. Butler, H.; Poucher, W. A. Poucher's Perfumes, Cosmetics, and Soaps.; Kluwer Academic Publishers: Dordrecht ; Boston, 2000.

## D. REFERENCE BOOKS

1. Ralph Gordon Harry; Rosen, M. R. *Harry's Cosmeticology*; Chemical Publishing Company: New York, 2015.
3. Sharma, P. P.; Vandana Publications. *Cosmetics : Formulation, Manufacturing & Quality Control*; Vandama Publications: Delhi, 2018.
4. Barel, A. O.; Paye, M.; Maibach, H. I. *Handbook of Cosmetic Science and Technology*; Taylor & Francis: Boca Raton, 2014.
5 And, T. *CTFA Membership Directory.*; Cosmetic, Toiletry And Fragrance Association, Inc: Washington, D.C., 1981.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember, Understand and Evaluate | To understand the key ingredients used in cosmetics and cosmeceuticals. |
| CO2 | Remember, Understand and Evaluate | To learn key building blocks for various formulations. |
| CO3 | Understand Apply and Evaluate | To learn the current technologies and regulatory requirements of cosmetics in the market |
| CO4 | Understand and Remember | To understand the various basic science to develop cosmetics and cosmeceuticals |
| CO5 | Remember, Understand and Evaluate | To learn the scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 3 | 2 | 3 | 1 | 3 | 1 | 3 | 2 |
| CO2 | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 3 | 3 | 3 | 1 | 2 | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 1 | 1 | 2 | 2 | 3 | 3 | 1 | 2 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| Avg | 3 | 2.4 | 3 | 3 | 1 | 1.2 | 1.6 | 2.6 | 2.6 | 2.6 | 1.4 | 2.4 | 2 | 3 | 2 |

## M. PHARM. SEMESTER – I (MPH)
## SUBJECT: PHARMACEUTICS PRACTICAL – II (MPH205P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 12 | 12 | 6 | 100 | 30 | 20 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This subject is designed to impart basic knowledge and skills on analytical techniques and development of various NDDS dosage forms

**Objectives:** Upon completion of the course student shall be able

- Formulation and evaluation of different novel drug delivery systems
- Application of QbD principles in designing dosage form.

## B. COURSE CONTENT

| NO | TOPIC | P (Hrs) | COs |
|---|---|---|---|
| [1] | 1. To study the effect of temperature change , non solvent addition, incompatible polymer addition in microcapsules preparation<br>2. Preparation and evaluation of Alginate beads<br>3. Formulation and evaluation of gelatin /albumin microspheres<br>4. Formulation and evaluation of liposomes/niosomes<br>5. Formulation and evaluation of spherules<br>6. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique.<br>7. Comparison of dissolution of two different marketed products /brands<br>8. Development and evaluation of Creams<br>9. Development and evaluation of Shampoo and Toothpaste base<br>10. To incorporate herbal and chemical actives to develop products To address Dry skin, acne, blemish, Wrinkles, bleeding gums and dandruff | **90** | CO1<br>CO3<br>CO5 |
| [2] | 1. Protein binding studies of a highly protein bound drug & poorly protein bound drug<br>2. Bioavailability studies of Paracetamol in animals.<br>3. Pharmacokinetic and IVIVC data analysis by WinnolineR software<br>4. In vitro cell studies for permeability and metabolism<br>5. DoE Using Design Expert® Software<br>6. Formulation data analysis Using Design Expert® Software<br>7. Quality-by-Design in Pharmaceutical Development<br>8. Computer Simulations in Pharmacokinetics and Pharmacodynamics<br>9. Computational Modeling Of Drug Disposition<br>10. To develop Clinical Data Collection manual<br>11. To carry out Sensitivity Analysis, and Population Modeling. | **90** | CO2<br>CO4 |

## C. TEXT BOOKS

## D. REFERENCE BOOKS

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | understand and analyse | Formulate and characterize various novel drug delivery systems |
| CO2 | Learn | Pharmacokinetic and IVIVC data analysis, simulation of pharmacokinetic using appropriate computational program/s |
| CO3 | Understand | Preparation and characterization of cosmetic preparations, herbal active containing products and toiletry items |
| CO4 | Understand and Remember | Applications of design of experiment software/s and Quality-by Design in pharmaceutical development. |
| CO5 | Understand and apply | Solubility improvement techniques & Dissolution profile comparison by various tools |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 3 | 1 | 1 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 2 | 1 |
| CO4 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| Avg | 3 | 3 | 2.6 | 2.6 | 1.4 | 2.2 | 1.8 | 2.4 | 2 | 2.6 | 2 | 2.4 | 3 | 2.2 | 2.2 |

## M. PHARM. SEMESTER – III (MPH)
## SUBJECT: RESEARCH METHODOLOGY AND BIOSTATISTICS -THEORY (MRM301T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | - | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** To understand the applications of Biostatics in Pharmacy. This subject also deals to understand research methodology process, ethics in medical, clinical and pre-clinical research.
**Objectives:** Upon completion of the course the student shall be able to

- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems.
- To know and understand medical research and ethical practise in clinical and non-clinical research

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | **General Research Methodology:** Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques. | **12** | CO1 |
| [2] | **Biostatistics:** Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (students "t" test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxan rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values. | **15** | CO2 |
| [3] | **Medical Research:** History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality. | **15** | CO3<br>CO4<br>CO5 |
| [4] | **CPCSEA** guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anaesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals. | **10** | CO4<br>CO3<br>CO5 |
| [5] | **Declaration of Helsinki:** History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care. | **08** | CO3<br>CO5 |

## C. TEXT BOOKS

1. Kothari, C R. Research Methodology: Methods & Techniques. New Delhi, New Age International (P) Ltd., Publishers, Cop, 2004.

## D. REFERENCE BOOKS

1. Prabhat Pandey, and Meenu Mishra Pandey. Research Methodology: Tools & Techniques. New Delhi, Bridge Center, 2015.
2. De, James E. Basic Statistics and Pharmaceutical Statistical Applications. New York, Marcel Dekker, 1999.
3. "GUIDELINES: Committee for the Purpose of Control and Supervision of Experiments on Animals." Cpcsea.nic.in, cpcsea.nic.in/Content/55_1_GUIDELINES.aspx.
4. Ulf Schmidt, et al. Ethical Research: The Declaration of Helsinki, and the Past, Present and Future of Human Experimentation. New York, Ny, Oxford University Press, 2020.
5. World Medical Association. "WMA - the World Medical Association-Declaration of Helsinki." Wma.net, WMA - The World Medical Association-Declaration of Helsinki, 2014, www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Apply | To understand research methodology and application of study design in clinical research. |
| CO2 | Remember, Understand and Apply | To learn and apply various biostatistical techniques in hypothesis testing of research. |
| CO3 | Understand and Create | To know process of ethical medical research and protocol designing |
| CO4 | Understand and Remember | To understand ethics and regulations use of animals in research. |
| CO5 | Understand and Remember | To know ethics and regulation in clinical research. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 3 | 0 | 3 | 3 | 2 | 0 | 3 | 3 | 1 | 1 | 3 |
| CO2 | 3 | 1 | 1 | 3 | 0 | 1 | 0 | 0 | 3 | 0 | 3 | 2 | 2 | 1 | 3 |
| CO3 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 3 |
| CO4 | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | 3 |
| CO5 | 3 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 1 | 3 |
| Avg | 3 | 2 | 2 | 2 | 2.2 | 2 | 2.4 | 2.4 | 2.6 | 1.8 | 3 | 2.4 | 2 | 1 | 3 |

## M.PHARM. SEMESTER – I (MQA)
## SUBJECT: QUALITY CONTROL AND QUALITY ASSURANCE (MQA103T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | 0 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications, GLP and regulatory affairs.

**Objectives:** Upon completion of this course the student should be able to

- Understand the cGMP aspects in a pharmaceutical industry
- To appreciate the importance of documentation
- To understand the scope of quality certifications applicable to
- Pharmaceutical industries
- To understand the responsibilities of QA & QC departments.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Introduction:** Concept and evolution and scopes of Quality Control and Quality Assurance, Good Laboratory Practice, GMP, Overview of ICH Guidelines - QSEM, with special emphasis on Q-series guidelines.<br>Good Laboratory Practices: Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non clinical testing, control on animal house, report preparation and documentation. CPCSEA guidelines. | 12 | CO1<br>CO2 |
| [2] | cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention(PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination and Good Warehousing Practice. | 12 | CO1<br>CO2 |
| [3] | Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), Developing specification (ICH Q6 and Q3), purchase specifications and maintenance of stores for raw materials.<br>In process quality control and finished products quality control for following dosage forms in Pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products (How to refer pharmacopoeias). | 12 | CO3 |
| [4] | Documentation in pharmaceutical industry: Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles- How to maintain, retention and retrieval etc. Standard operating procedures (How to write), Master Batch Record, Batch Manufacturing Record, Quality audit plan and reports. Specification and test procedures, Protocols and reports. Distribution records. Electronic data handling. Concepts of controlled and uncontrolled documents. | 12 | CO1 |

| | | | |
|---|---|---|---|
| | Submission documents for regulators DMFs, as Common Technical Document and Electronic Common Technical Documentation (CTD, eCTD). Concept of regulated and non regulated markets. | | |
| [5] | Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging, reprocessing, salvaging, handling of waste and scrap disposal.<br>Introduction, scope and importance of intellectual property rights.<br>Concept of trade mark, copyright and patents. | 12 | CO4<br>CO5 |

## C. TEXT BOOKS


1. Quality Assurance of Pharmaceuticals- A compedium of Guide lines and Related materials Vol I & II, 2 nd edition, WHO Publications, 1999.


## D. REFERENCE BOOKS


1. Weinberg, S. Good Laboratory Practice Regulations; M. Dekker: New York, 1995.
2. Sarker, D. K. *Quality Systems and Control for Pharmaceuticals*; John Wiley & Sons: Chichester, West Sussex ; Hoboken, Nj, 2008.
3. Willig, S. H.; Stoker, J. R. Good Manufacturing Practices for Pharmaceuticals : A Plan for Total Quality Control; Marcel Dekker: New York, 1997.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember, Understand and Apply | Remember cGMP aspects, the importance of documentation, scope of quality certifications in pharmaceutical industry |
| CO2 | Remember, Understand and Apply | Understand CDSCO, WHO, ICH, USFDA and other regulatory agency guidelines related to pharmaceutical product development |
| CO3 | Remember, Understand and Analyse | List various IPQC and finished product tests for variety of pharmaceutical dosage forms |
| CO4 | Understand, Remember and Apply | Explain various aspects of pharmaceutical manufacturing operations and controls and IPRs |
| CO5 | Understand and apply | To understand the responsibilities of QA & QC departments. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 3 | 3 | 3 | 2 | 1 | |
| CO2 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 3 | 3 | 1 | |
| CO3 | 3 | 2 | 2 | 2 | 1 | 2 | - | 2 | 2 | 1 | 3 | 3 | 3 | 2 | 1 | |
| CO4 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | |
| CO5 | 3 | 2 | 2 | 2 | 3 | 3 | - | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 1 | |
| | | | | | | | | | | | | | | | | |
| Avg | 3 | 2 | 2 | 2 | 1.6 | 2.4 | 0.6 | 2 | 1.6 | 2 | 2.6 | 3 | 3 | 2.6 | 1 | |

## M.PHARM. SEMESTER – I (MQA)
## SUBJECT: QUALITY MANAGEMENT SYSTEM-THEORY (MQA102T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | 0 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course is designed to impart fundamental knowledge and concepts about various quality management principles and systems utilized in the manufacturing industry. It also aids in understanding the quality evaluation in the pharmaceutical industries.

**Objectives:** At completion of this course, it is expected that students will be able to understand-

- The importance of quality
- ISO management systems
- Tools for quality improvement
- Analysis of issues in quality
- Quality evaluation of pharmaceuticals
- Stability testing of drug and drug substances
- Statistical approaches for quality

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | Cos |
|---|---|---|---|
| [1] | **Introduction to Quality:** Evolution of Quality, Definition of Quality, Dimensions of Quality<br>**Quality as a Strategic Decision:** Meaning of strategy and strategic quality management, mission and vision statements, quality policy, Quality objectives, strategic planning and implementation, McKinsey 7s model, Competitive analysis, Management commitment to quality<br>**Customer Focus:** Meaning of customer and customer focus, Classification of customers, Customer focus, Customer perception of quality, Factors affecting customer perception, Customer requirements, Meeting customer needs and expectations, Customer satisfaction and Customer delight, Handling customer complaints, Understanding customer behavior, concept of internal and external customers. Case studies.<br>**Cost of Quality:** Cost of quality, Categories of cost of Quality, Models of cost of quality, Optimising costs, Preventing cost of quality. | 12 | CO1 |
| [2] | **Pharmaceutical quality Management:** Basics of Quality Management, Total Quality Management (TQM), Principles of Six sigma, ISO 9001:2008, 9001:2015, ISO 14001:2004, Pharmaceutical Quality Management – ICH Q10, Knowledge management, Quality Metrics, Operational Excellence and Quality Management Review. OSHAS guidelines, NABL certification and accreditation, CFR-21 part 11, WHO-GMP requirements. | 12 | CO2 |
| [3] | **Six System Inspection model:** Quality Management system, Production system, Facility and Equipment system, Laboratory control system, Materials system, Packaging and labeling system. Concept of self inspection. Quality systems: Change Management/ Change control.<br>Deviations, Out of Specifications (OOS), Out of Trend (OOT), Complaints - evaluation and handling, Investigation and determination of root cause, Corrective & Preventive Actions (CAPA), Returns and Recalls, Vendor | 12 | CO3 |

| | | | |
|---|---|---|---|
| | Qualification, Annual Product Reviews, Batch Review and Batch Release. Concept of IPQC, area clearance/ Line clearance. | | |
| [4] | **Drug Stability:** ICH guidelines for stability testing of drug substances and drug products. Study of ICH Q8, Quality by Design and Process development report Quality risk management: Introduction, risk assessment, risk control, risk review, risk management tools, HACCP, risk ranking and filtering according to ICH Q9 guidelines. | 12 | CO4 |
| **[5]** | **Statistical Process control (SPC):** Definition and Importance of SPC, Quality measurement in manufacturing, Statistical control charts - concepts and general aspects, Advantages of statistical control, Process capability, Estimating Inherent or potential capability from a control chart analysis, Measuring process control and quality improvement, Pursuit of decreased process variability. Regulatory Compliance through Quality Management and development of Quality Culture Benchmarking: Definition of benchmarking, Reasons for benchmarking, Types of Benchmarking, Benchmarking process, Advantages of benchmarking, Limitations of benchmarking. | 12 | CO5 |

## C. TEXT BOOKS


1. Fairfield-Sonn, J. W. Corporate Culture and the Quality Organization; Quorum Books: Westport, Conn., 2001.


## D. REFERENCE BOOKS


1. Endres, A. C. Implementing Juran's Road Map for Quality Leadership: Benchmarks and Results; Wiley: New York, 2000.
2. Antony J, David P, Routledge, Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases, 2002
3. Okes D, Root Cause Analysis, The Core of Problem Solving and Corrective Action, 2009, ASQ Publications.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remember | To understand importance of different aspect of quality and customer focus on quality |
| CO2 | Understand and remember | To explain various quality systems of Pharmaceutical Quality Management |
| CO3 | Understand and remember | To describe aspects of six system inspection and analysis of issues in quality |
| CO4 | Understand and apply | To discuss the principles of stability testing of drug products, drug substances and quality risk management |
| CO5 | Understand and remember | To understand the principles of statistical approaches for quality and benchmarking of pharmaceutical products |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | |
| CO2 | 3 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 1 | |
| CO3 | 3 | 1 | 1 | 3 | 1 | 1 | 3 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | |
| CO4 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | |
| CO5 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | |
| | | | | | | | | | | | | | | | | |
| Avg | 3 | 1 | 1 | 1.8 | 1 | 1 | 1.6 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 2.6 | |

## M.PHARM. SEMESTER – I (MQA)
## SUBJECT: QUALITY CONTROL AND QUALITY ASSURANCE (MQA103T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | 0 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications, GLP and regulatory affairs.

**Objectives:** Upon completion of this course the student should be able to

- Understand the cGMP aspects in a pharmaceutical industry
- To appreciate the importance of documentation
- To understand the scope of quality certifications applicable to
- Pharmaceutical industries
- To understand the responsibilities of QA & QC departments.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Introduction:** Concept and evolution and scopes of Quality Control and Quality Assurance, Good Laboratory Practice, GMP, Overview of ICH Guidelines - QSEM, with special emphasis on Q-series guidelines.<br>Good Laboratory Practices: Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non clinical testing, control on animal house, report preparation and documentation. CPCSEA guidelines. | 12 | CO1<br>CO2 |
| [2] | cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention(PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination and Good Warehousing Practice. | 12 | CO1<br>CO2 |
| [3] | Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), Developing specification (ICH Q6 and Q3), purchase specifications and maintenance of stores for raw materials.<br>In process quality control and finished products quality control for following dosage forms in Pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products (How to refer pharmacopoeias). | 12 | CO3 |
| [4] | Documentation in pharmaceutical industry: Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles- How to maintain, retention and retrieval etc. Standard operating procedures (How to write), Master Batch Record, Batch Manufacturing Record, Quality audit plan and reports. Specification and test procedures, Protocols and reports. Distribution records. Electronic | 12 | CO1 |

| | | | |
|---|---|---|---|
| | data handling. Concepts of controlled and uncontrolled documents.<br>Submission documents for regulators DMFs, as Common Technical Document and Electronic Common Technical Documentation (CTD, eCTD). Concept of regulated and non regulated markets. | | |
| [5] | Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging, reprocessing, salvaging, handling of waste and scrap disposal.<br>Introduction, scope and importance of intellectual property rights.<br>Concept of trade mark, copyright and patents. | 12 | CO4<br>CO5 |

## C. TEXT BOOKS

1. Quality Assurance of Pharmaceuticals- A compedium of Guide lines and Related materials Vol I & II, 2 nd edition, WHO Publications, 1999.

## D. REFERENCE BOOKS


1. Weinberg, S. Good Laboratory Practice Regulations; M. Dekker: New York, 1995.
2. Sarker, D. K. *Quality Systems and Control for Pharmaceuticals*; John Wiley & Sons: Chichester, West Sussex ; Hoboken, Nj, 2008.
3. Willig, S. H.; Stoker, J. R. Good Manufacturing Practices for Pharmaceuticals : A Plan for Total Quality Control; Marcel Dekker: New York, 1997.

## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Remember, Understand and Apply | Remember cGMP aspects, the importance of documentation, scope of quality certifications in pharmaceutical industry |
| CO2 | Remember, Understand and Apply | Understand CDSCO, WHO, ICH, USFDA and other regulatory agency guidelines related to pharmaceutical product development |
| CO3 | Remember, Understand and Analyse | List various IPQC and finished product tests for variety of pharmaceutical dosage forms |
| CO4 | Understand, Remember and Apply | Explain various aspects of pharmaceutical manufacturing operations and controls and IPRs |
| CO5 | Understand and apply | To understand the responsibilities of QA & QC departments. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 1 | |
| CO2 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 3 | 3 | 3 | 3 | 1 | |
| CO3 | 3 | 2 | 2 | 2 | 1 | 2 | - | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 1 | |
| CO4 | 3 | 2 | 2 | 2 | 2 | 3 | 1 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | |
| CO5 | 3 | 2 | 2 | 2 | 3 | 3 | - | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 1 | |
| Avg | 3 | 2 | 2 | 2 | 1.6 | 2.4 | 0.6 | 2 | 1.6 | 2 | 3 | 3 | 3 | 3 | 1 | |

## M. PHARM. SEMESTER – I (MPH)
## SUBJECT: PRODUCT DEVELOPMENT AND TECHNOLOGY TRANSFER (MQA104T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | - | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** Scope This deal with technology transfer covers the activities associated with Drug Substance, Drug Product and analytical tests and methods, required following candidate drug selection to completion of technology transfer from R&D to the first receiving site and technology transfer related to post-marketing changes in manufacturing places.
Objectives: Upon completion of this course the student should be able to

- To understand the new product development process
- To understand the necessary information to transfer technology from R&D to actual manufacturing by sorting out various information obtained during R&D
- To elucidate necessary information to transfer technology of existing products between various manufacturing places

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | **Principles of Drug discovery and development:** Introduction, Clinical research process. Development and informational content for Investigational New Drugs Application (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Supplemental New Drug Application (SNDA), Scale Up Post Approval Changes (SUPAC) and Bulk active chemical Post approval changes (BACPAC), Post marketing surveillance, Product registration guidelines – CDSCO, USFDA. | **12** | CO1 |
| [2] | **Pre-formulation studies:** Introduction/concept, organoleptic properties, purity, impurity profiles, particle size, shape and surface area. Solubility, Methods to improve solubility of Drugs: Surfactants & its importance, co-solvency. Techniques for the study of Crystal properties and polymorphism. Pre-formulation protocol, Stability testing during product development. | **12** | CO2 |
| [3] | **Pilot plant scale up:** Concept, Significance, design, layout of pilot plant scales up study, operations, large scale manufacturing techniques (formula, equipment, process, stability and quality control) of solids, liquids, semisolid and parenteral dosage forms. New era of drug products: opportunities and challenges. | **12** | CO3<br>CO5 |
| [4] | **Pharmaceutical packaging:** Pharmaceutical dosage form and their packaging requirements, Pharmaceutical packaging materials, Medical device packaging, Enteral Packaging, Aseptic packaging systems, Container closure systems, Issues facing modern drug packaging, Selection and evaluation of Pharmaceutical packaging materials. **Quality control test**: Containers, closures and secondary packing materials. | **12** | CO4 |

| | | | |
|---|---|---|---|
| [5] | **Technology transfer:** Development of technology by R & D, Technology transfer from R & D to production, Optimization and Production, Qualitative and quantitative technology models. Documentation in technology transfer: Development report, technology transfer plan and Exhibit. | **12** | CO5 |

## C. TEXT BOOKS


1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.


## D. REFERENCE BOOKS


1. Smith, C. G.; O'donnell, J. The Process of New Drug Discovery and Development; Informa Healthcare: New York, 2006.
2. Willig, S. H.; Tuckerman, M. M.; Hitchings, W. S. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control; M. Dekker: New York, 1982.
3. Lieberman, H. A. Pharmaceutical Dosage Forms. Tablets, Vol. 1-3; New York, Ny Dekker, 1989.
4. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics; Pharmamed Press: Hyderabad, India, 2013.
5. Vandana Patravale; Disouza, J. I.; Maharukh Rustomjee. Pharmaceutical Product Development: Insights into Pharmaceutical Processes, Management and Regulatory Affairs; CRC Press: Boca Raton, 2016.
6. Abdou, H. M. Dissolution, Bioavailability and Bioequivalence; Mack Publishing Company: Easton, 1989.
7. Remington, J. P.; Gennaro, A. R. Remington: The Science and Practice of Pharmacy; Lippincott Williams & Wilkins: Baltimore, Md., 2000.
8. Dr. D.A.Savant. The Pharmaceutical Sciences; the Pharma Path Way 'Pure and Applied Pharmacy; Pragathi Books Pvt. Ltd, 2018.
9. Dean, D. A.; Evans, E. R.; Hall, I. H. Pharmaceutical Packaging Technology.; Taylor And Francis: London, 2000.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand, Remember, Apply | To understand new drug approval process and product registration guideline |
| **CO2** | Understand, Remember, Apply, Evaluate | To understand and apply preformulation studies in drug product development. |
| **CO3** | Understand. Remember | To understand development of drug product from R&D to Large scale manufacturing. |
| **CO4** | Understand, Remember, Evaluate | To understand and evaluate packaging requirement for drug products. |
| **CO5** | Understand, Remember | To understand regulation for technology transfer for drug product development |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 1 | 2 | 3 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 1 |
| CO3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 1 | 3 | 3 | 1 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 |
| Avg | 3 | 2.6 | 2.2 | 3 | 1.8 | 2.6 | 2.8 | 2.6 | 2.6 | 1.8 | 3 | 3 | 2.8 | 2.6 | 1.8 |

## M. PHARM. SEMESTER – I (MQA)
## SUBJECT: PHARMACEUTICAL QUALITY ASSURANCE – PRACTICAL-I (MQA105P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 12 | 12 | 6 | 100 | 30 | 20 | -- | 150 |

## A. COURSE OVERVIEW

**Scope**: This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs dosage forms, preformulation study, stability study etc. as well as Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

**Objectives:** After completion of course, student is able

- To understand and apply the fundamentals of spectroscopy and chromatography in single and combination drug analysis
- To understand the role of analytical techniques in preformulation, stability study, formulation analysis, QC testing and Modern statistical tools in analysis
- To understand working and handling of various analytical instruments.

## B. COURSE CONTENT

| NO | TOPIC | P (hrs) | COs |
|---|---|---|---|
| [1] | **1**.Analysis of Pharmacopoeial compounds in bulk and in their formulations (tablet/ capsules/ semisolids) by UV Vis spectrophotometer<br>**2**. Simultaneous estimation of multi-drug component containing formulations by UV spectrophotometry<br>**3.** Experiments based on HPLC<br>**4**. Experiments based on Gas Chromatography<br>**5**. Estimation of riboflavin/quinine sulphate by fluorimetry<br>**6**. Estimation of sodium/potassium by flame photometry or AAS<br>**7**. Assay of raw materials as per official monographs<br>**8.**Testing of related and foreign substances in drugs and raw materials | **90** | CO1<br>CO2<br>CO3<br>CO5 |
| [2] | **1.** Case studies on<br>• Total Quality Management<br>• Six Sigma<br>• Change Management/ Change control. Deviations,<br>• Out of Specifications (OOS)<br>• Out of Trend (OOT)<br>• Corrective & Preventive Actions (CAPA)<br>• Deviations<br>**2.** Development of Stability study protocol<br>**3** Estimation of process capability<br>**4.** In process and finished product quality control tests for tablets, capsules,parenterals and semisolid dosage forms.<br>**5.**To carry out pre formulation study for tablets, parenterals (2 experiment).<br>**6**. To study the effect of pH on the solubility of drugs, (1 experiment)<br>**7**. Quality control tests for Primary and secondary packaging materials<br>**8**. Accelerated stability studies (1 experiment)<br>**9**. Improved solubility of drugs using surfactant systems (1 experiment)<br>**10**. Improved solubility of drugs using co-solvency method (1 experiment)<br>19. Determination of Pka and Log p of drugs. | **90** | CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.
2. Lachman, L.; Liebermann, H. A. *The Theory and Practice of Industrial Pharmacy*; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.


## D. REFERENCE BOOKS


1. *Indian Pharmacopoeia*; Indian Pharmacopoeial Commission, Ministry of health and family welfare, Government of India: Ghaziabad, 2014; Vol. 1-4.
2. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
3. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
4. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
5. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
6. Garratt, D. C. *The Quantitative Analysis of Drugs : Assisted by L. Brealey Etc.*; Chapman & Hall: London, 1964.
7. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis.*; Pearson: New Delhi, 2009.
8. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand and remember | To understand and apply the fundamentals of spectroscopy in single and combination drug analysis |
| **CO2** | Understand Apply and Evaluate | To understand and apply the fundamentals of chromatography in single and combination drug analysis |
| **CO3** | Understand Apply and Evaluate | To understand the role of analytical techniques in preformulation, stability study and formulation analysis. |
| **CO4** | Understand Apply and Evaluate | To understand the role of analytical techniques in QC testing and applications of modern statistical tools in analysis |
| **CO5** | Understand Apply and Evaluate | To understand working and handling of various analytical instruments. |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | - | 3 | 3 | 1 | 1 | - |
| **CO2** | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | - | 3 | 3 | 1 | 1 | - |
| **CO3** | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | - | 3 | 3 | 1 | 1 | - |
| **CO4** | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | - | 3 | 3 | 1 | 3 | - |
| **CO5** | 3 | 2 | - | - | 1 | 2 | 1 | 1 | - | - | 3 | 2 | 1 | - | - |
| **Avg** | 3 | 2.8 | 2.4 | 1.6 | 1 | 2 | 1 | 1 | 0.8 | - | 3 | 2.8 | 1 | 1.2 | - |

## M.PHARM. SEMESTER – II (MQA)
## SUBJECT: HAZARDS AND SAFETY MANAGEMENT (MQA201T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | 0 | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course is designed to convey the knowledge necessary to understand issues related to different kinds of hazard and their management. Basic theoretical and practical discussions integrate the proficiency to handle the emergency situation in the pharmaceutical product development process and provides the principle-based approach to solve the complex tribulations.

**Objectives:** At completion of this course, it is expected that students will be able to

- Understand about environmental problems among learners.
- Impart basic knowledge about the environment and its allied problems.
- Develop an attitude of concern for the industry environment.
- Ensure safety standards in pharmaceutical industry
- Provide comprehensive knowledge on the safety management
- Empower an idea to clear mechanism and management in different kinds of hazard management system
- Teach the method of Hazard assessment, procedure, methodology for provide safe industrial atmosphere.

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Multidisciplinary nature of environmental studies**: Natural Resources, Renewable and non-renewable resources, Natural resources and associated problems, a) Forest resources; b) Water resources; c) Mineral resources; d) Energy resources; e) Land resources<br>Ecosystems: Concept of an ecosystem and Structure and function of an ecosystem.<br>Environmental hazards: Hazards based on Air, Water, Soil and Radioisotopes. | 12 | CO1 |
| [2] | **Air based hazards**: Sources, Types of Hazards, Air circulation maintenance industry for sterile area and non sterile area, Preliminary Hazard Analysis (PHA) Fire protection system: Fire prevention, types of fire extinguishers and critical Hazard management system. | 12 | CO2<br>CO3<br>CO4<br>CO5 |
| [3] | **Chemical based hazards:** Sources of chemical hazards, Hazards of Organic synthesis, sulphonating hazard, Organic solvent hazard, Control measures for chemical hazards, Management of combustible gases, Toxic gases and Oxygen displacing gases management, Regulations for chemical hazard, Management of over-Exposure to chemicals and TLV concept. | 12 | CO2<br>CO3<br>CO4<br>CO5 |
| [4] | **Fire and Explosion :** Introduction, Industrial processes and hazards potential, mechanical electrical, thermal and process hazards. Safety and hazards regulations, Fire protection system: Fire prevention, types of fire | 12 | CO2<br>CO3<br>CO4 |

| | | | |
|---|---|---|---|
| | extinguishers and critical Hazard management system mechanical and chemical explosion, multiphase reactions, transport effects and global rates. Preventive and protective management from fires and explosion- electricity passivation, ventilation, and sprinkling, proofing, relief systems -relief valves, flares, scrubbers. | | CO5 |
| [5] | **Hazard and risk management**: Self-protective measures against workplace hazards. Critical training for risk management, Process of hazard management, ICH guidelines on risk assessment and Risk management methods and Tools Factory act and rules, fundamentals of accident prevention, elements of safety programme and safety management, Physicochemical measurements of effluents, BOD, COD, Determination of some contaminants, Effluent treatment procedure, Role of emergency services. | 12 | CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Bharucha E, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India.
2. Gajjar D, Nagdev S, A TEXTBOOK OF HAZARDS AND SAFETY MANAGEMENT, PV books, 2020.


## D. REFERENCE BOOKS


1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. T S S Dikshith. Hazardous Chemicals Safety Management and Global Regulations; Crc Press: Boca Raton, Florida, 2017.
3. "Quantitative Risk Assessment in Chemical Process Industries" American Institute of Chemical Industries, Centre for Chemical Process safety.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and apply | To understand about environmental problems among learners and impart basic knowledge about the environment and its allied problems. |
| CO2 | Understand and Analyse | Development of attitude of concern for the industry environment and ensure safety standards in pharmaceutical industry |
| CO3 | Understand and Remember | To provide comprehensive knowledge on the safety management |
| CO4 | Understand and Apply | To empower ideas to clear mechanism and management in different kinds of hazard management system |
| CO5 | Understand and Remember | To understand the method of Hazard assessment, procedure, methodology for provide safe industrial atmosphere |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 1 | 3 | 2 | 3 | 1 | 2 | 3 | 3 | - | 1 | - | - | |
| CO2 | 3 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | - | 1 | - | - | |
| CO3 | 3 | 3 | 3 | 1 | 3 | 2 | - | 1 | 3 | 3 | 3 | - | 1 | - | - | |
| CO4 | 3 | 3 | 3 | 1 | 3 | 2 | - | 1 | 3 | 3 | 3 | - | 1 | - | - | |
| CO5 | 3 | 3 | 3 | 1 | 3 | 2 | - | 1 | 3 | 3 | 3 | - | 1 | - | - | |
| | | | | | | | | | | | | | | | | |
| Avg | 3 | 3 | 3 | 1 | 3 | 2 | 0.8 | 1 | 2.8 | 3 | 3 | - | 1 | - | - | |

## M.PHARM. SEMESTER – II (MPH)

## SUBJECT: PHARMACEUTICAL VALIDATION (MQA202T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect. | Tut | Prac. | Total | | Ext | Sess. | CM | Prac. | Total |
| 04 | - | - | 04 | 04 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**:.
The main purpose of the subject is to understand about validation and how it can be applied to industry and thus improve the quality of the products. The subject covers the complete information about validation, types, methodology and application.

**Objectives:**
At completion of this course, it is expected that students will be able to understand:

CO1 Understand and remember the concept of calibration, qualification, validation and analytical method validation

CO2 Learn the theoretical aspects about the qualification of various equipments and instruments

CO3 Understand and learn validation of utility systems and pharamceutical formulation validation.

CO4 Understand and learn the cleaning and computerized system validation for the equipments and computers, respectively used in manufacture of pharmaceuticals

CO5 Learn the importance of patent and intellectual property rights and significance of technology transfer

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | Introduction to validation: Definition of Calibration, Qualification and Validation, Scope, frequency and importance. Difference between calibration and validation. Calibration of weights and measures. Advantages of Validation, scope of Validation, Organization for Validation, Validation Master plan, Types of Validation, Streamlining of qualification & Validation process and Validation Master Plan. Qualification: User requirement specification, Design qualification, Factory Acceptance Test (FAT)/Site Acceptance Test (SAT), Installation qualification, Operational qualification, Performance qualification, Re-Qualification (Maintaining status- Calibration Preventive Maintenance, Change management). | **10** | CO1 |
| [2] | Qualification of manufacturing equipment: Dry Powder Mixers, Fluid Bed and Tray dryers, Tablet Compression (Machine), Dry heat sterilization/Tunnels, Autoclaves, Membrane filtration, Capsule filling machine. Qualification of analytical instruments: UV-Visible spectrophotometer, FTIR, DSC, GC, HPLC, HPTLC, LC-MS. | 10 | CO2 |
| [3] | Qualification of laboratory equipments: Hardness tester, Friability test apparatus, tap density tester, Disintegration tester, Dissolution test | 10 | CO2 |

| | | | |
|---|---|---|---|
| | apparatus Validation of Utility systems: Pharmaceutical water system & pure steam, HVAC system, Compressed air and nitrogen. | | |
| **[4]** | Process Validation: Concept, Process and documentation of Process Validation. Prospective, Concurrent & Retrospective Validation, Re validation criteria, Process Validation of various formulations (Coated tablets, Capsules, Ointment/Creams, Liquid Orals and aerosols.), Aseptic filling: Media fill validation, USFDA guidelines on Process Validation- A life cycle approach. Analytical method validation: General principles, Validation of analytical method as per ICH guidelines and USP. | 10 | CO3<br>CO4 |
| **[5]** | Cleaning Validation: Cleaning Method development, Validation of analytical method used in cleaning, Cleaning of Equipment, Cleaning of Facilities. Cleaning in place (CIP). Validation of facilities in sterile and non-sterile plant. Computerized system validation: Electronic records and digital signature - 21 CFR Part 11 and GAMP | 10 | CO5 |
| **[6]** | General Principles of Intellectual Property: Concepts of Intellectual Property (IP), Intellectual Property Protection (IPP), Intellectual Property Rights (IPR); Economic importance, mechanism for protection of Intellectual Property –patents, Copyright, Trademark; Factors affecting choice of IP protection; Penalties for violation; Role of IP in pharmaceutical industry; Global ramification and financial implications. Filing a patent applications; patent application forms and guidelines. Types patent applications-provisional and non provisional, PCT and convention patent applications; International patenting requirement procedures and costs; Rights and responsibilities of a patentee; Practical aspects regarding maintaining of a Patent file; Patent infringement meaning and scope. Significance of transfer technology (TOT), IP and ethics-positive and negative aspects of IPP; Societal responsibility, avoiding unethical practices. | 10 | CO6 |

## C. TEXT BOOKS


1. Berry, I. R.; Nash, R. A. *Pharmaceutical Process Validation*; Marcel Dekker: New York, 1993.
2. Syed Imtiaz Haider. *Pharmaceutical Master Validation Plan : The Ultimate Guide to FDA, GMP, and GLP Compliance*; St. Lucie Press: Boca Raton, 2002.
3. Respect, I.; Al, E. *Principles of Qualification and Validation in Pharmaceutical Manufacture : Recommendations on : Validation Master Plan : Installation and Operational Qualification : Non-Sterile Process Validation : Cleaning Validation*; S.L.] [S.N, 1996.
4. Destin Leblanc. *Validated Cleaning Technologies for Pharmaceutical Manufacturing*; Crc Press, 2000


## D. REFERENCE BOOKS


1. Loftus, B. T.; Nash, R. A. *Pharmaceutical Process Validation*; M. Dekker: New York ; Basel, 1984.
2. Carleton, F. J.; Agalloco, J. P. *Validation of Pharmaceutical Processes : Sterile Products*; M. Dekker: New York, 1999.
3. Lachman, L.; Liebermann, H. A. *The Theory and Practice of Industrial Pharmacy*; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.
4. Syed Imtiaz Haider. *Validation Standard Operating Procedures a Step by Step Guide for Achieving Compliance in the Pharmaceutical, Medical Device, and Biotech Industries*; Informa Healthcare, 2001.

5. Cloud, P. A. *Pharmaceutical Equipment Validation : The Ultimate Qualification Handbook*; Informa Healthcare: New York, 2007. Validation of Pharmaceutical Processes: Sterile Products, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker
6. Chung Chow Chan. *Analytical Method Validation and Instrument Performance Verification*; John Wiley & Sons: Hoboken, N.J., 2004.
7. Ludwig Huber. *Validation and Qualification in Analytical Laboratories*; Informa Healthcare: New York, 2007.

## 5. E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand, remember, analyse, apply and evaluate | Understand and remember the concept of calibration, qualification, validation and analytical method validation |
| CO2 | Understand, remember, analyse, apply and evaluate | Learn the theoretical aspects about the qualification of various equipments and instruments |
| CO3 | Understand, remember, analyse, apply and evaluate | Understand and learn validation of utility systems and pharamceutical formulation validation. |
| CO4 | Understand, remember, analyse, apply and evaluate | Understand and learn the cleaning and computerized system validation for the equipments and computers, respectively used in manufacture of pharmaceuticals |
| CO5 | Understand, remember, analyse, apply and evaluate | Learn the importance of patent and intellectual property rights and significance of technology transfer |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 | 2 | 2 | 1 | 2 |
| CO2 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 0 | 0 | 0 | 0 | 2 | 3 | 1 | 2 | 0 | 3 | 1 | 1 | 0 | 0 |
| Avg. | 3 | 2 | 1.3 | 0.6 | 0.6 | 1 | 1.2 | 1.8 | 1.2 | 0 | 3 | 2.4 | 2.4 | 2 | 2.2 |

## M.PHARM. SEMESTER – II (MPH-QA)
## SUBJECT: AUDITS AND REGULATORY COMPLIANCE (MQA203T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | - | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope:** This course deals with the understanding and process for auditing in pharmaceutical industries. This subject covers the different aspects like methodology involved in the auditing process of different in pharmaceutical industries, preparing audit report and audit checklist preparation etc.

**Objectives:** Upon completion of this course the student should be able to

- To understand the importance of auditing
- To understand the methodology of auditing
- To carry out the audit process
- To prepare the auditing report
- To prepare the check list for auditing

## B. COURSE CONTENT

| NO | TOPIC | L (hrs) | COs |
|---|---|---|---|
| [1] | **Introduction:** Objectives, Management of audit, Responsibilities, Planning process, information gathering, administration, Classifications of deficiencies | 12 | CO1 |
| [2] | **Role of quality systems and audits in pharmaceutical manufacturing environment:** cGMP Regulations, Quality assurance functions, Quality systems approach, Management responsibilities, Resource, Manufacturing operations, Evaluation activities, Transitioning to quality system approach, Audit checklist for drug industries. | 12 | CO2 |
| [3] | **Auditing of vendors and production department:** Bulk Pharmaceutical Chemicals and packaging material Vendor audit, Warehouse and weighing, Dry Production: Granulation, tableting, coating, capsules, sterile production and packaging. | 12 | CO3 |
| [4] | **Auditing of Microbiological laboratory:** Auditing the manufacturing process, Product and process information, General areas of interest in the building raw materials, Water, Packaging materials. | 12 | CO4 |
| [5] | **Auditing of Quality Assurance and engineering department:** Quality Assurance Maintenance, Critical systems: HVAC, Water, Water for Injection systems, ETP | 12 | CO5 |

## C. TEXT BOOKS

1. Ginsbury, K., Bismuth, G. Compliance auditing for Pharmaceutical Manufacturers, Interpharm/CRC, London, 2018

## D. REFERENCE BOOKS


1. Gad, C.S. Pharmaceutical Manufacturing Handbook, Wiley-Interscience,1st ed,; New Jersey, 2008
2. Baird, R.M., Hodges, N.A., Denyar, S.P. Handbook of microbiological Quality control, 1st ed,; CRC Press, London, 2017.
3. Singer, D.C., Stefan, R., Van Staden, J.F. Laboratory auditing for quality and regulatory compliance, 1st ed,; Taylor and Francis, Boca Raton, 2005


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and remember | To understand the important aspects of auditing |
| CO2 | Understand and remember | To understand role of quality systems and audits in pharmaceutical manufacturing environment |
| CO3 | Understand and apply | To explain auditing aspects of vendors and production department |
| CO4 | Analysis, Apply | To describe audit process of microbiological laboratory |
| CO5 | Apply | To discuss aspects of audit of quality assurance and engineering department |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 2 | 2 | - |
| CO2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 2 | 2 | - |
| CO3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 2 | - |
| CO4 | 2 | 2 | 2 | 3 | 1 | 1 | 3 | 3 | 1 | 1 | 3 | 2 | 2 | 2 | 2 | - |
| CO5 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | - |
| | | | | | | | | | | | | | | | | |
| Avg | 2.2 | 2.4 | 2.4 | 2.6 | 1.8 | 1.4 | 2.8 | 2.2 | 1.6 | 1 | 3 | 2.2 | 2.8 | 2.4 | 2.2 | - |

## M. PHARM. SEMESTER – II (MQA)
## SUBJECT: PHARMACEUTICAL MANUFACTURING TECHNOLOGY (MQA204T)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| 4 | - | - | 4 | 4 | 75 | 15 | 10 | - | 100 |

## A. COURSE OVERVIEW

**Scope**: This course is designed to impart knowledge and skills necessary to train the students with the industrial activities during Pharmaceutical Manufacturing.

**Objectives:** Upon completion of the course the student shall be able to

- The common practice in the pharmaceutical industry developments, plant layout and production planning
- Will be familiar with the principles and practices of aseptic process technology, non-sterile manufacturing technology and packaging technology.
- Have a better understanding of principles and implementation of Quality by design (QbD) and process analytical technology (PAT) in pharmaceutical manufacturing

## B. COURSE CONTENT

| NO | TOPIC | L (Hrs) | COs |
|---|---|---|---|
| [1] | Pharmaceutical industry developments: Legal requirements and Licenses for API and formulation industry, Plant location- Factors influencing. Plant layout: Factors influencing, Special provisions, Storage space requirements, sterile and aseptic area layout. Production planning: General principles, production systems, calculation of standard cost, process planning, routing, loading, scheduling, dispatching of records, production control. | 12 | CO1<br>CO5 |
| [2] | Aseptic process technology: Manufacturing, manufacturing flowcharts, in process-quality control tests for following sterile dosage forms: Ointment, Suspension and Emulsion, Dry powder, Solution (Small Volume & large Volume). Advanced sterile product manufacturing technology : Area planning & environmental control, wall and floor treatment, fixtures and machineries, change rooms, personnel flow, utilities & utilities equipment location, engineering and maintenance. Process Automation in Pharmaceutical Industry: With specific reference to manufacturing of sterile semisolids, Small Volume Parenterals & Large Volume Parenterals (SVP & LVP), Monitoring of Parenteral manufacturing facility, Cleaning in Place (CIP), Sterilization in Place (SIP), Prefilled Syringe, Powdered Jet, Needle Free Injections, and Form Fill Seal Technology (FFS). Lyophilization technology: Principles, process, equipment. | 12 | CO1<br>CO2<br>CO4 |
| [3] | Non sterile manufacturing process technology: Manufacturing, manufacturing flowcharts, in process-quality control tests for following Non-Sterile solid dosage forms: Tablets (compressed & coated), Capsules (Hard & Soft). Advance non-sterile solid product manufacturing technology: Process Automation in Pharmaceutical Industry with specific reference to manufacturing of tablets and coated products, Improved Tablet Production: Tablet production process, granulation and pelletization equipments, continuous and batch mixing, rapid mixing granulators, rota granulators, spheronizers and marumerisers, and other specialized granulation and drying equipment. Problems encountered. | 12 | CO1<br>CO3<br>CO4 |

| | | | |
|---|---|---|---|
| | Coating technology: Process, equipments, particle coating, fluidized bed coating, application techniques. Problems encountered. | | |
| **[4]** | Containers and closures for pharmaceuticals: Types, performance, assuring quality of glass; types of plastics used, Drug plastic interactions, biological tests, modification of plastics by drugs; different types of closures and closure liners; film wrapper; blister packs; bubble packs; shrink packaging; foil / plastic pouches, bottle seals, tape seals, breakable seals and sealed tubes; quality control of packaging material and filling equipment, flexible packaging, product package compatibility, transit worthiness of package, Stability aspects of packaging. Evaluation of stability of packaging material. | **12** | CO4 CO5 |
| **[5]** | Quality by design (QbD) and process analytical technology (PAT): Current approach and its limitations. Why QbD is required, Advantages, Elements of QbD, Terminology: QTPP. CMA, CQA, CPP, RLD, Design space, Design of Experiments, Risk Assessment and mitigation/minimization. Quality by Design, Formulations by Design, QbD for drug products, QbD for Drug Substances, QbD for Excipients, Analytical QbD. FDA initiative on process analytical technology. PAT as a driver for improving quality and reducing costs: quality by design (QbD), QA, QC and GAMP. PAT guidance, standards and regulatory requirements. | **12** | CO3 |

## C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. *The Theory and Practice of Industrial Pharmacy*; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.

## D. REFERENCE BOOKS

1. Martin, A.; Bustamante, P.; Chun, A. H. C. *Physical Pharmacy : Physical Chemical Principles in the Pharmaceutical Sciences*; Lea & Febiger: Philadelphia, 1993.
2. Lieberman, H. A. *Pharmaceutical Dosage Forms Tablets, Vol. 1-3*; New York, Ny [U.A.] Dekker, 1990.
4. Banker, G. S.; Rhodes, C. T. *Modern Pharmaceutics*; Marcel Dekker: New York, 2002.
5. Willig, S. H.; Stoker, J. R. *Good Manufacturing Practices for Pharmaceuticals : A Plan for Total Quality Control*; Marcel Dekker: New York, 1997.
6. Ministry, India. *Indian Pharmacopoeia, 1996. Veterinary Supplement 2000*; Controller Of Publications: Delhi, 2000.
7. Great Britain. Stationery Office. *British Pharmacopoeia 2016.*; The Stationary Office: London, 2015.
8. United States Pharmacopœial Convention. *The United States Pharmacopoeia : The National Formulary*; United States Pharmacopoeial Convention: Rockville, Md, 2019.
9. Jean, U. K.; Goupale, D. C.; S Nayak. *Pharmaceutical Packaging Technology*; Hyderabad Pharmamed Pres, 2008..
10. Bauer, E. J. *Pharmaceutical Packaging Handbook*; Informa Healthcare: New York, 2009.
11. Shayne Cox Gad. *Pharmaceutical Manufacturing Handbook.*; Wiley-Interscience, 2008.

## E. COURSE OUTCOMES

(Minimum 5 Cos are required)

| CO Number | Skill | Statement |
|---|---|---|
| CO1 | Understand and Analyse | To learn the common practice in the pharmaceutical industry developments, plant layout and production planning |
| CO2 | Understand and Analyse | To be familiar with the principles and practices of aseptic process technology technology |
| CO3 | Understand Apply and Evaluate | To have a better understanding of principles and implementation of Quality by design (QbD) process analytical technology (PAT) in pharmaceutical manufacturing |
| CO4 | Understand and apply | To understand non sterile manufacturing technology, Process Automation in Pharmaceutical Industry with specific reference to manufacturing of tablets and coated products |
| CO5 | Understand and analyse | To learn the quality control of packaging material, container and closure and evaluation of stability of packaging material |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Avg | 3 | 3 | 3 | 3 | 2.8 | 2.8 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

## M. PHARM. SEMESTER – II (MQA)
## SUBJECT: PHARMACEUTICAL QUALITY ASSURANCE – PRACTICAL-II (MQA205P)

| Teaching Scheme (Hours/Week) | | | | Credits | Examination Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lect | Tut | Prac | Total | | Ext | Sess. | CM | Prac | Total |
| - | - | 12 | 12 | 6 | 100 | 30 | 20 | -- | 150 |

## A. COURSE OVERVIEW

**Scope:** The main purpose of the subject is to understand about method validation, process validation, equipment qualification and how it can be applied to industry and thus improve the quality of the products. The subject also covers drugs and environmental analysis as well as Qbd and PAT.

**Objectives**

At completion of this course, it is expected that students will be able

- To Understand the fundamentals of analytical method, instrument and Pharmaceutical process validation.
- To Understand the fundamentals of pharmaceutical equipment and analytical instrument qualification. And aspects of Pat, QbD

## B. COURSE CONTENT

| NO | TOPIC | P (Hrs) | COs |
|---|---|---|---|
| [1] | • Organic contaminants residue analysis by HPLC<br>• Estimation of Metallic contaminants by Flame photometer<br>• Identification of antibiotic residue by TLC<br>• Estimation of Hydrogen Sulphide in Air.<br>• Estimation of Chlorine in Work Environment.<br>• Sampling and analysis of SO2 using Colorimetric method<br>• Validation of an analytical method for a drug<br>• Qualification of at least two analytical instruments | **90** | CO1<br>CO2<br>CO3 |
| [2] | • Check list for Bulk Pharmaceutical Chemicals vendors<br>• Check list for tableting production.<br>• Check list for sterile production area<br>• Check list for Water for injection.<br>• Design of plant layout: Sterile and non-sterile<br>• Case study on application of QbD<br>• Case study on application of PAT<br>• Validation of a processing area<br>• Qualification of Pharma equipments like Autoclave, Hot air oven, Powder Mixer (Dry), Tablet Compression Machine<br>• Cleaning validation of one equipment<br>• Qualification of Pharmaceutical Testing Equipment (Dissolution testing apparatus, Friability Apparatus, Disintegration Tester) | **90** | CO2<br>CO3<br>CO4<br>CO5 |

## C. TEXT BOOKS


1. Lachman, L.; Liebermann, H. A. *The Theory and Practice of Industrial Pharmacy*; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.
2. Loftus, B. T.; Nash, R. A. *Pharmaceutical Process Validation*; M. Dekker: New York ; Basel, 1984.


## D. REFERENCE BOOKS


1. Indian Pharmacopoeia, Indian Pharmacopoeial Commission, Ministry of health and family welfare, Government of India, Vol- I, II, III, 2014.
2. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
3. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
4. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
5. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
6. Chung Chow Chan; Netlibrary, I.; Al, E. *Analytical Method Validation and Instrument Performance Verification*; John Wiley & Sons: Hoboken, N.J., 2004.
7. *International conference on harmonisation of technical requirements for registration of pharmaceuticals for human use ich harmonised tripartite guideline validation of analytical procedures: text and methodology Q2(R1).*
8. Cloud, P. A. *Pharmaceutical Equipment Validation : The Ultimate Qualification Handbook*; Informa Healthcare: New York, 2007.
9. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis.*; Pearson: New Delhi, 2009.
10. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.


## E. COURSE OUTCOMES

| CO Number | Skill | Statement |
|---|---|---|
| **CO1** | Understand Apply and Evaluate | To apply the fundamentals of spectroscopy and chromatography in drug and environmental analysis |
| **CO2** | Understand Apply and Evaluate | To Understand and apply the fundamentals of analytical method and Pharmaceutical process and utilities validation. |
| **CO3** | Understand Apply and Evaluate | To Understand and apply the fundamentals of pharmaceutical equipment and analytical instrument qualification. |
| **CO4** | Understand and Analyse | To understand the role of modern tools like QbD and PAT in Pharmaceutical processing. |
| **CO5** | Understand and Remember | To remember checklists for various dosage forms |

## F. COURSE MATRIX

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 3 | 2 | 1 | 1 | - |
| **CO2** | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | - | 3 | 2 | 2 | 2 | 3 |
| **CO3** | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | - | 3 | 2 | 2 | 2 | 3 |
| **CO4** | 3 | - | - | 2 | - | 1 | - | 1 | - | - | 3 | 3 | 2 | 3 | - |
| **CO5** | 3 | - | - | - | - | 1 | - | 1 | - | - | 3 | 1 | 1 | 1 | - |
| **Avg** | 3 | 1.8 | 1.8 | 1.6 | 0.6 | 1.6 | 0.6 | 1 | 0.6 | 0.6 | 3 | 2 | 1.6 | 1.8 | 1.2 |