DHARMSINH DESAI UNIVERSITY

FACULTY OF TECHNOLOGY

Department of Civil Engineering

Course Structure for B.Tech (Civil Engineering): Sem-III to VII w.e.f. 2025-26 (Revised)

Sem	Subject	Teaching Scheme				Credit	Exam Scheme (Marks)				
		Lect	Tut	Prac	Total		Th.	Int.	TW	Prac.	Total
III	Mathematics-III	3	1	0	4	4.0	60	40	-	-	100
	Surveying	3	0	2	5	4.0	60	40	25	25	150
	Structural Analysis-I	3	1	0	4	4.0	60	40	25	-	125
	Introduction to Civil Engineering	3	0	2	5	4.0	60	40	25	25	150
	Engineering Materials	3	0	0	3	3.0	60	40	-	-	100
	English	2	0	2	4	3.0	40	-	50	-	90
	TOTAL	17	2	6	25	22.0	340	200	125	50	715
IV	Fluid Mechanics-I	3	0	2	5	4.0	60	40	25	25	150
	Structural Analysis-II	3	2	0	5	5.0	60	40	25	25	150
	Building Planning	3	0	2	5	4.0	60	40	25	25	150
	Environmental Engineering -I	3	0	0	3	3.0	60	40	-	-	100
	Transportation Engineering-I	3	0	0	3	3.0	60	40	-	-	100
	Essence of Indian Traditional Knowledge	2	0	0	2	0.0	-	-	-	-	0
	Universal Human Values-II	3	0	0	3	3.0	60	-	-	-	60
	TOTAL	20	2	4	26	22.0	360	200	75	75	710
V	Geotech. Engineering-I	3	0	2	5	4.0	60	40	25	25	150
	Fluid Mechanics-II	3	0	0	3	3.0	60	40	-	-	100
	Concrete Technology	3	0	2	5	4.0	60	40	25	25	150
	Design of Structures-I (RCC)	3	0	2	5	4.0	60	40	25	25	150
	Program Elective-1	3	0	0	3	3.0	60	40	-	-	100
	Open Elective-1 (Disaster management)	3	0	0	3	3.0	60	40	-	-	100
	TOTAL	18	0	6	24	21.0	360	240	75	75	750

Sem	Subject	Teaching Scheme				Credit	Exam Scheme (Marks)				
		Lect	Tut	Prac	Total		Th.	Int.	TW	Prac.	Total
VI	Environmental Engineering-II	3	0	2	5	4.0	60	40	25	25	150
	Geotech. Engineering-II	3	0	2	5	4.0	60	40	25	25	150
	Water Resources Engineering	3	0	0	3	3.0	60	40	-	-	100
	Program Elective-2	3	0	2	5	4.0	60	40	25	25	150
	Open Elective-2 (Green Building Technolog	3	0	0	3	3.0	60	40	-	-	100
	Effective Technical Comm.	3	0	0	3	3.0	60	-	-	-	60
	TOTAL	18	0	6	24	21.0	360	200	75	75	710
VII	Professional Practice & Valuation	3	0	2	5	4.0	60	40	25	25	150
	Transportation Engineering-II	3	0	2	5	4.0	60	40	25	25	150
	Design of Structures-II (Steel)	3	0	2	5	4.0	60	40	25	25	150
	Program Elective-3	3	0	0	3	3.0	60	40	-	-	100
	Program Elective-4	3	0	0	3	3.0	60	40	-	-	100
	Program Elective-5	3	0	0	3	3.0	60	40	-	-	100
	TOTAL	18	0	6	24	21.0	360	240	75	75	750
VIII	Industrial Training Project (14 weeks)	0	0	20	20	10.0	-	-	100	200	300
	Seminar	0	0	4	4	2.0	-	-	-	50	50
	TOTAL	0	0	24	24	12.0	0	0	100	250	350

List of Program Electives

Sr No	Subject
1	Advanced Construction Techniques
2	Advanced Surveying
3	Building Services and Safety
4	Software Application in Civil Engg.
5	Irrigation Engineering
6	Design of Hydrraulic Structure
7	Flow Through Open Channel
8	Solid Waste Management
9	Environmental Design Projects

Sr No	Subject
10	Advanced Foundation Engineering
11	Geotechnical Testing Practice
12	Numerical Modelling in Geotech. Engg.
13	Advanced Structural Analysis
14	Advanced Concrete Technology
15	Prestressed Concrete
16	Building Repair and Rehabilatation
17	Earthquake Engineering
18	Design of Special Structure

Note: Sessional Exams added to all Subjects

B. TECH. SEMESTER – III (CL)
SUBJECT: SURVEYING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	-	2	5	4	60	40	25	25	150

A. COURSE OVERVIEW

The aim of this course is to deliver rudiments of plane surveying and its various techniques, which are necessary for all Civil Engineering projects. The surveying practicals will run concurrently with the course.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction to Surveying: Definition, Objectives, Principles, Types and Methods of Engineering Surveying	3	CO1, CO5
[2]	Linear Measurements: (A) Horizontal Distance: Methods of distance measurements; Taping - Taping Equipment and accessories, Ranging, Obstacles in tape measurements, Corrections in tape measurements; Electronic Distance Measurement (EDM) - Principle, Various types of EDM instruments, Errors in EDM. (B) Levelling: Instruments, Principle of Levelling, Types of Levelling, Field Methods, Plotting of LS and CS; Contouring - Characteristics, Plotting Methods, Uses. (C) Area and Volume: Methods of Area calculation from field measurements and plans; Volume by trapezoidal and prismoidal formula, Calculation of earthwork in cutting and embankment for civil engineering works, Mass haul diagram, Volume by spot levels, Capacity of reservoir.	13	CO1, CO2, CO4
[3]	Angular Measurements: (A) Azimuth & Bearings: Introduction, Direction of a line, Kinds of Horizontal angles, Azimuth & Bearing, The compass and the Earth's magnetic field, Magnetic Declination, Local Attraction. (B) Theodolite: Theodolite types, Measurement of Vertical and Horizontal Angles, Theodolite Traverse and its adjustments	6	CO1, CO2,
[4]	Tacheometric Surveying: Instruments, Different types of Tacheometric systems - Stadia and Non stadia.	4	CO1, CO2,
[5]	Plane Table Surveying: Principle, Accessories, Methods, Two-point and Three-point problems.	3	CO1, CO2, CO3
[6]	Total Station Survey: Introduction, Components used in Total station,Types of Total station survey, Advantages and Disadvantages of Total station surveying.	4	CO1, CO2, CO3, CO4
[7]	Elements of Curves: Different types of Curves, Elements of Horizontal and Vertical Curves.	4	CO1
[8]	Introduction to Modern Surveying Techniques: Introduction to GIS, GPS, Remote Sensing, Photogrammetry, LiDAR.	3	CO1

C. TEXT BOOKS

1. Surveying- Volume-I- B C Punmia, A K Jain, A K Jain- Laxmi Publication (New Delhi) - 17th ed. - 2018.
2. Surveying- Volume-II- B C Punmia, A K Jain, A K Jain- Laxmi Publication (New Delhi) - 16th ed. - 2019.

D. REFERENCE BOOKS

1. Surveying- Volume-I - S K Duggal - McGraw-Hill India (New Delhi) - 5th ed. - 2019.
2. Surveying- Volume-II - S K Duggal - McGraw-Hill India (New Delhi) - 5th ed. - 2019.
3. Plane Surveying - A M Chandra - New Age Publication (New Delhi) - 2nd ed. - 2006.
4. Surveying and Levelling - T P Kanetkar, S V Kulkarni - Vidyarthi Gruh Prakashan (Pune) - 2010.
5. Engineering Surveying - W Schofield - Butterworth-Heinemann Publication - 2001.
6. Surveying and Levelling - R Agor - Khanna Publishers (New Delhi) - 12th ed. - 2016.
7. Surveying - Volume-I&II - K R Arora - Rajsons Publications (New Delhi) - 15th ed. - 2018.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Understand the fundamentals of engineering surveying and it's conventional as well as modern techniques.
CO2	Evaluate	Measure and calculate distance, height difference between points, horizontal and vertical angle, area and volume of civil engineering works.
CO3	Application	Prepare a map of small area using conventional and advanced surveying instruments.
CO4	Synthesis	Synthesise various techniques of surveying to lay down any building plan to field.
CO5	Decision Making	Decide appropriate surveying technique pertaining to various field applications.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	2	1	1	1	3	1	2	2	2	3	2
CO2	2	2	1	1	2	2	-	1	3	1	2	2	3	3	2
CO3	2	2	3	1	3	2	-	1	3	3	2	2	3	3	2
CO4	2	2	3	1	2	1	-	1	3	1	2	2	2	3	2
CO5	2	3	2	2	3	1	1	1	1	-	-	2	2	3	2
..															
Avg															

B. TECH. SEMESTER – III
SUBJECT: STRUCTURAL ANALYSIS -I

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	-	-	100

A. COURSE OVERVIEW

The course is designed to create background of Structural Engineering field. Students will be introduced to various analysis methods for deflection calculations in determinate beams, solution of determinate pin jointed truss and column elements. Construction of influence line diagrams for beams and uses of diagram for design will be explored.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**BASIC INTRODUCTORY CONCEPTS** Types of Structures, Static determinacy and Indeterminacy, Development of S.F. and B.M Diagram for beam	03	CO-1
[2]	**FORCES IN DETERMINATE PIN JOINTED TRUSSES** Different types of pin jointed trusses, analysis of trusses using (i) method of joints (ii) method of sections (iii) graphical method	10	CO-2
[3]	**STRAIN ENERGY** Resilience, strain energy in tension compression, bending and torsion, proof resilience, impact loads and their application, Castigliano's first theorem	06	CO-3
[4]	**SLOPE AND DEFLECTION OF STATICALLY DETERMINATE BEAM** Double integration method, Macaulay's method, moment area method, conjugate beam method	18	CO-3
[5]	**DIRECT AND BENDING STRESSES** Short columns subjected to eccentric load, middle third rule, kernel (core) of section	09	CO-4
[6]	**COLUMNS AND STRUTS** Buckling of columns, different end conditions, Euler's theory of long columns, its applicability, Rankine's formula and secant formula	09	CO-5
[7]	**INFLUENCE LINES** Statically determinate beams and Trusses – for support reaction,shear and bending moment for UDL and several point loads. Criteria for maximum effect.	12	CO-6

C. TEXT BOOKS

1. Basic Structural Analysis-C.S. Reddy-Tata McGraw Hill (New Delhi)-3rd Edition-2018

D. REFERENCE BOOKS

1. Structural Analysis-Hibbler R C-Pearson Education Publication (Noida)-10th Edition-2018
2. Structural Analysis-Bhavikatti S. S-Vikas Publishing House Pvt Ltd (New Delhi)-5th Edition-2021
3. Applied Mechanics-S. B. Junnarkar & H. J. Shah-Charotar Publication (Anand)-19th Edition-2015
4. Strength of Materials-Ramamrutham-Dhanpat Rai Publication (New Delhi)-18th Edition-2014
5. Structural Analysis-Thandavamoorthy-T. S.-Oxford University Press (New Delhi)-1st Edition-2011

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Understand the basic concept analysis of Determinate structures.
CO2	Analysis	Solve plane truss problems using different methods of analysis
CO3	Analysis	Calculate deflections & slopes for statically determinate problems using various methods.
CO4	Analysis	Analyse Determine stresses due to axial & eccentric loading
CO5	Analysis	Analyse column element with different boundary conditions and understand buckling phenomenon.
CO6	Application	Apply the concepts of ILD and moving loads on determinate structures

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		.
CO1	2	2	3	3	3	3	1	2	3	1	1	1	3	3	2		
CO2	3	3	3	2	3	3	2	2	3	1	2	1	3	3	3		
CO3	2	3	2	3	3	3	1	2	3	2	2	1	3	2	3		
CO4	3	2	3	3	3	3	2	1	3	1	1	1	3	3	3		
CO5	3	2	3	2	3	3	2	2	3	1	2	1	3	2	2		
CO6	3	2	3	3	3	3	1	1	3	2	1	1	3	3	2		
Avg																	

B. TECH. SEMESTER – III (CL)
SUBJECT: INTRODUCTION TO CIVIL ENGINEERING

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

A. COURSE OBJECTIVE

The Objectives of the course are to introduce a diversified field of civil engineering and impart the importance of the various techniques and practices on various stages of building construction, factors considered in construction of a building and careful selection of suitable construction components.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**INTRODUCTION TO CIVIL ENGINEERING** Brief history of civil engineering, Introduction to Structural engineering, Geotechnical engineering, Transportation engineering, Environmental Engineering, Water Resource engineering, Building technology and Construction Management.	04	CO1
[2]	**INTRODUCTION TO BUILDING CONSTRUCTION** Classification of buildings, Components of buildings and their broad functions, Types of building & Building system, Frame structure, Load bearing structure.	03	CO2
[3]	**FOUNDATION** Functions, Classification, suitability and constructional features of shallow foundations, building foundation in black cotton soil, machine foundation, Constructional features and suitability of pile foundations, Underpinning	05	CO2 CO3
[4]	**MASONRY** 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.	07	CO2 CO3
[5]	**FLOORING** Introduction, Factors affecting selection, Type of flooring and its suitability, Construction details of CC/RCC flooring, Tile flooring, Mosaic, Marble Flooring, Industrial flooring.	03	CO4
[6]	**STAIR CASE** Technical terms, Requirement, location and classification, construction features and Design of stair.	03	CO4 CO2

[7]	**DOORS & WINDOWS** Classification, material, suitability, requirement & location, construction features of panelled & flushed doors/windows, metal doors/windows.	04	CO4 CO2
[8]	**ROOFS AND ROOF COVERINGS** Classification, functions and requirement of roofs, roofing materials, construction of trussed roofs with AC/GI sheets, RCC roofs.	04	CO4 CO2
[9]	**BUILDING FINISHES** Plastering, pointing, painting and white washing: construction materials & methods.	03	CO5
[10]	**BUILDING PROTECTION AND MAINTENANCE** Fire proofing, Anti-termite treatments, Damp proofing in building construction.	04	CO5

C. TEXT BOOKS

1. Building Construction- Dr. B.C. Punamia- Laxmi Publication (New Delhi)- 11th Edition- 2008.
2. Elements of Civil Engineering- Dr.R.B.Khasiya- Mahajan Publishing House(Gujarat)- 3rd Edition-2015

D. REFERENCE BOOKS

1. The text book of Building Construction- S.P.Arora and S.P.Bindra- Dhanpatrai Publications (New Delhi)- 5th Edition- 2012.
2. Building Construction- P.C..Varghese-, PHI Learning Publications(New Delhi)- 2nd Edition-2017.
3. Building Construction- S.C.Rangwala- Charotar Publication(Gujarat)- 3rd Edition- 2017.
4. Elements of Civil Engineering- R.Agor- Khanna Publication (New Delhi)- 6th Edition- 2015.
5. Building Construction Handbook- R.Chudley & Roger Greeno- Butterworth Heinemann(Oxford)- 5th Edition- 2004.
6. SP-7(2016)Volume 1-National Building Code of India – Bureau of Indian Standards(New Delhi).-2016.
7. SP:62 (S& T)-Handbook on Building Construction Practice -Bureau of Indian Standards(New Delhi)-1st Edition-1997.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding	Understand the broad perspective of Civil Engineering.
CO2	Comprehension, Application	Identify, Select and Draw various building components.
CO3	Analysis	Categorize different construction activities.
CO4	Comprehension, Analysis	Classify appropriate openings, roofs, flooring, vertical transportation facilities and recommend appropriate modes of vertical movements.

CO5	Application	Illustrate proper approaches of building services.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	3	1	2	-	-	-	2	-
CO2	2	2	2	1	2	2	-	2	2	3	1	2	1	2	1
CO3	1	2	1	-	2	2	-	2	2	2	1	2	1	2	1
CO4	1	-	2	-	1	2	1	2	2	2	1	2	2	2	1
CO5	2	1	1	-	2	2	1	2	2	2	1	1	1	2	1
Avg															

B. TECH. SEMESTER – III (CL)
SUBJECT: ENGINEERING MATERIALS

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

A. COURSE OVERVIEW

To introduce students to various civil engineering construction materials, along with their properties and significance

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**Introduction** 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, Vander walls force; Crystalline and Non-Crystalline nature of solids, Imperfections in crystal structure, Types of Imperfections- Vacancies, Dislocations.	04	CO2
[2]	**Stones and Aggregates** Stone as building material; Criteria for selection; Tests on stones; Deterioration and Preservation of stone work.	03	CO1 CO2 CO3 CO4
[3]	**Bricks** Classification; Manufacturing of clay bricks; Tests on bricks; Compressive Strength; Water Absorption; Efflorescence.	04	CO1 CO2 CO3 CO4
[4]	**Ceramic Materials** Tiles; Roofing tiles; Flooring tiles; Glazed tiles, Special Industrial tiles, Earth ware, Stoneware, Porcelain., Refractories.	03	CO1 CO2 CO3 CO4
[5]	**Lime and Cement** Types of Lime and Cements and their applications.	03	CO1 CO2 CO3 CO4
[6]	**Mortar & Concrete** Mortars – Types of Mixed proportions and their uses, Concrete in construction, P.C.C. & R.C.C., Different concrete mixes and usages.	03	CO1 CO2 CO3 CO4
[7]	**Timber** Sources of Timber; Seasoning of Timber, Market forms; Industrial timber; Plywood; Veneer.	03	CO1 CO2 CO3 CO4
[8]	**Paints, Varnishes and Distempers** Paints, Varnish & Distempers: Function; Constituents, Characteristics and applications. Water-proofing materials	03	CO1 CO2 CO3 CO4
[9]	**Plastic**	02	CO1

	Constituents of plastics; classification of plastics; properties of plastic; application of plastics., Fibre Reinforced Plastics		**CO2 CO3 CO4**
[10]	**Metals and Alloys** Metals-Classification, Properties and Application. Alloys-Types & Applications	**05**	**CO1 CO2 CO3 CO4**
[11]	**Sustainable Materials** Fibre – Geotextiles, fly ash; Concrete hollow blocks – Lightweight concrete blocks, Fibre Reinforced Plastic, Rubber.	**03**	**CO1 CO2 CO3 CO4**

C. TEXT BOOKS

1. Engineering Materials-Rajput R.K. - S. Chand & Co. Ltd (New Delhi)- 4th ed.- 2014.
2. Alternative Building Materials Technology - Duggal.S. K - New Age International (New Nelhi)- 4th ed.- 2008.
3. Engineering Materials- Rangwala S.K. - Charotar Publications (Anand)- 42nd ed.-2015.

D. REFERENCE BOOKS

1. Construction Materials - Varghese.P.C.- Prentice Hall Inc. (New Delhi)- 2nd ed.- 2015.
2. Alternative Building Materials Technology - Jagadish.K.S. - New Age International (New Delhi)- 2nd ed.- 2017.
3. Relevant Indian Standard Codes of Practice.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Evaluate	Distinguish various construction materials.
CO2	Comprehension	Understand the properties of construction materials
CO3	Synthesis	Create understanding about the usages and selection of different construction materials.
CO4	Application	Evaluate and select appropriate construction materials for intended applications.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	1	1	1	-	1	-	3	2	2	1
CO2	1	1	1	-	-	1	2	1	-	1	1	2	1	2	1
CO3	1	2	2	1	-	1	2	2	1	2	2	2	2	2	2
CO4	2	2	3	2	1	2	2	2	1	2	3	2	2	2	2
Avg															

B. TECH. SEMESTER – IV (CL)
SUBJECT: FLUID MECHANICS-I

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

A. COURSE OVERVIEW

The applications of Fluid Mechanics in industries, human body, medical science, fluid-structure interactions, design of automobiles, spacecrafts, watercrafts, power plants etc. motivates the students to study Fluid Mechanics. The objectives of the course are to explain the students, basic principles of fluid mechanics, properties of fluids, hydrostatic forces, buoyancy and flotation, kinematics and dynamics of fluid flow, various devices for discharge measurement, dimensional analysis & hydraulic machines. Fluid Mechanics has a broad scope covering applications in water supply, construction of dams and bridges, hydraulic machines etc.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Properties of Fluids: Introductory concepts and definitions: Fluids and soils; Liquid, Gas and vapor; Continuum; Control volume., Types of fluids, Fluid properties like Density; Specific weight; Specific Volume; Specific Gravity; Bulk modulus of Elasticity; Pressure; Viscosity; Surface tension; Capillarity.	4	CO1
[2]	Fluid Statics: (A) Fluid pressure and its 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 onsubmerged plane and curved sur-faces; Location of hydrostatic force;Applications of hydrostatic force. (C) Buoyancy and flotation: Archimedes' Principle; Buoyant force; Determination of metacentric height; Stability of floating bodies.	8	CO3, CO5
[3]	Fluid Kinematics: Methods of describing fluid motion - Langrangian and Eulerian method; Velocity and Acceleration of a fluid particle; Types of fluid flow; Streamline, Path line and Streak line; Continuity Equation in cartesian and polar coordinates; Circulation and vorticity, Velocity potential and stream function; flow net; Types of motion; Vortex motion.	5	CO1
[4]	Fluid Dynamics: Equation of motion and Energy equation; Forces acting on fluid in motion; Euler's equation of motion; Bernoulli's equation from Euler's equation of motion; Practical applications of Bernoulli's equation.	5	CO1
[5]	Fluid Flow Measurement: Measurement of discharge by Orifice and Mouthpiece; time of emptying a tank through orifice and mouthpiece; Measurement of discharge by Weir and Notch; time of emptying a tank through weir and notch.	7	CO4
[6]	Dimensional Analysis and Principles of Similitude: 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.	5	CO6
[7]	Hydraulic Machines: Hydraulic turbines; Types of turbines; Pumps; Types of pumps; Specific speed of pumps and turbines.	6	CO2

C. TEXT BOOKS

1. Fluid Mechanics - R K Bansal - Laxmi Publication Pvt. Ltd (New Delhi) - 10th ed.- 2019
2. Fluid Mechanics - R K Rajput - S. Chand & Co. Ltd. (New Delhi) - 6th ed.- 2019.

D. REFERENCE BOOKS

1. Fluid Mechanics - A K Jain - Khanna Publishers Pvt. Ltd. (New Delhi) - 12th ed. - 2018.
2. Fluid Mechanics & Hydraulic Machines - P N Modi, S M Seth, Standard Book House Pvt. Ltd. (New Delhi) - 22nd ed. - 2019
3. Fluid Mechanics and Machinery - H M Raghunath - CBS Publishers & Distributors Pvt. Ltd. (Chennai) 2018.
4. Fluid Mechanics - D S Kumar - S K Kataria & Sons (New Delhi) - 2nd ed.- 2012.
5. Fluid Mechanics - V L Streeter, E B Wylie - McGraw Hill Education Pvt. Ltd. (New York) – 2017.
6. Theory and Applications of Fluid Mechanics - K Subramanya - McGraw Hill Education Pvt. Ltd. (New York) - 1933.
7. Introduction to Fluid Mechanics (SI Edition) - E J Shaughnessy, I M Katz, J P Schaffer - Oxford University Press (United Kingdom) - 2005.
8. Engineering Fluid Mechanics - R J Garde, A G Mirajgaoker - S. Chand & Co. Ltd. (New Delhi) - 1st ed. - 2010.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Understand various types of fluids, their properties, Stability of floating bodies, types of fluid motion and vortex motion
CO2	Comprehension	Understand various types of hydraulic pumps, turbines & their applications in Civil Engineering.
CO3	Evaluate	Evaluate various hydrostatic forces acting on plane and curved surfaces, buoyant forces on floating and submerged bodies.
CO4	Evaluate	Calculate discharge by various means in channels and pipes
CO5	Application	Apply the fundamentals of fluid mechanics for measurements of fluid discharge, calculation of fluid pressure, buoyancy and workingof hydraulic machines.
CO6	Application	Apply the knowledge of dimensional analysis and principles of similitude in the design of various hydraulic structures

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	1	1	2	2	1	-	2	1	2	2
CO2	2	1	1	1	2	2	2	1	1	2	1	2	3	2	2
CO3	2	3	2	1	2	1	1	2	2	2	1	2	2	2	1
CO4	2	2	1	1	2	1	1	-	2	1	1	1	1	2	1
CO5	2	2	1	1	2	1	1	1	1	1	1	2	2	2	1
CO6	2	2	2	-	1	-	-	-	1	1	-	2	3	2	1
Avg															

5B. TECH. SEMESTER – IV
SUBJECT: STRUCTURAL ANALYSIS -II

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

A. COURSE OVERVIEW

Students will explore the concept of global structural stability, theory of structural analysis, and methods in structural analysis. To impart the principles of elastic structural analysis and behaviour of indeterminate structures**.** Journey through this course will help students to build the foundationfor more advanced courses related to structural engineering.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**INTRODUCTION AND BASIC PRINCIPLE** Static and Kinematic Indeterminacy, Stable and Unstable Structures. Principle of Superposition, Maxwell's Reciprocal Theorem. Development of S.F. and B.M Diagram for frame	02	CO-1
[2]	**ENERGY PRINCIPLES** Castigliano's Theorem II, Unit load Method	03	CO-2
[3]	**ANALYSIS OF FIXED BEAMS** Analysis of fixed beam subjected to various loads	03	CO-2
[4]	**METHOD OF CONSISTENT DEFORMATION** Analysis of Statically Indeterminate Beams	07	CO-2
[5]	**SLOPE DEFLECTION METHOD** Analysis of continuous beams including settlement / rotation of support	07	CO-3
[6]	**MOMENT DISTRIBUTION METHOD** Analysis of continuous beams and frames including sway	09	CO-3
[7]	**MATRIX METHODS** Introduction to flexibility and stiffness method. (System approach)	09	CO-4
[8]	**INFLUENCE LINES** Muller Breslau principle, Application for Indeterminate beams and frames	08	CO-5
[9]	**ANALYSIS OF TWO HINGED AND THREE HINGED ARCHES**	06	CO-6

C. TEXT BOOKS

1. Structural Analysis-Hibbler R C-Pearson Education Publication (Noida)-10th Edition-2018

D. REFERENCE BOOKS

E. COURSE OUTCOMES

1. Theory of Structures-Timoshenko S.P.& Young D.H-McGraw Hill (New Delhi)-2nd Edition -2017
2. Structural Analysis-Devdas Menon-Narosa Publishing House (New delhi)-2nd Edition-2017
3. Indeterminate Structural Analysis-Kinney-J.S-Addison-Wesley Educational Publishers (USA)-1957
4. Fundamentals of structural Mechanics & analysis-M.L. Gambhir-Prentice Hall (New Delhi) -2011
5. Structural Analysis-A Matrix Approach-G.S. Pandit-Tata McGraw Hill (New Delhi)- 2nd Edition-2008
6. Structural Analysis-Thandavamoorthy-T. S.-Oxford University Press (New Delhi)- 1st Edition-2011

CO Number	Skill	Statement
CO1	Evaluate	Distinguish between stable and unstable structures; statically determinate and indeterminate structures
CO2	Analysis	Analyse Shear force and Bending moment in statically indeterminate Beam
CO3	Evaluate	Evaluate ends moment and Reactions of beam and frame
CO4	Analysis	Analyse ends moment beam using matrix method
CO5	Analysis	Determine internal forces and reactions in indeterminate beams subjected to moving Loads using influence lines
CO6	Analysis	Analyse internal forces and reactions for two hinged and three hinged arches

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		.
CO1	3	2	3	3	3	3	1	1	3	1	1	1	3	2	2		
CO2	3	3	3	3	3	3	2	2	3	1	2	1	3	3	3		
CO3	2	3	2	3	3	3	1	2	3	2	2	1	3	2	3		
CO4	3	2	3	3	3	3	1	1	3	1	1	1	3	3	3		
CO5	3	2	3	2	3	3	2	2	3	1	2	1	3	2	2		
CO6	3	2	3	3	3	3	1	1	3	2	1	1	3	3	2		
Avg																	

B. TECH. SEMESTER – IV(CL)
SUBJECT: BUILDING PLANNING

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

A. COURSE OVERVIEW

To introduce students to the role of civil engineers in town and building planning along with various factors affecting it.
To understand the principles of planning and bylaws applicable to various types of buildings.
To prepare detailed working drawing for doors, windows, etc.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**ARCHITECTURAL PLANNING OF BUILDING** Architectural compositions, Principles of building planning, Orientation of building, Climatic factors, Role of architect, Process of planning.	**04**	CO1
[2]	**PLANNING STANDARDS** Introduction, Definitions, building bye-laws- objects, importance, Principles, Set-back, light plane, margins, F.S.I., TP Schemes, Minimum requirements of building components.	**04**	CO2
[3]	**PLANNING OF RESIDENTIAL BUILDING** Space planning, requirements, conceptual plan, activity space, elements of human scale, size and dimensions, furniture planning.	**03**	CO1 CO4
[4]	**PLANNING OF PUBLIC BUILDINGS** Classification, site selection, safety considerations, requirements, factors to be considered for planning, codal provisions.	**04**	CO1 CO4
[5]	**USE OF NATIONAL BUILDING CODE GUIDELINES FOR BUILDING SERVICES- LIGHT, VENTILATION, FIRE SAFETY.**	**05**	CO2
[6]	**INTRODUCTION TO GREEN BUILDING AND SMART HOME TECHNOLOGY.**	**02**	CO3
[7]	**INTRODUCTION TO COMPUTER-AIDED DESIGN AND EDITING OF BUILDING DRAWINGS.**	**03**	CO5
[8]	**INTRODUCTION TO TOWN PLANNING** Introduction, Evolution, objects, principles, necessity, types of growth, personality, land use, site for New towns.	**03**	CO6
[9]	**CIVIC SURVEYS** Necessity, types, uses of civic surveys, Data collected and methods of data collection, drawings and report.	**03**	CO6
[10]	**PRINCIPLES OF TOWN-PLANNING** Zoning, Housing, Re-development, Slum clearance, Garden city concept, Master plan, Reports and Drawing, Smart city	**05**	CO3 CO6

C. TEXT BOOKS

1. Building Planning and drawing - Kumaraswamy N. and Rao Kameswara A- Charotar Publishing House (Anand) - 9th ed.- 2019.
2. Town Planning - Rangwala S.C. - Charotar publishing House (Anand)- 31st ed.- 2021.

3. Hiraskar G.K. Town Planning - Dhanpat Rai Publication (New Delhi)- 17th ed.- 2019.
4. Building drawing: with an integrated approach to build environment - Shah M.G.,Kale. C.M. and Patki.S.Y. - Tata McGraw Hill (New Delhi)- 4th ed.-2010.

D. REFERENCE BOOKS

1. Building Planning, Designing and scheduling- Gurcharan Singh-Standard Book House (New Delhi)- 2nd ed.-1992.

2. SP 7: 2016 -National Building Code of India 2016 (NBC 2016) (Part-I and II)- BIS,(New Delhi)

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Create	Create different types of building plans.
CO2	Comprehension	Associate building codes, planning principles, and architectural composition principles in town and building planning.
CO3	Application	Understand smart city development, sustainable building technology and environment friendly green technologies in building construction.
CO4	Synthesis	Prepare working drawings, foundation plans, and other executable drawings for various buildings with proper details.
CO5	Create	Develop building plans in Auto-CAD.
CO6	Comprehension	Understand the process of town planning and principles of planning.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	3	2	3	3	3	3	2	3	2	3	2
CO2	3	3	2	2	1	2	2	2	1	1	1	2	2	2	1
CO3	2	2	2	2	2	3	3	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	2	1	2	3	3	2	2	3	3	2
CO5	3	2	2	1	3	-	-	1	2	3	1	1	2	2	2
CO6	2	2	1	1	1	2	2	1	2	1	-	1	1	1	-
Avg.															

B. TECH. SEMESTER – IV (CL)
SUBJECT: ENVIRONMENTAL ENGINEERING - I

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

A. COURSE OBJECTIVE

The objectives of the course are to describe various aspects of the Environmental System and concepts of water demand, water supply and water distribution system, Develop analytical skills in the design of water treatment units.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**INTRODUCTION** Interrelationship of environmental System Overview: Water Resource Management System, Waste water management system and Air resource management system.	03	CO1
[2]	**QUANTITY AND QUALITY OF WATER** Water demand-Types of demand, Population forecast method, Variation in water demand, Water quality parameters-Physical, Chemical and microbiological, Principles of their analysis, Drinking water quality standards.	08	CO2, CO3
[3]	**COLLECTION AND CONVEYANCE OF WATER** Sources of water, Intake structure and its types, Free flow and Pressure system, Hydraulic design of conduits, Rising main.	05	CO4
[4]	**WATER TREATMENT** Objectives of water treatment, Process details and design consideration of treatment units such as aeration, sedimentation, coagulation, flocculation, filtration, disinfection and water softening. Introduction to advanced water treatment methods such as reverse osmosis, ion exchange process.	13	CO4
[5]	**WATER DISTRIBUTION SYSTEM** Distribution of treated water, Requirements of water distribution system, Types of water distribution system, Distribution reservoirs, Branched and Loop pipe configuration, Hydraulics of pipe network.	05	CO4
[6]	**AIR POLLUTION AND CONTROL** Air pollution sources and effects, Meteorology, Control of gaseous and particulate air pollutants.	06	CO5

C. TEXT BOOKS

1. Water supply and Sanitary Engineering-Birdie G.S & Birdie J.S- Dhanpatrai Publishing(New Delhi) , 9th edition- 2014.
2. Introduction to Environmental Engineering-Davis M.L and Cornwell D.A-Tata McGraw Hill publication(New York)- 5th edition- 2017

D. REFERENCE BOOKS

1. Environmental Engineering-Peavy, Rowe, Tchobanoglous -McGraw Hill Education Publication (Singapore)- 1st edition-2017.
2. Water & Wastewater Engineering-Steel & MgZee-Tata Mcgraw Hill publication(New York)-2003.
3. Air Pollution-Rao M.N. & Rao H.V- Tata McGraw Hill publication(New Delhi) -1st edition-2017.
4. Manual on Water supply and Treatment- Central Public Health and Environmental Engineering Organization (CPHEEO)- Ministry of Urban Development- Govt. Of India(New Delhi)- 3rd edition -1999.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding	Understand the inter-related aspects of water resource management and waste water management.
CO2	Assessment	Assess water demand and quality of water.
CO3	Estimation	Estimate domestic water requirements for a given locality.
CO4	Creation,Analysis	Design water treatment plant units based on the water sources and analyze water distribution network.
CO5	Understanding	Understand the concept of air pollutants, sources and effects and identify control strategies.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	3	1	1	-	-	-	-	-	1	-
CO2	3	2	2	-	2	2	2	2	2	-	-	-	2	3	1
CO3	3	3	2	-	3	3	1	2	3	1	-	1	2	3	2
CO4	3	3	3	1	3	3	3	2	2	1	-	2	3	3	3
CO5	1	-	1	-	1	3	3	3	1	-	-	-	2	1	1
Avg															

B. TECH. SEMESTER – IV (CL)
SUBJECT: TRANSPORTATION ENGINEERING-I

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

A. COURSE OVERVIEW

Transportation plays very important role in the development of a society and a country. This course is intended to deliver the overview of different modes of transportation and their suitability. Emphasis would be given to fundamentals of Railways, Airports, Hocks and Harbours.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction to Transportation: Definition of Transportation, Importance of Transportation, Different modes of transportation- Air Transportation, Water Transportation, Land Transportation; Comparison between modes of transportation and their suitability.	2	CO1
[2]	Rail Transportation: (A) Permanent Way: Gauge - Types, Uniformity of Gauges; Rails - Types of Rails, Defects in Rails; Sleepers - Sleeper Density, Types of Sleepers; Ballast - Types of Ballast, Ballast Cross Section; Formation - Characteristics, Improvement methods. (B) Geometric Design: Alignment, Gradient, Curves, Superelevation. (C) Points and Crossing: Terminology, Turnout, Track Junctions and Crossings. (D) Railway Station and Yards: Site Selection, Classification, Components of railway station, Equipment at station and yards. (E) Railway Signalling System, Classification and their functions. (F) Railway Construction: Various methods of railway track construction.	18	CO2, CO3, CO4, CO5
[3]	Airports: (A) Introduction: Civil Aviation, Authorities for airports. (B) Airport Planning: Airport Site Selection- Factors Affecting Site Selection and Surveys; Components of Airport, Typical Layouts. (C) Geometric Design of Airport components: Runway- Runway Orientation, Wind Rose Diagram, Basic Runway Length, Correction for Runway Length; Taxiway- Layouts and Design standards.	12	CO2, CO3, CO5
[4]	Harbours & Docks: (A) Harbours: Classification of harbour, harbour planning, requirements of harbour. (B) Docks and Spillways: Introduction, advantages of docks, moles, shape of docks and basins, dock entrance, entrance docks, quays, jetties and wharves, tide, wind and wave, dry dock, types of breakwaters.	8	CO2

C. TEXT BOOKS

1. A text book of Railway Engineering - S C Saxena, S P Arora - Dhanpat Rai Publications (New Delhi) - 8th ed. - 2013.
2. Airport Engineering - S C Rangwala - Charotar Publishing House (Anand) - 17th ed. - 2019.
3. Harbour, Dock and Tunnel Engineering - R Srinivasan - Charotar Publishing House (Anand) - 30th ed. - 2022.

D. REFERENCE BOOKS

1. Railway Engineering - S Chandra, M M Agarwal - Oxford University Press (New Delhi) - 2nd ed. - 2013.
2. Airport Planning and Design - S K Khanna, M G Arora, S S Jain - Nem Chand Publication (Roorkee) - 6th ed. - 2017.
3. Docks and Harbour Engineering - H P Oza, G H Oza - Charotar Publishing House (Anand) - 8th ed.- 2016.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Understand different modes of transportation and their suitability.
CO2	Comprehension	Acquire knowledge on types and components of Railway Track, Airport, Docks and Harbours.
CO3	Comprehension	Understand the governing factors of site selection for construction of railway station and airport.
CO4	Analysis	Compare and select appropriate material for various components of railway track like rails, sleepers and ballast.
CO5	Design	Design the basic geometry of railway track, runway length and taxiway length.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	2	2	1	-	-	-	2	1	1	2
CO2	1	1	1	-	1	2	-	1	-	-	-	2	2	2	2
CO3	1	1	1	1	1	2	1	1	1	-	-	2	2	2	3
CO4	1	2	2	1	1	2	2	2	1	1	2	2	2	2	2
CO5	1	1	3	1	1	2	1	2	1	2	2	2	3	3	2
..															
Avg															

B. TECH. SEMESTER – V (CL)
SUBJECT: GEOTECHNICAL ENGINEERING - I

Teaching Scheme (Hours/Week)				Credit	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

A. COURSE OVERVIEW

To impart knowledge on the various factors governing the behaviour of soils, understand various index and engineering properties of soils and suitability of soils for various Geotechnical Engineering applications. Also, to characterize stress-strain behaviour of soils, the failure criteria and to evaluate the shear strength and compressibility parameters of soils.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**PHYSICAL GEOLOGY AND ORIGIN AND NATURE OF SOIL** Surface Process and Landforms, Weathering and Erosion, Introduction to geological agents (river, wind, oceans, glaciers, groundwater) and their actions, Basic introduction of earth and crust of earth, Formation of soil by various agents, residual soils, alluvial soils, marine and lacustrine soils, Loess, Till, Peat.	2	CO1
[2]	**SUBSURFACE INVESTIGATION** Planning soil exploration, Methods of exploration, Soil borings and methods, sampling, spacing and depth of borings, record of field investigation.	2	CO1
[3]	**IDEALIZED CONCEPT OF SOIL, PRELIMINARY DEFINITIONS AND RELATIONSHIPS** Soil, Its behavior, Types of problems in geotechnical engineering, Effective stress principle, Soil as a 3-phase system, Unit Weight, Water content, Specific gravity, Porosity, Void ratio, Degree of Saturation, Relative density.	4	CO2
[4]	**INDEX PROPERTIES OF SOIL** Grain size distribution, Effective size of particle, Stoke's law, Viscosity, Sedimentation analysis, Consistency of soils, Atterberg's Limit: Liquid Limit, Plastic Limit and Shrinkage Limit, Activity of clays, Sensitivity and Thixotropy of clays.	4	CO2
[5]	**CLASSIFICATION OF SOILS** Particle size classification, Textural classification, Highway Research Board (HRB) classification, Unified Soil Classification System (USCS), I.S. classification of soils.	3	CO3
[6]	**SOIL STRUCTURE AND CLAY MINERALOGY** Inter-particle forces, Single grained structure, Flocculent structure, Dispersed structure, Clay Minerals.	1	CO3
[7]	**SOIL WATER** Hygroscopic moisture, Capillary water, Gravitational water, absorbed water, Adsorbed water.	1	CO4
[8]	**PERMEABILITY AND SEEPAGE ANALYSIS** Introduction to permeability, Darcy's Law and its validity, Discharge and Seepage velocities, Laboratory determination of permeability, Fieldmethods of determination of k, Approximate values of the co-efficient of	7	CO4

	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.		
[9]	**STRESS DISTRIBUTION IN SOILS** 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	**4**	**CO5**
[10]	**COMPRESSIBILITY IN SOILS** Compressibility of soils, definition and mechanism, consolidation, types of consolidation, spring analogy, one dimensional consolidation test, Laboratory and theoretical time curves, compressibility parameters, Types of clays based on consolidation, consolidation settlement calculation for uniform pressure increment in clay layer, Derivation of Terzaghi's one dimensional consolidation equation, Time factor and consolidation ratio, time rate settlement calculation, solution to Terzaghi's one dimensional consolidation theory, Sand Drains.	**8**	**CO6**

C. TEXT BOOKS

1. Soil Mechanics and Foundation engineering - V.N.S Murthy - CBS Publishers & Distributors Pvt Ltd. (New Delhi). - 1st edition - 2007.

D. REFERENCE BOOKS

1. SP-36-1 - Compendium of Indian standards on Soil Engineering: Part-1 Laboratory testing of Soils for civil Engineering Purpose - BIS (New Delhi).
2. SP-36-2 - Compendium of Indian standards on Soil Engineering: Part-2 Field testing of Soils for civil Engineering Purpose - BIS (New Delhi).
3. Geotechnical and Foundation Engineering - Dr. A. K. Verma - Charotar Publishing House Pvt. Ltd (Gujarat) - 1st edition - 2021.
4. Soil Mechanics and Foundation Engineering - Dr. K. R. Arora - Standard Publishers Distributors (New Delhi) - 6th edition - 2003.
5. Soil Mechanics and Foundations by Dr. B. C. Punmia - Laxmi Publications (New Delhi) - 16th edition - 2005.
6. Physical and Geotechnical Properties of soils - Joseph E. Bowles - McGraw Hill Book Company (New Delhi) - 2nd edition - 1985.
7. Principles of Geotechnical Engineering - B.M. Das - Cengage Learning(Delhi) - 5th edition - 2012.

E. COURSE OUTCOMES

(Minimum 5 Cos are required)

CO Number	Skill	Statement
CO1	Understanding	Understand soil formation and Design, plan and execute various methods of boring, field tests and sampling techniques.
CO2	Comprehension	Determine index properties of soils.
CO3	Understanding	Understand classification and mineralogy of soils
CO4	Comprehension	Determine permeability and seepage properties of soils.
CO5	Evaluate	Evaluate stresses in soils.
CO6	Evaluate	Evaluate compressibility parameters of soils.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	3	3	1	3	3	3	2	3	3	2	3
CO2	3	1	1	3	3	1	1	3	3	1	1	3	3	2	3
CO3	3	1	1	3	3	1	1	3	3	1	1	3	1	2	3
CO4	3	1	1	3	3	1	1	3	3	1	1	3	3	2	3
CO5	3	1	1	3	3	1	1	3	3	1	1	3	3	2	3
CO6	3	1	1	3	3	1	1	3	3	1	1	3	3	2	3
Avg															

B. TECH. SEMESTER – V (CL)
SUBJECT: FLUID MECHANICS - II

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
04	01	0	05	05	60	40	-	-	100

A. COURSE OVERVIEW

The objectives of the course are to explain the students, concepts of open channel flow, laminar and turbulent flow and their applications in the civil engineering, dimensional analysis and its practical use in design of hydraulic structures. Various hydraulic machines like turbines and pumps.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**OPEN CHANNEL FLOW:** **(a) Introduction**: comparison between open channel flow and pipe flow; Types of channels; Classification of open channel flows; Velocity distribution in open channel flow. **(b) Energy – Depth – Relationships:** Specific energy; Critical depth; Transitions. **(c) Uniform flow:** Various uniform flow formulas; Uniform flow computations; Hydraulic efficient channel section; Compound sections. **(d) Gradually Varied Flow**: Dynamic equation of gradually varied flow; Classification of flow profiles; Control sections; Simple numerical solutions of GVF problems. **(e) Rapidly Varied Flow – Hydraulic Jump**: Introduction; Momentum equation for jump; Classification of jumps; Characteristics of jump in a rectangular channel; Jumps in Non-rectangular channels.	**24**	**CO1** **CO3** **CO5**
[2]	**FLOW IN PIPES:** Types of pipe flow; Reynolds's experiment; Chezy's formula, Manning's formula; Frictional loss and other minor losses in pipe flow; Total Energy Line and Hydraulic Gradient Line; Syphon and Rising Mains; Pipes in series and equivalent pipe; Pipes in parallel; Branched pipe.	**09**	**CO2** **CO4** **CO6**
[3]	**LAMNIAR FLOW IN PIPES:** Reynold's experiment; Navier – Stoke's equation; Laminar flow in circular pipes - Hagen - Poiseullie law; laminar flow between two parallel plates: Coquette's flow; Measurement of viscosity.	**06**	**CO2** **CO4** **CO6**
[4]	**TURBULENT FLOW IN PIPES:** Characteristics of turbulent flow; Shear stress in turbulent flow – Prandtl's mixing length theory; Universal velocity distribution equation; hydro-dynamically smooth and rough boundaries; Velocity distribution for turbulent flow in smooth and rough pipes; Nikuradse's experiments on artificially roughened pipes; Moody's diagrams; Stanton's curves; Aging of pipes; Friction factor in turbulent flow for smooth & rough pipes.	**06**	**CO2** **CO4** **CO6**
[5]	**BOUNDARY LAYER THEORY:** 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.	**03**	**CO2** **CO4**

C. TEXT BOOKS

1. Fluid Mechanics and Hydraulic Structures - Bansal, R. K. - Laxmi Publications (New Delhi) (P) Ltd. -11th ed. - 2019.

2. A Text Book of Fluid Mechanics - Rajput, R. K. - S Chand and Company (New Delhi) Ltd. - 6th ed. - 2019.
3. Flow in Open Channel - Subramanya, K. - Mc-Graw Hill Publications (India) (P) Ltd. - 5th ed. - 2019.
4. Open Channel Flow - Madan Mohan Das - PHI Learning (Delhi) Pvt. Ltd. - 2009.

D. REFERENCE BOOKS

1. Fluid Mechanics & Hydraulic Machines - Modi, P. N. & Seth S. M - Standard Book House (New Delhi) - 22nd ed. - 2019.
2. Fluid Mechanics and Machinery - Raghunath. H. M - CBS Publisher (New Delhi) Pvt. Ltd. - 1987.
3. Flow Through Open Channels - Srivastava R. - Oxford University Press (Noida). - 1st ed. - 2008.
4. Open Channel Hydraulics - Chow, V. T. - Black Burn Press (Kolkata). - 2009.
5. Fluid Mechanics - Kumar. D. S. - S. K. Kataria & Sons (New Delhi). - 1st ed. - 2009.
6. Theory and Applications of Fluid Mechanics - Subramanya. K. - Mc-Graw Hill Education (New Delhi) Pvt. Ltd. - 1st ed. - 2003.
7. Fluid Mechanics - White. F. M. - Mc-Graw Hill Education (New Delhi) Pvt. Ltd. - 9th ed. - 2022.
8. Engineering Fluid Mechanics - Garde. R. J. & Mirajgaoker. A. C. - Scitech Publications (Chennai) Pvt. Ltd. - 1st ed. - 2010.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Understand the classification of open channel flow; Specific energy and critical depth; Uniform flow; Hydraulically efficient channel cross-section; Compound Channels; Transitions; Gradually Varied Flow; Classification and analysis of flow profiles; Hydraulic jump.
CO2	Comprehension	Understand various losses in pipe flow; Pipes in series and parallel; Equivalent pipe; Laminar flow in Pipes; Laminar flow between two parallel plates; Turbulent flow in Pipes; Hydrodynamically smooth and rough boundaries; Boundary layer theory.
CO3	Evaluate	Calculate critical depth and specific energy; kinetic energy correction factor and momentum correction factor; various parameters in uniform flow, gradually varied flow and Rapidly Varied Flow in open channel; Length of water surface profiles.
CO4	Evaluate	Determine Frictional loss and other minor losses in pipe flow; Determine viscosity by various methods; Determine discharge in the pipe for pipes in series and in parallel; Flow in equivalent pipe; Flow in branched pipe; Determine shear friction velocity, wall shearstress, Height of roughness elements, coefficient of friction; Determine boundary layer thickness and drag force.
CO5	Application	Apply Open channel flow theory to determine various parameters of uniform flow, gradually varied flow; various parameters of Hydraulic jump; Design of Transitions; Find most efficient channel cross-section.
CO6	Application	Apply pipe flow theory to find out various parameters of pipe flow, to draw Hydraulic Gradient Line and Total Energy Line; Design of syphon; Power requirements of pump; Laminar flow theory to determine fluid viscosity.

G. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	.	.
CO1	-	-	-	1	1	1	-	1	3	2	1	2	-	2	1		
CO2	-	1	-	1	3	-	1	1	2	2	-	2	-	2	2		
CO3	2	2	2	-	2	-	-	-	3	1	-	2	2	2	3		
CO4	2	1	2	-	3	-	-	-	3	1	-	2	2	3	3		
CO5	2	2	2	-	2	-	1	2	2	2	-	2	2	2	2		
CO6	2	2	2	-	2	-	1	2	2	2	-	2	2	2	2		
..																	
Avg																	

B. TECH. SEMESTER – V (CL)
SUBJECT: CONCRETE TECHNOLOGY

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

A. COURSE OBJECTIVE

Objective of this course is to explain 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. By learning the quality of concrete in its fresh state and hardened state, students can design the concrete mix using admixtures by different methods.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**CEMENT** Introduction to Concrete, Composition of concrete, Overview of sustainability and concrete development. Manufacture of Ordinary Portland cement, Chemical composition and hydration mechanism of Cement, Properties of cement hydrates, Different types of cements- Properties, Composition and Applications, Physical & chemical test for cement as per IS :4031, IS:269.	05	CO1, CO4
[2]	**AGGREGATES** 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 curves, Fineness Modulus, Gap grading, Maximum Size of aggregates.	04	CO1
[3]	**ADMIXTURES** Water reducing admixtures, plasticizers, super plasticizers, Accelerators, Retarders, Air entraining agents, Mineral admixtures.	02	CO1
[4]	**FRESH CONCRETE** Workability – factors affecting workability, Measurement of workability, Segregation and bleeding of concrete, Batching, Mixing, Conveying, and Placing, compacting and curing of concrete.	04	CO2
[5]	**HARDENED CONCRETE** 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. Non-destructive testing – Rebound hammer, Ultrasonic pulse test.	07	CO2
[6]	**DURABILITY, CREEP AND SHRINKAGE OF CONCRETE** Elastic properties of concrete, Factors affecting modulus of elasticity, Dynamic and static modulus, Creep & Shrinkage of concrete. Durability : Factors affecting durability, Permeability of concrete, Sulphate attack Sea water attack, Carbonation and Corrosion induced cracking, Resistance of concrete to freezing and thawing conditions, Resistant to abrasion, erosion and cavitation.	06	CO3

[7]	**MIX DESIGN OF CONCRETE** Statistical quality control of concrete, concept of mix design, Specification of mix design, IS method for concrete mix design, Acceptability criteria, Variability of result.	**06**	**CO1, CO4**
[8]	**SPECIAL CONCRETE AND CONCRETING METHODS** 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, fibre-reinforced concrete, High density concrete.etc. Special concreting methods: Concreting in hot and cold weather, Ready mix concrete, and Pumped concrete.	**06**	**CO5**
		40	

C. TEXT BOOKS

1. Concrete Technology-M.S.Shetty -S.Chand Publishers(New Delhi)- 7th edition- 2013.
2. Properties of Concrete - A.M.Neville -Pearson education publication India(New Delhi)- 5th edition-2012

D. REFERENCE BOOKS

1. Concrete Technology-A.M.Neville & J.J.brooks -Pearson education publication-2nd edition-2019
2. Concrete-Microstructure, Properties and Materials- P.Kumar Mehta, P.J.M Monterio.-McGraw hill Publishers(New Delhi)- 4th edition-2017
3. Concrete Technology: Theory and Practice- M.L.Gambhir- McGraw hill Publishers(New Delhi)- 5th edition- 2005
4. IS 10262:2019-Indian Standard Code of Practice for Concrete Mix Proportioning.-BIS(New Delhi)
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)

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding, Applications	Understand basic constituents of the concrete and their applications w.r.t. sustainability approach. Assess the physical properties of ingredients of concrete.
CO2	Understanding, Applications, Analysis	Understand the properties of concrete in its fresh state and hardened state. Conduct the experiments on fresh concrete and carry out Destructive and Non-Destructive tests on hardened concrete.
CO3	Understanding, Application	Understand the durability, creep and shrinkage of concrete. Categorize the use of different ingredients of concrete in the field.
CO4	Application, Analysis, Creation	Design a concrete mix compatible with design stipulations. Categorize and optimize the use of different ingredients in the field.
CO5	Understanding, Application	Apply the knowledge of special concrete and concreting methods to the field.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	3	2	1	2	2	2	1	1	3	2	1
CO2	2	3	2	2	3	2	2	2	2	2	2	2	3	2	2
CO3	2	2	-	-	1	2	2	2	2	2	2	2	2	2	2
CO4	3	3	3	2	2	2	1	3	3	3	3	3	3	2	2
CO5	1	3	2	1	3	3	2	3	2	2	3	2	2	2	2
Avg															

B. TECH. SEMESTER – V (CL)
SUBJECT: DESIGN OF STRUCTURES-I (RCC)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	2	5	4.0	60	40	25	25	150

A. COURSE OVERVIEW

This course is to introduce the basic design philosophy and principles of concrete structure design. The course combines basic structural fundamentals and analysis methods into a single unified treatment and provides a background to understand the structural design methods in the design field. This course provides the concepts of design the various structural RCC elements using different design methods with application to structural engineering problems as per relevant Indian Standards.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction: Introduction to various design methods i.e. Working Stress Method, Ultimate Load Method and Limit State Method - Brief History and Comparison, Loading Standards as per BIS, Distribution of Loads, Wind Load and Earthquake forces, Combination of Loads	**2**	**CO1**
[2]	Limit State Design of RCC Beams Under Flexural and Shear: 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.	**12**	**CO1, CO2, CO3, CO4**
[3]	Limit State Design of RCC Flexural Slab Elements: Design One-way and Two-way slabs, Simply supported & Continuous slabs.	**9**	**CO1, CO2, CO3, CO4**
[4]	Limit State Design of RCC Compression Elements: Short Axial Columns with Uniaxial and Biaxial Bending, Practical provision on Reinforcement Detailing.	**8**	**CO3, CO4, CO5**
[5]	Limit State Design of Footings: Design of Axially loaded Isolated Footings, Isolated Footings with Uniaxial and Biaxial Bending and Combined Footing.	**9**	**CO3, CO4, CO5**

C. TEXT BOOKS

1. Design of R.C.C. Structures - Vol-I&II - H.J. Shah - Charotar Publication (Anand) - 12th edition - 2021.
2. Reinforced Concrete Design - Devdas Menon and S. Unnikrishna - Tata McGraw Hill Publication (New Delhi) - 4th edition - 2021.

D. REFERENCE BOOKS

1. Limit State Design of Reinforced Concrete - P.C. Varghese - PHI Publication (Delhi) - 2nd edition - 2013.
2. Reinforced Concrete Design - S. N. Sinha - Tata McGraw Hill Publication (New Delhi) - 3rd edition - 2017.
3. Reinforced Concrete Structural Elements – N. Krishnaraju - New Age International Pvt Ltd (Delhi) – 1st edition - 2016.
4. RCC Design (Reinforced Concrete Structures) - B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain - Laxmi Publications (New Delhi) - 11th edition - 2023.

5. IS 456 - 2000 - Plain and Reinforced Concrete - Code of Practice - BIS (New Delhi).
6. SP 24 - 1983 - Explanatory Handbook on Indian Standard Code of Practice for Plain and Reinforced Concrete Structures - BIS (New Delhi).
7. SP 34 - 1987 - Handbook on Concrete Reinforcement and Detailing - BIS (New Delhi).
8. SP 16 -1980 - Design aids for Reinforced Concrete - BIS (New Delhi).

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding	To understand various design methods of structures and brief history.
CO2	Design	Design of RCC flexural & shear members using Limit state method.
CO3	Design	Design and detailing of various RCC structural elements as per Indian code guidelines.
CO4	Application	Apply the principles, procedures and current Indian code requirements to design structural elements.
CO5	Design	Design of RCC compression member and footing of structures using limit state method.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	1	-	-	1	1	1	1	2	2	2	1
CO2	3	2	3	1	3	1	1	2	2	3	2	3	3	3	2
CO3	2	2	2	1	2	1	-	2	2	1	1	2	3	2	2
CO4	2	2	3	1	2	1	2	1	2	1	1	2	3	3	1
CO5	3	3	3	1	3	1	1	3	2	2	1	3	3	3	2
..															
Avg															

B. TECH. SEMESTER –V (CL)

SUBJECT: ADVANCED CONSTRUCTION TECHNIQUES (PROGRAM ELECTIVE – I)

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

A. COURSE OVERVIEW

The objective of this course is to create awareness about advanced construction practices of heavy structures under various conditions and to gain knowledge of various construction equipment and construction methodologies and their selection criteria.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**CONSTRUCTION EQUIPMENT** Introduction, Standard equipment and special equipment, Factors affecting selection of equipment, excavating equipment, hoisting equipment, compacting equipment, hauling equipment, grading equipment, concreting equipment, economic analysis of equipment, financial comparisons of alternatives	7	CO1, CO5
[2]	**CONCRETE CONSTRUCTION FOR HEAVY ENGINEERING PROJECTS** Selection of equipment for batching, mixing, transporting, placing and compacting for various types of jobs, safety measures during concreting, concreting under water, concreting in different weather condition.	4	CO5
[3]	**CONSTRUCTION OF DEEP FOUNDATION** Pile foundation: Type, use and selection, construction process, pile hammer Caisson: Classification, use and selection criteria of caissons,transportation, launching and sinking of various caissons, Construction problems	6	CO4, CO5
[4]	**PREFABRICATED CONSTRUCTION** Planning for pre-casting, selection of equipment for fabrication, transport and erection, quality measures, safety measure during erection.	4	CO2, CO5
[5]	**BRIDGE AND TUNNEL CONSTRUCTION** Bridge construction: Types, Methods – in-situ and precast construction methods, balanced cantilever methods, span-by-span method, incremental launching method Tunnel construction: Site investigation and geological studies, drilling, pneumatic breakers, explosives, blasting, Tunnel boring machine	6	CO2, CO5
[6]	**STEEL CONSTRUCTION** Planning for field operation, selection of equipment and erection tools and methods of welding, tools, and methods of cutting and joining, safety measures during fabrication and erection.	3	CO2, CO5
[7]	**TEMPORARY STRUCTURE AND WORK** Cofferdam: Type, use and selection of Cofferdam, leakage problems Scaffolding: Types, erection process Shoring for excavation: excavation support systems- Diaphragm wall, Soil nailing etc., timbering of trenches, Construction methodologies, Advantages & Uses Shoring for structures: Vertical Shoring, Horizontal Shoring, Inclined Shoring, Underpinning Groundwater control during excavation, Selection Criteria, Various	7	CO3, CO5

NO	TOPIC	L+T (hrs)	COs
	methods: Sump, Bore-well, well points, Electro osmosis, Grouting, Freezing, shotcrete etc. Formwork: Requirement of formwork, loads carried by formwork, types of formworks such as timber formwork, Steel formwork, patent formwork, modular shuttering, slip forms, steel scaffolding, Formwork for beam, column and slab.		
[8]	**DEMOLITION OF STRUCTURES** Demolition, taking down, dismantling methods, safety measures	3	CO5

C. TEXT BOOKS

1. Construction Planning, Equipment and Methods - R.L. Peurifoy, C. L. Schexnayder, R. L. Schmitt, A. Shapira - Tata McGraw Hill Education Pvt. Ltd. (New Delhi) - 9th Edition - 2018

D. REFERENCE BOOKS

1. Advanced Construction Technology - R. Chudley, R. Greeno, M. Hurst, S. Topliss - Pearson Education Limited (Harlow) - 5th Edition – 2012
2. Construction Equipment and Its Management - S. C. Sharma, - Khanna Publishers (New Delhi) - 6th Edition – 2008
3. Precast concrete – Materials, manufacture properties and usage - M. Levitt - Applied Science - Taylor & Francis Ltd. (London) - 2nd Edition – 2019
4. Formwork for concrete structures - K. N. Jha - McGraw Hill Education India (New Delhi) - 1st Edition – 2017
5. Building Construction Handbook - R. Chudley & R. Greeno - Butterworth-Heinemann (Oxford) - 6th Edition – 2006
6. Technological innovation in underground construction - G. Beer - CRC Press (London) - 1st Edition – 2009
7. Advanced construction techniques & equipment - M. Samal - S. K. Kataria & Sons (New Delhi) - 1st Edition - 2022

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Analysis	Identify and compare suitable alternative construction equipment for any activity
CO2	Application	Choose suitable construction techniques for bridge and tunnel construction, prefabricated construction and steel structures.
CO3	Application	Select appropriate temporary structures and work for construction project
CO4	Application	Supervise construction of deep foundation for heavy construction work
CO5	Creation	Prepare method statements for large and heavy construction projects

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	1	2	3	2	3	3	2	3	2	2	3	3
CO2	1	1	3	1	1	3	2	3	3	2	3	2	2	3	2
CO3	1	2	3	1	1	3	2	3	3	2	3	2	2	3	2
CO4	1	1	2	-	-	3	2	3	3	3	3	2	2	3	1
CO5	2	1	2	-	2	2	1	3	3	3	3	3	1	3	2
Avg															

B. TECH. SEMESTER – V (CL)
SUBJECT: ADVANCED STRUCTURAL ANALYSIS (PROGRAM ELECTIVE-I)

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

A. COURSE OVERVIEW

To understand advanced analysis of indeterminate structures and adopt an appropriate structural analysis technique and Determine response of structures by classical and matrix methods.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**Plastic Method:** Plastic hinge concept, Shape factor, Static and kinematic method for beams and frames with portal and sway mechanism	08	CO1
[2]	**Matrix methods (Member Approach)** Stiffness Member Approach for Beams problem	10	CO2
[3]	**Approximate Methods.** Portal Method and Cantilever Method	06	CO2
[4]	**Column Analogy Method**	04	CO3
[5]	**Beams Curved in Plan and Elevation**	04	CO4
[6]	**Analysis of Spherical and Conical Domes**	04	CO5
[7]	**Unsymmetrical bending, z – polygon and shear centre**	04	CO6

C. TEXT BOOKS

1. Structural Analysis-Devdas Menon-Narosa Publishing House (New delhi) 2nd Edition-2017

D. REFERENCE BOOKS

1. Indeterminate Structural Analysis-Kinney J.S- Addison-Wesley Educational Publishers-(USA)-1957
2. Structural Analysis-Thandavamoorthy-T. S.-Oxford University Press (New Delhi)-1st Edition-2011
3. Structural Analysis A Unified Classical and Matrix Approach -A Gali, A M Neville, T G Brown-CRC Press (Florida)-6th edition-2009
4. Matrix Analysis of Framed Structures-W. Gere and weaver-springer publications (UK)-1990
5. Statically Indeterminate Structures-Wang C.K-McGraw-Hill publications (New Delhi)-1995

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the Plastic moment, shape factor and development of plastic hinges.
CO2	Analyse	Analyse ends moment and reactions of structure.
CO3	Determine	Analyse beam using column Analogy method

CO4	Analyse	Analyse the behaviour of Beams Curved in Plan
CO5	Analyse	Evaluate the stresses in the Spherical and Conical Domes
CO6	Understand	Explain unsymmetrical bending and shear centre

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	1	1	3	1	1	2	3	3	3
CO2	3	3	3	3	3	3	1	2	3	1	1	2	3	3	3
CO3	3	3	3	3	3	3	1	2	3	1	1	1	3	3	3
CO4	3	2	3	3	3	3	2	1	3	1	1	2	3	3	3
CO5	3	2	3	2	3	3	2	1	3	1	1	2	3	3	3
CO6	3	2	3	2	3	3	1	1	3	1	1	1	3	3	3
Avg															

B. TECH. SEMESTER –V (CL)
SUBJECT: BUILDING SERVICES AND SAFETY (PROGRAM ELECTIVE-I)

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

A. COURSE OVERVIEW

The objective of this course is to provide information about various building services and safety measures and impart knowledge about various building services.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**INTRODUCTION** Importance, problems of maintenance and repairs, role of building maintenance in construction process, expression of standards, selection of level of maintenance and fixing standards, maintenance cycle, maintenance profile.	3	CO1
[2]	**PLUMBING SYSTEM** Water storage and distribution, heating methods, dual plumbing, pipe fittings, maintenance of plumbing system. Drainage system: components, types and design, Safety measures, piped gas supply system	7	CO1, CO2
[3]	**ELECTRIFICATION OF BUILDING** Electrical system installations, electrical control and safety devices, Electrical wiring systems. Factors affecting illumination in building, modern theory of light and colour, synthesis of light, Luminous flux, utilization factor, artificial light sources, types of energy efficient lamps.	7	CO1, CO3
[4]	**HEAT, VENTILATION AND AIR CONDITIONING (HVAC)** Importance, components, design consideration, planning of HVACsystems, basic psychrometry, air conditioning process & system. Methods of Air Conditioning, Problems	7	CO1, CO4
[5]	**MECHANICAL SERVICES IN BUILDING** Lift: Types, sizes and capacity, speed, mechanical safety method, installation requirements, design criteria. Escalators and Travellators: Types, uses, safety method	7	CO1, CO4
[6]	**FIRE SAFETY SYSTEM** Causes of fire, fire resistance materials, safety regulations, heat and smoke detectors, firefighting devices and systems, fire escapes.	5	CO5
[7]	**BUILDING SECURITY AND AUTOMATION** Need, types and concept of smart building automations	4	CO5

C. TEXT BOOKS

1. Handbook of Designing and Installation of Services in High Rise Building Complexes - V. K. Jain - Khanna Publishers (New Delhi) - 3rd Edition - 2022

D. REFERENCE BOOKS

1. Fire Safety in Buildings - V. K. Jain - New Age International Ltd. Publishers (New Delhi) - 3rd Edition - 2021
2. Building Services - G. Hassan - Palgrave Macmillan (New York) - 1st Edition – 1996

3. Building Services, Technology and Design - R. Greeno - Routledge publication (New York) - 1st Edition – 2014
4. Building Services Handbook - F. Hall & R. Greeno - Butterworth-Heinmann (Oxford) - 4th Edition – 2007
5. Electrical Safety, fire safety Engineering and Safety Management - S. S. Rao, R. K. Jain, H. L. Saluja - Khanna Publishers (New Delhi) - 2nd Edition - 1997

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding	Understand the role of building services and required safety measures in a building
CO2	Application	Choose water supply and drainage system in a building
CO3	Application	Apply electrical and lighting system in a building
CO4	Application	Select appropriate mechanical services and HVAC system
CO5	Application	List appropriate safety and security system in a building

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	1	3	2	3	2	2	2	3	1	2	2
CO2	1	1	2	2	2	3	3	3	3	3	2	3	2	2	2
CO3	1	1	2	2	2	3	3	3	3	3	2	3	2	2	2
CO4	1	1	2	2	2	3	3	3	3	3	2	3	2	2	2
CO5	1	-	1	-	2	2	2	3	2	3	1	2	1	1	1
Avg															

B. TECH. SEMESTER – V
SUBJECT: DISASTER MANAGEMENT (OPEN ELECTIVE-1)

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

A. COURSE OVERVIEW

This course addresses all stages of disaster management in a comprehensive and holistic manner including pre- disaster preparedness and mitigation, rescue and relief in the context of disaster and post disaster rehabilitation, reconstruction and recovery.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**INTRODUCTION:** Disaster: Definition, Factors and Significance, Difference between Hazard and Disaster, Natural and Manmade Disasters.	**07**	**CO1**
[2]	**ROLE OF NGO, GOVERNMENT BODIES AND PUBLIC** Social and Economic Development of Disaster-Prone areas – Emergency Planning.	**05**	**CO2**
[3]	**DISASTER PREPAREDNESS AND MANAGEMENT** Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard, Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.	**08**	**CO2** **CO3**
[4]	**RISK ASSESSMENT** Disaster Risk: Concept and Elements, Disaster Risk Reduction, Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.	**08**	**CO4**
[5]	**DISASTER REDUCTION STRATEGIES AND MITIGATION** Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.	**07**	**CO3**
[6]	**VARIOUS CASE STUDIES** Examples of cyclone disaster management, Fire Disaster Management, Industrial disaster management, Medical disaster management and earthquake disaster management.	**05**	**CO5**

C. REFERENCE BOOKS

1. Disaster Management in India: Perspectives, Issues and Strategies - Singh A. K. and Rai Nishith -New Royal Book Company (New Delhi) – 1st Edition - 2007.
2. Disaster Administration and Management - Goel S.L. - Deep and Deep Publications (New Delhi) -1st Edition - 2007.
3. Citizen's Guide to Disaster Management: How to Save Your Own Life and Help Others -Modh Satish - Macmillan Publishers India (New Delhi) - 1st Edition - 2006.
4. Disaster Mitigation Experiences and Reflections - Sahni Pardeep, Alka Dhameja and Uma Medury - PHI Learning Pvt. Ltd. (New Delhi)-1st Edition - 2010.
5. Disaster Management in India, Ministry of Home Affairs - Government of India (New Delhi).

D. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Identify the various features of natural and manmade disaster and safety measures for them.
CO2	Analysis	Formulate the structure of disaster management (NDMA and GSDMA).
CO3	Analysis	Design mitigation preparedness, early warning system for various disasters.
CO4	Analysis	Evaluate disaster management plan for any system.
CO5	Analysis	Explain various disaster plan and apply the knowledge in field.

E. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		.
CO1	3	2	2	1	1	2	2	1	1	1	2	2	1	2	2		
CO2	2	3	2	2	1	2	1	1	1	1	1	1	2	2	1		
CO3	3	2	3	2	1	1	2	1	1	1	3	1	3	3	2		
CO4	3	2	3	2	1	2	2	1	1	1	2	1	3	3	2		
CO5	2	3	2	1	2	3	3	1	1	1	2	2	3	2	1		
Avg																	

B. TECH. SEMESTER – VI (CL)
SUBJECT: ENVIRONMENTAL ENGINEERING: II

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

A. COURSE OBJECTIVE

Objective of this course is to explain basic concepts of wastewater engineering and Solid waste management. By analyzing waste water, municipal waste water treatment plant units can be designed and managed.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**CHARACTERISTICS OF WASTEWATER** Physical, Chemical & Biological Characteristics of wastewater and their significance, Decomposition of sewage, Bio-chemical oxygen demand, chemical oxygen demand, B.O.D. Test, sampling.	07	CO1
[2]	**SEWERAGE SYSTEM DESIGN** Quantity of wastewater, classification of wastewater, Sewerage system for domestic wastewater, Collection and Conveyance of wastewater-Sewer types and appurtenances, Velocity in sewer, Construction and maintenance of sewer, Design of a simple sewerage system.	06	CO2
[3]	**WASTE-WATER TREATMENT** Objectives, Treatment methods- Physical unit operations and Biological processes. Physical unit operations : Screening, grit removal, Sedimentation : Types and Design, Biological Processes: Suspended Growth Process- Activated sludge process, Modifications in ASP, Design Example of Activated sludge process Attached growth processes- trickling filters, Design Example of Trickling filter, Waste stabilization ponds, Basics of Anaerobic digestion, Process biochemistry of sludge digestion.	14	CO3, CO4
[4]	**SLUDGE TREATMENT & WASTEWATER DISPOSAL** Importance of sludge management, Quantity & quality of sludge, Methods of sludge treatment, : Sludge digestion and drying beds, Low cost sanitation systems, Natural Methods of Wastewater disposal – Self-purification of streams, Dilution into Sea, Disposal by land treatment.	06	CO4
[5]	**MUNICIPAL SOLID WASTES** Types, Sources and Composition of solid waste, Methods of collection, Transportation and Disposal.	07	CO5

C. TEXT BOOKS

1. Water supply and Sanitary Engineering-Birdie G.S & Birdie J.S- Dhanpatrai Publishing(New Delhi) , 9th edition- 2014.
2. Wastewater Engineering-: Treatment and Reuse- Metcalf and Eddy -Tata McGraw Hill publication(Singapore)- 4th edition -2003

D. REFERENCE BOOKS

1. Introduction to Environmental Engineering-Davis M.L and Cornwell D.A-Tata McGraw Hill publication(New York)- 5th edition- 2017
2. Environmental Engineering-Peavy, Rowe, Tchobanoglous -McGraw Hill Publication(Singapore)- 1st edition-2017.
3. Water & Wastewater Engineering-Steel & MgZee-Tata Mcgraw Hill publication(New York)- 2003.
4. Handbook of Solid Waste management- Tchobanoglous, G. & Kreith, F.- Tata Mcgraw Hill publication(Singapore)-2002
5. Manual on Sewerage and Sewage Treatment System- Central Public Health and Environmental Engineering Organization (CPHEEO)- Ministry of Urban Development, Govt. Of India(New Delhi)- 3rd edition-2013.
6. Manual on Municipal Solid Waste Management- Central Public Health and Environmental Engineering Organization (CPHEEO)- Ministry of Urban Development- Govt. Of India(New Delhi)- 2000.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding, Assessment	Understand and Evaluate characteristics of wastewater.
CO2	Understanding, Application, Analysis	Evaluate types of sewer in sewerage system based on wastewater generation and flow and design an applicable Sewerage system.
CO3	Analysis, Evaluation, Creation	Distinguish various Physical unit operations and processes with design applications.
CO4	Understanding, Application, Analysis, Evaluation	Understand the concept of Biological treatment and removal mechanisms and apply it in the design of Suspended and Attached growth systems, Sludge management and disposal techniques.
CO5	Understanding, Application	Illustrate the concept of municipal solid waste management.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	3	3	3	2	2	1	1	1	2	2	2
CO2	2	1	2	-	1	3	3	3	2	2	2	2	2	3	3
CO3	2	2	3	1	3	3	3	3	3	2	2	2	2	3	2
CO4	2	2	3	-	3	3	3	3	2	2	2	2	2	3	2
CO5	1	-	1	-	1	3	3	3	1	1	1	1	1	1	1
Avg															

B. TECH. SEMESTER – VI (CL)
SUBJECT: GEOTECHNICAL ENGINEERING - II

Teaching Scheme (Hours/Week)				Credit	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	25	25	150

A. COURSE OVERVIEW

To acquire knowledge for shear strength and compaction in soil. Evaluation of stability of slope and earth pressure in soils. Understand the need of foundation and determine bearing capacity of shallow foundation and pile foundation. Also, understand the basic properties of rock.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**COMPACTION** 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.	3	CO1
[2]	**SHEARING RESISTANCE AND STRENGTH** 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.	4	CO1
[3]	**EARTH PRESSURE** Active and Passive earth pressure due to backfill, Earth pressure at rest, Rankine's earth pressure theory, Coulomb's earth pressure theory, Coulomb's graphical method to find active and passive earth pressure	5	CO2
[4]	**STABILITY OF SLOPES** 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 center of most critical failure rupture, Taylor's Stability Number, Ordinary method of slice	6	CO3
[5]	**NEED OF FOUNDATION** Need of Study, General aspects to be considered in foundation selection and design, Different types of footings, Difference between shallow foundation and deep foundation, Factors governing the choice of foundation type, General requirements of satisfactory performance of foundation.	2	CO4
[6]	**BEARING CAPACITY OF SHALLOW FOUNDATIONS** Basic Terminologies, Modes of shear failures, bearing capacity theories (Shear criteria): Terzaghi's, IS code from Standard Penetration Test, Calculation of Total settlement: Immediate, consolidation.	9	CO4, CO5
[7]	**PILE FOUNDATIONS** Introduction, Classification of Pile, Load transfer mechanism, Method of determining axial load carrying capacity of single pile: Static equation as per IS-2911, Pile Load Test.	5	CO6
[8]	**ROCK MECHANICS** Geotechnical Investigation in Rocks, Methods of rock exploration, Core drilling and core recovery, R.Q.D., Geological and Engineering	2	CO6

	classification of rocks, Important physical and mechanical properties of rocks and their methods of testing in laboratory. Outlines of Seismic and Resistively methods.		

C. TEXT BOOKS

1) Soil Mechanics and Foundation engineering - V.N.S Murthy - CBS Publishers & Distributors Pvt Ltd. (New Delhi) - 1st edition - 2007.

D. REFERENCE BOOKS

1) SP-36-1 - Compendium of Indian standards on Soil Engineering: Part-1 Laboratory testing of Soils for civil Engineering Purpose - BIS (New Delhi).
2) SP-36-2 - Compendium of Indian standards on Soil Engineering: Part-2 Field testing of Soils for civil Engineering Purpose - BIS (New Delhi).
3) IS 6403 - 1981 - Determination of Bearing Capacity of Shallow Foundations - BIS (New Delhi).
4) IS 8009 (Part 1) - 1976 : Determination of Settlement of Shallow Foundations - BIS (New Delhi).
5) IS 2911 (Part 1-Sec 2) - 2010 : Design and Construction of Bored Cast In-situ concrete piles - BIS (New Delhi).
6) Physical and Geotechnical Properties of soils - Joseph E. Bowles - McGraw Hill Book Company (New Delhi) - 2nd edition - 1985.
7) Geotechnical and Foundation Engineering - Dr. A. K. Verma - Charotar Publishing House Pvt. Ltd (Gujarat) - 1st edition - 2021.
8) Soil Mechanics and Foundation Engineering - Dr. K. R. Arora - Standard Publishers Distributors (New Delhi) - 6th edition - 2003.
9) Soil Mechanics and Foundations by Dr. B. C. Punmia - Laxmi Publications (New Delhi) - 16th edition - 2005.
10) Principles of Geotechnical Engineering - B.M. Das - Cengage Learning(Delhi) - 5th edition - 2012.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Evaluate	Determine strength parameters of soil
CO2	Evaluate	Evaluate Lateral earth pressure in soil.
CO3	Analyze	Analyze stability of slopes.
CO4	Understanding	Understand basic terminologies and need of foundation and design shallow foundation based on shear criteria.
CO5	Application	Design shallow foundation based on settlement criteria.
CO6	Application	Design of pile foundation and understand basic properties of rock.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	3	3	1	1	3	3	1	1	3	3	2	3
CO2	3	1	1	3	3	1	1	3	3	1	1	3	3	3	3
CO3	3	1	1	3	3	1	1	3	3	1	1	3	3	3	3
CO4	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3
CO6	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3
Avg															

B. TECH. SEMESTER – VI (CL)
SUBJECT: WATER RESOURCE ENGINEERING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	0	0	03	03	60	40	-	-	100

A. COURSE OVERVIEW

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 means of measurement of precipitation, analysis of rainfall data, different types of water losses, run-off process, uses of hydrograph in water resources, stream gauging, sub-surface hydrology, Importance floods in water resources and flood frequency studies.

B. COURSE CONTENT

NO	TOPIC	L + T (hrs)	COs
[1]	**INTRODUCTION** Hydrologic cycle; History of hydrology, Scope and application of hydrology; Hydrologic equation.	2	CO1
[2]	**PRECIPITATION** 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	7	CO1 CO3 CO4
[3]	**WATER LOSSES** (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	6	CO1 CO4
[4]	**RUN-OFF** 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.	4	CO2 CO4 CO5
[5]	**HYDROGRAPH ANALYSIS** 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 fromflood Hydrograph; Altering Duration of Unit Hydrograph; Unit Hydrograph from complex storms; S - hydrograph; Instantaneous unit hydrograph; Synthetic unit hydrograph.	6	CO2 CO3 CO5
[6]	**GROUND WATER** Types of aquifers; Well Hydraulics; Cavity Wells; Spacing of Wells;	5	CO2

NO	TOPIC	L + T (hrs)	COs
[7]	**FLOODS** 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.	6	CO2 CO3

C. TEXT BOOKS

1. Engineering Hydrology - Subramanya, K. - Mc-Graw Hill Publications (New Delhi) (P) Ltd. - 5th ed. - 2022.
2. A Text Book of Hydrology - JayaRami Reddy, P. - Laxmi Publication (New Delhi) (P) Ltd. - 3rd ed. - 2016.
3. Applied Hydrology - Mutreja, K.N. - Mc-Graw Hill Publications (New Delhi) (P) Ltd - 1996.

D. REFERENCE BOOKS

1. A Text Book of Hydrology and Water Resources Engineering - Sharma, R.K., and Sharma, T.K. - DhanpatRai Publications (New Delhi) (P) Ltd. - 5th ed. - 2000.
2. Water Resources Engineering - Larry W. Mays - Wiley India (New Delhi) Pvt. Ltd. - 2nd ed. - 2011.
3. IS 4987: 1994 - Recommendations for Establishing Net Work of Rain Gauge Stations - Bureau of Indian Standards (New Delhi).
4. IS 4986: 2002 - Installation of Rain Gauge (Non-Recording Type) and Measurement of Rain - Code of Practice - Bureau of Indian Standards (New Delhi).
5. IS 1192: 1981 - Velocity – Area methods for measurement of flow of water in open channels - Bureau of Indian Standards (New Delhi).
6. IS 3918: 1966 - Code of practice for use of current meter (cup type) for water flow measurement - Bureau of Indian Standards (New Delhi).
7. IS 5973: 1970 - Pan Evaporimeter - Bureau of Indian Standards (New Delhi). (Amendment no.3) (Reaffirmed 1990).
8. IS 6509: 1971 - Recommendation for liquid flow measurement in open channels by weirs and flumes – weirs of finite crest width for free discharge - Bureau of Indian Standards (New Delhi). (Reaffirmed 1990).
9. IS 6062: 1971 - Method of Measurement of Flow of Water in Open Channels Using Standing Wave Flume-fall - Bureau of Indian Standards (New Delhi). (Reaffirmed 1989).
10. IS 6063: 1971 - Method of measurement of flow of water in open channels using standing wave flume - Bureau of Indian Standards (New Delhi). (Reaffirmed 1989).
11. IS 6939: 1992 - Methods for determination of evaporation from reservoirs - Bureau of Indian Standards (New Delhi).
12. IS 8389: 2003 - Installation and Use of Rain gauges, Recording - Code of Practice - Bureau of Indian Standards (New Delhi).
13. Handbook of Hydrology - Maidment R.D. - McGraw-Hill Professional (Ontorio). - 1st ed. - 1992.
14. Handbook of Applied Hydrology - Singh P.V. - McGraw-Hill Professional (Ontorio). - 2nd ed. – 2016.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Understand hydrologic cycle, different types of precipitation, run- off process, Analysis of rainfall data, different types of water losses, moving averages curves.
CO2	Comprehension	Understand various types of stream gauging methods, stage-discharge relationship, hydrographs, importance of floods in water resources, encounter probability, groundwater development and management.
CO3	Design and analysis	Analysis of rainfall data, double mass curve analysis, hydrograph analysis, depth-area-duration analysis, flood frequency analysis
CO4	Evaluate	Calculate mean precipitation depth over a catchment, estimate various types of water losses from a basin, estimate peak flood for a given basin, estimate run-off from a catchment, estimating missing rainfall data.
CO5	Application	Apply hydrograph theory to derive unit hydrograph from flood hydrograph, flood hydrograph from unit hydrograph, to change duration of unit hydrograph, apply encounter probability method to determine probability of occurrence and non-occurrence of storm; apply stream gauging theory to estimate discharge in a stream by various methods.

G. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	.	.
CO1	-	-	1	1	2	2	1	1	3	3	1	2	1	1	2		
CO2	1	1	-	1	2	-	-	1	3	2	-	2	1	2	2		
CO3	2	2	-	-	2	-	-	1	2	2	-	2	2	2	2		
CO4	1	1	-	-	2	1	1	1	2	1	-	2	2	3	2		
CO5	2	2	1	-	1	1	1	1	3	1	2	2	2	2	2		
..																	
Avg																	

B. TECH. SEMESTER – VI (CL)
SUBJECT: ADVANCED CONCRETE TECHNOLOGY

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	---	125

A. COURSE OBJECTIVE

Objective of this course is to explain various techniques and practices on microstructure of cement paste, concrete and Special Concrete and careful selection of suitable construction materials and their mix proportions to satisfy performance criteria of structure. By learning the quality of concrete in its fresh state and hardened state, Student can design the concrete mix using admixtures by different methods

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**CEMENT HYDRATION AND CHEMISTRY** Hydration, Chemistry and microstructure of cement paste, Special cement	07	CO1, CO3
[2]	**MICROSTRUCTURES OF CONCRETE** Interfacial transition zone, Structure-property relationships.	04	CO1, CO2
[3]	**CHEMICAL AND MINERAL ADMIXTURES IN CONCRETE** Water reducing admixtures, plasticizers, super plasticizers, Accelerators, Retarders, Air entraining agents, water proofing agents,- Types, Mechanism, Application	05	CO1, CO5
[4]	**PROPERTIES OF HARDENED CONCRETE** Strength, Stress- strain behaviour, Dimensional stability, Fracture Mechanics and concrete failure mechanism	05	CO2
[5]	**CONCRETE MIX PROPORTIONING** Concept of mix design, Performance based mix design approaches	04	CO3
[6]	**DURABILITY** Physical deterioration (abrasion, erosion, cracking) Chemical attack (sulfates/seawater/acid), Corrosion, Durability improvement measures.	03	CO2
[7]	**TESTING AND QUALITY ASSURANCE OF CONCRETE** Testing of fresh concrete, Destructive and non-destructive evaluation of hardened concrete, statistical quality control.	04	CO5
[8]	**SPECIAL CONCRETE** Self-Compacting concrete, Ultra High strength and High-Performance Concrete, Geopolymer concrete, 3-D printable concrete, Recent advancements	08	CO4

C. TEXT BOOKS

1. Concrete -Microstructure, Properties and Materials-P.Kumar Mehta, P.J.M Monterio.- McGraw hill Publishers(New Delhi)-4th edition- 2017
2. Properties of Concrete - A.M.Neville -Pearson education publication India(New Delhi)- 5th edition-2012

D. REFERENCE BOOKS

1. Concrete Technology-A.M.Neville & J.J.brooks -Pearson education publication-2nd edition-2019
2. Concrete Technology-M.S.Shetty-S.Chand Publishers(New Delhi)- 7th edition–2013
3. Concrete Technology: Theory and Practice- M.L.Gambhir- McGraw hill Publishers(New Delhi)-5th edition- 2005
4. IS 10262:2019-Indian Standard Code of Practice for Concrete Mix Proportioning.-BIS(New Delhi)
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)

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding Applications	Understand properties of micro-structure of the cement paste and concrete.
CO2	Understanding Applications Analysis	Understand the durability and properties of hardened concrete.
CO3	Creation Analysis	Design a concrete mix compatible with design stipulations.
CO4	Understanding Applications	Apply the knowledge of special concrete, Modern concrete and concreting methods to the field.
CO5	Understanding Application Analysis	Determine compressive strength using Destructive and Non-Destructive methods and flexural strength by destructive method.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	2	1	1	1	2	2	1	1	1	2	-
CO2	2	2	1	2	2	1	1	2	2	2	2	2	2	2	1
CO3	2	2	3	2	2	2	1	2	3	3	2	2	3	2	2
CO4	2	2	2	1	3	2	1	3	3	3	2	2	3	2	2
CO5	3	3	2	2	2	2	1	3	2	2	2	2	3	2	2
Avg															

B. TECH. SEMESTER – VI (CL)
SUBJECT: ADVANCED SURVEYING (PROGRAMME ELECTIVE-II)

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

A. COURSE OVERVIEW

Subject covers fundamentals and applications of advanced surveying techniques like Setting out methods of curve on field, hydrographic surveying, Field astronomy and its applications, Geodetic surveying along with GIS, GPS and remote sensing and aerial photogrammetric survey.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Setting Out of Curves: Setting out methods of horizontal curves: Linear and Angular methods; Setting out of vertical curves using tangent correction method.	7	CO3
[2]	Hydrographic Surveying: Introduction, Shore line survey, Sounding, Methods of Locating sounding, Tides, Prediction of tides, Tide gauges, Mean Sea Level.	3	CO1
[3]	Survey Adjustment and Theory of Errors: Errors, Types of Errors, Accuracy and Precision, Principle of Least Square, Laws of Weights, Normal distribution and Standard Deviation, Most Probable Value and Most Probable Error, Distribution of Errors to the field measurements, Triangulation Adjustments.	5	CO2
[4]	Tacheometric Surveying: Computation of distance and levels using Stadia and Non-stadia methods of tacheometry for different field conditions	7	CO1
[5]	Field Astronomy: Definition of Astronomical Terms, Coordinate System, Spherical Trigonometry and Spherical Triangle, Astronomical Triangle, Measurement of Distance and Azimuth	4	CO4
[6]	Geodetic Survey: (A) Remote Sensing: Introduction, Basics of electromagnetic energy, Stages of Remote sensing, Types of remote sensing, Ideal vs real remote sensing system, Limitations of remote sensing system. (B) Global Positioning System: Geopositioning, GPS Segments, Positioning Systems - Absolute and Differential, Errors in GPS. (C) Geographic Information System: Introduction and principle of GIS, Components of GIS, Applications.	6	CO4
[7]	Photogrammetric Surveying: Introduction, Uses, Aerial Cameras, Types of Aerial Photographs, Scale of a Vertical Photograph, Ground Coordinates from a Single Vertical Photograph, Relief Displacement on a Vertical Photograph, Flying Height of a Vertical Photograph, Stereoscopy and parallax and their applications, Flight Planning	6	CO5
[8]	Modern Surveying Techniques: Airborne laser thematic mapping, LIDAR, Digital Elevation Models.	2	CO1

C. TEXT BOOKS

1. Surveying- Volume-I- B C Punmia, A K Jain, A K Jain- Laxmi Publication (New Delhi)- 17th ed. - 2018.
2. Surveying- Volume-II- B C Punmia, A K Jain, A K Jain- Laxmi Publication (New Delhi)- 16th ed. - 2019.

D. REFERENCE BOOKS

1. Surveying- Volume-I - S K Duggal - McGraw-Hill India (New Delhi) - 5th ed. - 2019.
2. Surveying- Volume-II - S K Duggal - McGraw-Hill India (New Delhi) - 5th ed. - 2019.
3. Plane Surveying - A M Chandra - New Age Publication (New Delhi) - 2nd ed. - 2006.
4. Engineering Surveying - W Schofield - Butterworth-Heinemann Publication - 2001.
5. Surveying and Levelling - R Agor - Khanna Publishers (New Delhi) - 12th ed. - 2016.
6. Surveying - Volume-I&II - K R Arora - Rajsons Publications (New Delhi) - 15th ed. - 2018.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Understand the fundamentals of Hydrographic Surveying, Tacheometry and other modern surveying techniques with their applications.
CO2	Application	Apply the theory of errors and related statistical analysis in the surveying measurements.
CO3	Application	Apply the knowledge of Curvatures in plotting of various types of curves for highways and railways applications.
CO4	Application	Understand celestial & geographic coordinate system, Geodetic surveying (including GIS, GPS and remote sensing) and apply this in measurements of distance using latitude and longitude of locations.
CO5	Application	Understand rudiments of aerial photogrammetry and its application in civil engineering.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	2	1	1	1	3	1	2	2	3	3	2
CO2	2	2	1	1	2	2	-	1	3	1	2	2	3	3	2
CO3	2	2	3	1	3	2	-	1	3	3	2	2	3	3	2
CO4	2	2	3	1	2	1	-	1	3	1	2	2	3	3	2
CO5	2	3	2	2	3	1	1	1	1	-	-	2	2	3	2
..															
Avg															

B. TECH. SEMESTER – VI
SUBJECT: PRESTRESSED CONCRETE (PROGRAM ELECTIVE-II)

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

A. COURSE OVERVIEW

To make students familiar with the fundamentals Prestressed Concrete and learn design of Prestressed concrete Sections.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**INTRODUCTION:** Development of Prestressed concrete, Advantages of Pre-stressing, Materials for Prestressed concrete, Classification of types of Prestressing.	03	CO1
[2]	**PRESTRESSING SYSTEM** Analysis of section, Load balancing concept, Stresses at transfer and service load in flexure member, Different types of Losses in Prestress.	07	CO1 CO2
[3]	**FLEXURAL STRENGH OF PRESTRESSED CONCRETE SECTION** Type of flexural failure, Strain compatibility method, Simplified code procedure.	08	CO3
[4]	**LIMIT STATE DESIGN OF PRESTRESSED CONCRETE STRUCTURE** Introduction, Criteria for limit states, Design Load and Strength, Strength and serviceability limit states, crack widths in prestressed member. Design of section for Flexure, Axial Tension, Compression and Bending, Shear and Torsion.	12	CO4
[5]	**DESIGN OF END BLOCK** Shear stresses and bond stresses in end block, Transfer of prestress, Transmission length, Bond Stresses, Codal provision for bond and transmission length	05	CO4
[6]	**DEFLECTION OF PRESTRESSED CONCRETE MEMBER** Factor influencing deflection, short-term deflection of uncrack member, Prediction of long-term deflection.	05	CO5

C. TEXT BOOKS

1. Concrete Technology - A.N.Neville and J.J.brooks - Pearson Education Ltd. (New Delhi) - 2nd Edition -2010.

D. REFERENCE BOOKS

1. Prestressed Concrete - N. Krishna Raju - Tata McGraw-Hill Publishing Co. (New Delhi) - 6th Edition - 2018.
2. Prestressed Concrete - Pandit. G.S. and Gupta. S.P. - CBS Publishers and Distributers Pvt Ltd (New Delhi) – 1st Edition - 2019.

3. Design of prestressed concrete structure - Lin T.Y. and Ned. H. Burns - Wiley India Pvt. Ltd. (New Delhi) - 3rd Edition – 2013.
4. Prestressed Concrete Structures – P. Dayaratnam and P. Sarah - Medtech Publication (New Delhi) – 7th Edition - 2017.
5. IS1343:2012 - Prestressed Concrete - Code of Practice - Bureau of Indian Standards (New Delhi) – 2nd Revision - 2012.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Students will be well versed with philosophy and use pre-stress concrete.
CO2	Analysis	Students shall get the knowledge of different types of losses in prestress.
CO3	Analysis	Students will be able to Analyse the flexural behaviour of simple beams.
CO4	Design	To impart the concepts of analysis and design of prestressed concrete.
CO5	Evaluate	Students shall learn calculation of short-term and long-term deflection of prestressed concrete members.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	2	2	1	1	2	2	1	1	1	2	2	1	2	2	
CO2	2	3	2	2	1	2	1	1	1	1	1	1	2	2	1	
CO3	3	2	3	2	1	1	2	1	1	1	3	1	3	3	2	
CO4	3	2	3	2	1	2	2	1	1	1	2	1	3	3	2	
CO5	2	3	2	1	2	3	3	1	1	1	2	2	3	2	1	
Avg																

B. TECH. SEMESTER – VI (CL)
SUBJECT: BUILDING REPAIRS & REHABILITATION (PROGRAMM ELECTIVE-II)

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

A. COURSE OVERVIEW

To teach the importance of durability of structure and introducing causes of deterioration of structures & To introduce the students in depth about knowledge of professional practice of repair techniques with right selection of repairing material.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**DURABILITY OF BUILDINGS** Life expectancy of buildings serviceability and Durability, Maintenance and Repair strategies, Estimation of building strength and durability, Effects of environmental elements on buildings.	08	CO1
[2]	**MAINTENANCE OF BUILDINGS** Preventive and corrective maintenance, scheduled and contingency maintenance planning, Maintenance standards, Maintenance cost, Prevention of Dampness, fire and termites, Maintenance and repair of construction joints.	10	CO2 CO3
[3]	**FAILURE & REPAIR OF BUILDING** Type of failure, Investigation of failure, testing methods, Material forrepair, Techniques for repair, Repair of concrete and masonry elements, Repair and strengthening of foundations, Flooring and roofs	12	CO1 CO3 CO4
[4]	**REHABILITATION OF BUILDINGS** Analysis, Planning, cost estimates, Rehabilitation methods.	10	CO1 CO4

C. TEXT BOOKS

1. Deterioration and maintenance and repair of building - S.M. Johnson's -(New Delhi)- McGraw Hill Text 1st ed.- 1965.
2. Handbook on Repairs and Rehabilitation of structures – CPWD (New Delhi)- 2016.

D. REFERENCE BOOKS

1. Building Planning Designing and scheduling - Gurcharan Singh. - Standard Book House (New Delhi)- 2nd ed.- 1992.
2. SP-7 National Building Code (2016). (Part-I and II)- BIS (New Delhi).

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the properties of fresh and hardened concrete.
CO2	Comprehension	Know the strategies of maintenance and repair
CO3	Create	Get an idea of repair techniques
CO4	Synthesis	Understand the properties of repair materials
CO5	Application	Understand and apply the retrofitting strategies and techniques

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	3	2	3	2	3	3	3	3	2	3	2	3	2
CO2	2	3	2	2	1	2	2	2	1	1	1	2	2	2	1
CO3	3	2	2	2	2	3	3	3	3	3	2	3	2	2	2
CO4	3	3	3	3	3	2	1	2	3	3	2	2	3	3	2
CO5	3	2	2	1	3	-	-	1	2	3	1	3	2	2	2
Avg.															

B. TECH. SEMESTER – VI (CL)
SUBJECT: GREEN BUILDING TECHNOLOGY(OPEN ELECTIVE -II)

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

A. COURSE OVERVIEW

The course is imparting fundamental knowledge of Introduction to Sustainable Site Selection, Water conservation and rain water harvesting, Building Materials, Passive and Active Architecture, Green Rating of building, Methods to reduce energy consumption and IGBC guidelines.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**Introduction to green buildings** Definition of green buildings, definition of sustainability, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.	05	CO2
[2]	**Site selection and planning** Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, and so on.	03	CO1 CO2 CO3 CO4
[3]	**Water conservation and efficiency** Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems.	04	CO1 CO2 CO3 CO4
[4]	**Building materials** Methods to reduce embodied energy in building materials: (a)Local building materials. (b) Natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks. (c)Materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from Argo and industrial waste. (d) Reuse of waste and salvaged materials.	03	CO1 CO2 CO3 CO4
[5]	**Methods to reduce operational energy** Energy efficient building envelopes, Solar Heat Gain Coefficient, U-Values for facade materials, efficient lighting technologies, energy efficient and BEE rated appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of NET ZERO buildings.	03	CO1 CO2 CO3 CO4
[6]	**IGBC guidelines** Introduction; IGBC green new building Rating system – Overview and process – project checklist; Sustainable architecture and design; Site selection and planning; Water conservation and energy efficiency; Building materials and resources; IndoorEnvironment quality; Innovation and development.	04	CO1 CO2 CO3 CO4

C. TEXT BOOKS

1. Sustainable Construction- Green Building Design and Delivery - Kibert C.J.- John Wiley and Sons (New York)- 4th ed.- 2016.
2. Alternative building materials and technologies - K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao- New Age International Publishers (New Delhi) - 2nd ed.- 2017.
3. Non-Conventional Energy Resources - G.D. Rai - Khanna Publishers (New Delhi) – 6th ed. - 1988.
4. Sustainable Building Design Manual - Vol.1 and 2 - TERI (New Delhi) -2004.

D. REFERENCE BOOKS

1. Green Homes Rating System- IGBC - Version 3.0. - Abridged reference guide - Indian Green Building Council Publishers - 2019.
2. Green Rating for Integrated Habitat Assessment – GRIHA- version 2 - GRIHA rating system- 2015.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Evaluate	List major Energy efficiency areas of Building.
CO2	Comprehension	Understand the properties of Green / cost effective materials
CO3	Synthesis	Compare cost effectiveness of Green Building Vs Conventional Building.
CO4	Application	Evaluate a building performance using building rating system.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	1	1	1	-	1	-	3	2	2	1
CO2	1	1	1	-	-	1	2	1	-	1	1	2	1	2	1
CO3	1	2	2	1	-	1	2	2	1	2	2	2	2	2	2
CO4	2	2	3	2	1	2	2	2	1	2	3	2	2	2	2
Avg															

B. TECH. SEMESTER – VII (CL)

SUBJECT: FOUNDATION ENGINEERING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	2	0	6	6	60	40	25	0	125

A. COURSE OVERVIEW

The course is designed for to build the necessary theoretical background for design and construction of foundation systems.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**INTRODUCTION** Different types of footings, Suitability of foundation on different soil types, difference between shallow and deep foundation, factors governing the choice of soil type.	03	CO1
[2]	**BEARING CAPACITY OF SHALLOW FOUNDATIONS** 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.	12	CO1
[3]	**BEARING CAPACITY OF RAFT OR MAT FOUNDATION** Introduction, Combined footings, Common types of Mat foundation, Bearing capacity of mat foundation, Compensated foundation.	04	CO1
[4]	**PILE FOUNDATION** 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 codemethod), 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.	12	CO2
[5]	**UNDER-REAMED PILE** Introduction, Installation method, Bearing capacity of under-reamed pile.	06	CO2
[6]	**FOOTINGS ON COLLAPSIBLE SOIL** General consideration, significant characteristics of collapsible soil, design	03	CO5

	of foundation on un-wetted collapsible soils and soils subjected to wetting, treatment methods for collapsible soils.		
[7]	**FOOTINGS ON EXPANSIVE SOIL** General consideration, significant characteristics of expansive soil, clay mineralogy and mechanism of swelling, design of foundation in expansive soil, treatment methods for expansive soils.	03	CO5
[8]	**CAISSON FOUNDATION** Introduction, Types of caissons, stability analysis of caissons, Determination of Scour depth in cohesionless soils, thickness of steining of well.	05	CO3

C. TEXT BOOKS

1. Soil Mechanics and Foundation engineering by V.N.S Murthi, UBS Publisher Principles of Geotechnical Engineering by B.M. Das, Tata McGraw Hill Publication

D. 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

E. COURSE OUTCOMES

(Minimum 5 Cos are required)

CO Number	Skill	Statement
CO1	Create	Design of shallow footings like isolated and mat footings.
CO2	Create	Design of Deep foundation like pile and under-reamed pile.
CO3	Analyzing	Understand types of well and analyse Lateral stability of well foundation.
CO4	Analyzing	Analyse anchored and cantilever sheet pile wall.
CO5	Remembering	Identify expansive soil and suggest suitable types of ground improvement techniques.

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	PS O1	PS O2	PS O3
CO1	3	3	3	3	3	3	2	3	2	3	2	3	3	3	3
CO2	3	3	3	3	3	3	2	3	2	3	2	3	3	3	3
CO3	3	3	3	3	3	3	2	3	2	3	2	3	2	3	3
CO4	3	3	3	3	3	3	2	3	2	3	2	3	2	3	3
CO5	2	2	1	2	1	2	1	3	2	3	1	3	2	2	1
..															
Avg															

B. TECH. SEMESTER – VII (CL)
SUBJECT: ADVANCED CONCRETE TECHNOLOGY

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	---	125

A. COURSE OBJECTIVE

Objective of this course is to explain various techniques and practices on microstructure of cement paste, concrete and Special Concrete and careful selection of suitable construction materials and their mix proportions to satisfy performance criteria of structure. By learning the quality of concrete in its fresh state and hardened state, Student can design the concrete mix using admixtures by different methods

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**CEMENT** Hydration, Chemistry and microstructure of cement paste, Special cement	07	CO1,CO3
[2]	**MICROSTRUCTURES OF CONCRETE** Interfacial transition zone, Structure-property relationships.	04	CO1,CO2
[3]	**CHEMICAL AND MINERAL ADMIXTURES IN CONCRETE** Water reducing admixtures, plasticizers, super plasticizers, Accelerators, Retarders, Air entraining agents, water proofing agents,- Types, Mechanism, Application	05	CO1,CO5
[4]	**PROPERTIES OF HARDENED CONCRETE** Strength, Stress- strain behaviour, Dimensional stability, Fracture Mechanics and concrete failure mechanism	05	CO2
[5]	**MIX DESIGN** Concept of mix design, Specification of mix design, IS,ACI,BS method for concrete mix design	04	CO3
[6]	**DURABILITY** Physical deterioration (abrasion, erosion, cracking) Chemical attack (sulfates/seawater/acid), Corrosion, Durability improvement measures.	03	CO2
[7]	**TESTING AND QUALITY ASSURANCE OF CONCRETE**	04	CO5

	Testing of fresh concrete, Destructive and non-destructive evaluation of hardened concrete, statistical quality control.		
[8]	**SPECIAL CONCRETE** 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, Recent advancements	08	CO4

C. TEXT BOOKS

1. P.Kumar Mehta, P.J.M Monterio.",Concrete -Microstructure, Properties and Materials" 4th edition, McGraw hill Publishers, New Delhi,2017
2. A.M.Neville " Properties of Concrete" 5th edition Pearson education publication,2012

D. REFERENCE BOOKS

1. A.M.Neville & J.J.brooks " Concrete Technology" 2nd edition Pearson education publication,2019
2. M.S.Shetty "Concrete Technology" 7th edition, S.Chand Publishers, New Delhi,2013.
3. M.L.Gambhir "Concrete Technology: Theory and Practice" 5th edition McGraw hill Publishers,N.Delhi,2005
4. IS10262:2019 , Indian Standard Code of Practice for Concrete Mix Proportioning.
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

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understanding Applications	Understand properties of micro-structure, behavior and properties of the cement paste and concrete.
CO2	Understanding Applications Analysis	Understand the durability and properties of concrete in hardened state.
CO3	Creation Analysis	Design a special concrete mix considering supplementary ceme ntitious materials.
CO4	Understanding Applications	Apply the knowledge of special concrete, Modern concrete and concreting methods to the field.

CO5	Understanding Application Analysis	Determine workability of concrete using supplementary cementitious material and compressive strength using Destructive and Non-Destructive methods .

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	1	2	1	1	1	2	2	1	1	1	2	-
CO2	2	2	1	2	2	1	1	2	2	2	2	2	2	2	1
CO3	2	2	3	2	2	2	1	2	3	3	2	2	3	2	2
CO4	2	2	2	1	3	2	1	3	3	3	2	2	3	2	2
CO5	3	3	2	2	2	2	1	3	2	2	2	2	3	2	2
Avg															

B. TECH. SEMESTER – VII (CL)
SUBJECT: (CL-710) IRRIGATION AND HYDRAULIC STRUCTURES

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
03	02	0	05	05	60	40	25	-	125

A. COURSE OVERVIEW

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, canal irrigation system, design of irrigation canals by different methods, diversion headworks, canal falls, 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 & embankment dam in particular.

B. COURSE CONTENT

NO	TOPIC	L (hrs)	COs
[1]	**IRRIGATION** 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.	02	CO1
[2]	**WATER REQUIREMENTS OF CROPS** 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.	03	CO1 CO3 CO5
[3]	**CANAL IRRIGATION SYSTEM** 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.	02	CO1 CO2
[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 regime diagrams and canal lining, design of canals by tractive force approach, cross – section of an irrigation canal, balancing depth of excavating canal.	03	CO3 CO5
[5]	**DIVERSION HEADWORKS** (a) Introduction, purpose, weirs, and barrages types, causes of failure, layout of diversion headwork. (b) Bligh's and Khosla's theory, component parts, Design of vertical drop weir.	02	CO2 CO4 CO5

[6]	**CANAL FALLS** Definition and location, types of falls, design of - trapezoidal notch fall, simple vertical drop fall, Sarda type fall, straight glacis fall.	**02**	**CO2** **CO4**
[7]	**REGULATORS, MODULES AND OTHER MISCELLANEOUS CANAL STRUCTURES** 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.	**04**	**CO2** **CO4**
[8]	**CROSS DRAINAGE WORKS** Definition, types of cross – drainage works, selection of suitable type of cross – drainage work, design considerations for cross – drainage works.	**04**	**CO2** **CO4** **CO5**
[9]	**GRAVITY DAMS** 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 structuralstability of gravity dams, elementary and practical profile of a gravitydam, high and low gravity dams, design of High and low gravity dam; galleries, joints,keys and water seals.	**06**	**CO2** **CO3** **CO4** **CO6**
[10]	**EARTHEN DAMS** 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.	**06**	**CO1** **CO2** **CO3** **CO4** **CO6**
[11]	**SPILLWAYS** 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.	**02**	**CO2**

C. TEXT BOOKS

1. Modi, P. N.; *Irrigation, Water Resources and Water Power Engineering*, 11th ed.; Standard Book House, 2020.
2. Arora, K.R, *Irrigation Water Power and Water Resources Engineering*; Standard Publisgers Distributors, 2010.

D. REFERENCE BOOKS

1. Punmia, B. C.; Pande, B. B.; *Irrigation and Water Power Engineering*, 17th ed.; Laxmi Publications (P) Ltd., 2021.
2. Singh, B.; *Fundamental of Irrigation Engineering*, 6th ed.; Nem Chand and Brothers, 1979

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Understand necessity of irrigation in India and different types of irrigation systems, irrigation efficiencies, irrigation requirements of crops, quality of irrigation water, water logging problem, slip circle method of stability analysis, canal regulation.
CO2	Comprehension	Understand the importance of different types of hydraulic structures like - irrigation canals, diversion head works, canal falls, canal escapes, regulators, cross – drainage works, dams, spillways etc.
CO3	Evaluate	Calculate different types of irrigation efficiencies, estimate water requirements of crops, find out the discharge required at the head of the distributary, calculate balancing depth of canal, calculate principal and shear stress in gravity dam, determine phreatic line in earth dam.
CO4	Evaluate	Stability analysis of gravity and earth dam, design of high and low gravity dam, design of elementary and practical profile of a gravity dam, design of filters in earth dam, design considerations of earth dam in seismic regions, seepage analysis in earth dam, design of simple vertical drop fall and Sarda type fall, design of differenttypes of cross drainage works, design of distributary head regulator and cross regulator, design of a barrage.
CO5	Application	Apply (i) Blaney-Criddle method (ii) Hargreaves class A pan evaporation method and (iii) Penman's method to estimate consumptive irrigation requirement of crops, apply soil – moisture regime concept to workout irrigation schedule, apply (i) Mitra's method (ii) Chaturvedi's method and (iii) Hind's method to design canal transitions, design of irrigation outlet, apply Bligh's and Khosla's theory to calculate uplift pressure below hydraulic structures, apply Kennedy's theory, Lacey's theory and tractive force approach for design of stable channels in India.
CO6	Application	Apply response spectrum and seismic coefficient methods to determine earthquake forces acting on a dam, apply Zanger's formula to determine hydrodynamic force on a gravity dam, apply Laplace equation and Darcy's law to estimate discharge in earth dam, carry out stability analysis of earth dam section using slip circle method, design upstream impervious blanket in earth dam using Bennet's method.

G. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	.	.
CO1	1	1	-	-	2	2	2	1	2	1	-	2	1	2	2		
CO2	-	-	1	-	-	1	1	1	2	1	-	2	1	1	1		
CO3	2	2	2	-	2	1	-	-	2	1	-	2	1	2	2		
CO4	2	1	1	-	2	1	-	1	2	1	-	2	1	2	2		
CO5	2	1	1	-	2	1	-	1	3	2	-	2	2	1	3		
CO6	2	2	1	1	3	1	-	1	3	1	-	2	1	1	3		
Avg																	

B. TECH. SEMESTER –VII (CL)
SUBJECT : CONSTRUCTION MANAGEMENT & ECONOMICS

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

A. COURSE OVERVIEW

The objective of this course is to understand the concepts of management and organization and implement them in construction planning, resource management, financial analysis of a project and safety in construction.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**INTRODUCTION** Construction Industry in India: Construction & Economy - Requisites for successful contractor. Requisites for profitable construction business.	3	CO1
[2]	**ORGANISATION & MANAGEMENT** Organization: Types, Principles, Suitability. Management: Principles, Functions, Benefits. Management Information Systems and Techniques.	6	CO1
[3]	**CONSTRUCTION PLANNING** 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.	16	CO2, CO3
[4]	**PROGRAM EVALUATON & REVIEW TECHNIQUE PERT** Time concept, Calculations-frequency distribution curves	4	CO2
[5]	**FINANCIAL ANALYSIS** Financial comparisons of alternatives & Different cost-its implications, decision making Benefits of financial analysis.	11	CO4
[6]	**CONSTRUCTION LABOUR MANAGEMENT** Welfare-efficiency-Training-System of wages-Incentive plans.	5	CO5, CO3
[7]	**CONSTRUCTION MATERIAL MANAGEMENT** Material planning-storage - inventory control systems advantages material accounting - order quantity- Different concept of analysis - Determination of safety stock level	7	CO5, CO3
[8]	**MANAGEMENT INFORMATION SYSTEMS AND SAFETY IN CONSTRUCTION**	2	CO1

C. TEXT BOOKS

1. Chitkara, K. K.; Construction Project Management, 5th edition; Tata McGraw-Hill publication, 2019.

D. REFERENCE BOOKS

1. Jha K. N.; Construction Project Management – Theory and Practice, 2nd edition; Pearson publication, 2015.
2. Peurifoy, R. L.; Schexnayder, C. J.; Schmitt, R.; Construction Planning, Equipment, and

Methods, 9th edition; McGraw-Hill Education: Columbus, OH, 2018.
3. Seetharaman, S.; Construction Engineering & Management, 5th edition; Umesh Publications, 2017
4. Punamia B. C.; Khandelwal K. K.; Project Planning and Control with PERT and CPM 4th edition;, Laxmi Publications, 2016

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the concepts of management and organisation.
CO2	Evaluate	Use network diagram and planning & scheduling tools & techniques on a construction project.
CO3	Create	Organize site and resources for construction project.
CO4	Evaluate	Make decisions related to the financial aspects of a construction project.
CO5	Application	Apply labour and materials management techniques in construction.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	2	-	2	3	1	3	2	-	-	1
CO2	1	2	1	1	3	2	-	3	3	3	3	2	2	2	3
CO3	1	2	2	2	3	3	2	3	3	2	3	3	2	2	1
CO4	1	3	2	2	2	1	-	3	3	2	3	3	2	3	1
CO5	1	2	2	2	2	3	1	3	3	3	3	2	2	2	1
Avg	1	2	1.8	1.8	2.5	2.2	1.5	2.8	3	2.2	3	2.4	2	2.3	1.4

B. TECH. SEMESTER – VII (CL)
SUBJECT: (CL715) EARTHQUAKE ENGINEERING

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	-	125

A. COURSE OVERVIEW

The course is designed for impart the knowledge of causes and effects of earthquakes on civil engineering structures. This course provides the concepts of theories of vibration of SDOF and MDOF systems also gives the background of seismic analysis of framed and masonry structures usingIS Code provisions. This course helpful to understand of design beam, column and joints by apply the concepts of ductile detailing as per IS codes provisions that improved later load resistanceof the structures.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**INTRODUCTION TO EARTHQUAKE** Geology of earth, influence of geology on earthquake, causes of earthquake and their characteristics. Earthquake parameters, magnitude, intensity, scales.	4	CO1
[2]	**THEORIES OF VIBRATION FOR SINGLE DEGREE OF FREEDOM (SDOF) SYSTEMS:** 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	13	CO2, CO1
[3]	**THEORIES OF VIBRATION FOR MULTI DEGREE OF FREEDOM (MDOF) SYSTEMS** Classical Modal Analysis for MDOF Systems, Calculation of Base Shear and Lateral Force on MDOF Systems	8	CO2, CO1
[4]	**SEISMIC ANALYSIS OF STRUCTURES AS PER IS 1893 (Part-1): 2016** 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	16	CO3, CO4, CO5
[4]	**CAPACITY DESIGN AS PER IS 13920: 2016** Concept of ductile detailing. IS:13920 code provisions for different RCC elements viz. Beams, Columns and Shear Walls.	7	CO3

C. TEXT BOOKS

1. Chopra, A. K. *Dynamics of Structures*, 5th ed.; Pearson Education Limited, 2022.
2. Shrikhande Manish and Agrawal Pankaj, *Earthquake Resistant Design of Structures*; 3rd ed.; Prentice-Hall India Pvt. Ltd; New Delhi, 2006.

D. REFERENCE BOOKS

1. Paz Mario, Kim Young Hoon *Structural Dynamics Theory and Computation;* 6th Edition; Springer; Switzerland, 2019
2. Clough Ray. W. and Penzin J. *Structural Dynamics* by*;* 3rd ed.; McGraw Hill Int, 2003
3. Farzad Naeim *The Seismic Design Handbook,* Springer Publishers
4. IS 1893 (Part 1), *Criteria for Earthquake Resistant Design of Structures (Part 1: General Provisions and Buildings),* Bureau of Indian Standards, 2016
5. IS 13920, *Ductile Design and Detailing of Reinforced Concrete Structures subjected to Seismic Forces – Code of Practice,* Bureau of Indian Standards, 2016

E. COURSE OUTCOMES

(Minimum 5 Cos are required)

CO Number	Skill	Statement
CO1	Understanding	To understand the basics concepts of earthquake engineering.
CO2	Comprehension	Compute structural responses of SDOF and MDOF systems and analyse the structures subjected to earthquakes using basics of structural dynamics.
CO3	Application	Apply the building code provisions in the design of structural systems and design beam, column and joints by applying the concepts of ductile detailing.
CO4	Evaluation	Compute the effect of Unreinforced Masonry Infill on analysis of Reinforced Concrete Frames and Effect of unsymmetrical geometry and masses in the building.
CO5	Analysis	To Estimate Liquefaction Potential of soil strata under the effect of earthquake force.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	.
CO1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
CO2	1	3	3	2	2	1	3	2	1	2	1	3	3	3	1	
CO3	1	3	2	2	2	2	3	2	1	2	1	3	3	2	2	
CO4	1	2	2	1	1	1	2	2	-	2	1	2	3	2	1	
CO5	1	2	1	1	1	1	2	1	1	1	1	1	1	1	-	
Avg																

B. TECH. SEMESTER – VII (CL)
SUBJECT: HIGHWAY 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

A. COURSE OVERVIEW

Highways plays a vital role for the development of any nation. This course is intended to establish the understanding of fundamental concepts of highway engineering and to build the necessary theoretical and practical background for the design and construction of various types of pavements.

B. COURSE CONTENT

NO	TOPIC	L (hrs)	COs
[1]	Introduction: Importance of transportation, Modes of transportation, Roles of Transportation, Scope of highway engineering	3	CO1
[2]	Highway Alignment: Highway Alignment, Engineering Surveys & Preparation of detailed report	3	CO2
[3]	Geometric Design of Highways: Importance of geometric design, highway cross sectional elements, sight distance, design of horizontal and vertical alignment, highway capacity	12	CO2
[4]	Highway Materials: Physical and Mechanical Properties of Soil, Stone aggregates, Bitumen binders, and Bitumen paving mixes; Bituminous mix design	4	CO4
[5]	Highway Construction: General features, Stages of construction, Earthwork, Soil stabilization, Bitumen Pavement Construction & Cement Concrete Pavement construction	4	CO4
[6]	Pavements: Types of Pavements, Factors affecting Pavement Performance and Design	3	CO3
[7]	Flexible Pavement Design: Design criteria, Design parameters, Design Methods-Empirical, Semi-empirical and Theoretical methods, IRC recommendations	7	CO3
[8]	Rigid Pavement Design: Design criteria, Design parameters, Stresses in Rigid Pavements, Design of Joints, Rigid Pavement Design, IRC recommendations	7	CO3
[9]	Distresses in Pavements and Its Maintenance: Introduction, Types of failures in flexible pavements and rigid pavements, Pavement evaluation – Structural and Functional, Maintenance techniques	5	CO5

C. TEXT BOOK

1. Khanna, S K; Justo, CEG; Veeraragavan, A.; *Highway Engineering*; 10th ed.; Nem Chand & Bros. publication, 2018.

D. REFERENCE BOOKS

1. Kadiyali, L R; Lal, N B; *Principles and Practices of Highway Engineering*, 7th ed.; Khanna Publishers, 2019.

2. Chakroborty, P.; Das, A.; *Principles of Transportation Engineering*, 2nd ed.; PHI Learning publication, 2017.
3. Yoder, E. J.; Witczak, M. W.; *Principles of Pavement Design*, 2nd ed.; John Willey & Sons Inc. publication, 1975.
4. IS-2386 (Part-I to Part-VIII), *Methods of test for aggregate for concrete*, Bureau of Indian Standards, 2016
5. IS-1201 to 1220, *Methods for Testing Tar and Bituminous Materials*, Bureau of Indian Standards, 2018
6. IRC-37, *Tentative Guidelines for the Design of Flexible Pavements*, Indian Road Congress, 2018
7. IRC-15, Code of Practice for Construction of Joined Plain Concrete Pavements, Indian Road Congress, 2017
8. IRC-73, Geometric Design Standards for Rural (Non-Urban) Highways, Indian Road Congress, 1980

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Comprehension	Understand the importance of highway transportation in society.
CO2	Design	Understand various parameters which affect the highway alignment design, apply this knowledge for the selection of highway alignment and design the geometry of rural highways as per IRC guidelines.
CO3	Analysis and Design	Analyse various types of stresses in pavements and design the crust of flexible and rigid pavements as per IRC guidelines.
CO4	Evaluate	Understand the desired properties of highway materials and construction steps of different types of roads.
CO5	Comprehension	Learn various types of distresses in pavements and their possible causes.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	-	2	2	1	-	-	-	3	1	1	2
CO2	3	1	2	1	1	2	2	1	1	1	1	2	2	3	2
CO3	3	1	2	2	1	2	2	1	1	1	1	2	2	3	3
CO4	2	2	2	2	1	2	2	2	1	1	1	2	2	2	2
CO5	2	1	2	2	1	2	1	2	1	1	1	2	2	2	2
..															
Avg															

B. TECH. SEMESTER – VII (CL)
SUBJECT : PROFESSIONAL PRACTICE AND VALUATION

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

A. COURSE OVERVIEW

The objective of this course is to build the professional skills by imparting knowledge of estimating, tendering and contracting, dispute resolution and valuation techniques.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**ESTIMATES** Necessity and types, Approximate and detailed estimates, methods and Uses.	8	CO1
[2]	**SPECIFICATIONS** Definition, objects and Importance, Requisites of good specification, classification of specifications, Standard specifications, Specifications of some important typical items.	3	CO2
[3]	**RATE ANALYSIS** Purpose, factors affecting rate analysis, SOR, Task works per day, rate of material and labour, rate analysis of typical items.	4	CO2
[4]	**CONDITIONS OF CONTRACT** Definition, object, importance, general provisions, typical conditions of contract.	2	CO4
[5]	**CONTRACTS** 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.	4	CO4
[6]	**TENDER** Meaning, Opening, Scrutiny and acceptance of tenders, Revocation of tender, unbalanced tender, liquidated damages.	3	CO4
[7]	**ARBITRATION** Definition, Arbitrator and referee, types of arbitration, powers of an arbitrator, process of arbitration, advantages of arbitration.	3	CO5
[8]	**EASEMENTS** Definition, Essential characteristics, Creation of easements, Extinguishment of easements.	3	CO5
[9]	**VALUATION** Purposes, Cost - price - value, Different forms of value, Freehold and leasehold properties, Sinking fund, Amortization, depreciation and obsolescence, Capitalized value and year's purchase, Interest rates, Ideal investment, Mortgage, Annuity, Methods of valuation.	8	CO3
[10]	**WORKS AND STORES ACCOUNTING:** 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	2	CO4

	establishments, Inventory		

C. TEXT BOOKS

1. Dutta B. N.; Estimating & Costing in Civil Engineering Theory & Practice, 28th edition; CBS Publishers & Distributors Pvt. Ltd., 2021.

D. REFERENCE BOOKS

1. Rangwala; Estimation Costing and Valuation, 17th edition; Charotar Publications, 2017.
2. Chakraborti M.; Estimating, Costing, Specification and Valuation in Engineering.
3. Kohli D. D.; Estimation, Costing and Accounts, 1st edition; S. Chand & Company Pvt. Ltd., 2013.
4. Birdie G. S.; Textbook of Estimating and Costing (Civil Engineering), 1st edition; Dhanpat Rai Publications, 2014.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Estimation	Estimate cost of construction projects based on rates.
CO2	Evaluate	Work out rate analysis and draft specifications and abstract for all works related to civil engineering projects.
CO3	Evaluate	Carry out valuation of properties/buildings.
CO4	Create	Prepare tender and contract documents following acts and byelaws.
CO5	Understand	Understand the concept of arbitration and easement.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	3	3	-	3	3	3	3	3	1	3	3
CO2	2	2	2	2	3	3	2	3	3	3	3	3	1	3	3
CO3	1	2	2	3	3	3	-	3	3	3	3	3	1	3	3
CO4	-	1	2	2	3	3	2	3	3	3	3	3	2	2	3
CO5	-	2	1	1	-	2	1	3	2	3	2	3	-	1	3
Avg	1.7	1.8	1.6	2	3	2.8	1.7	3	2.8	3	2.8	3	1.3	2.4	3

B. TECH. SEMESTER – VII (CL)
SUBJECT : PROJECT PLANNING AND CONTROL

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	2	0	5	5	60	40	25	0	125

A. COURSE OVERVIEW

The objective of this course is to impart the knowledge, skills, and understanding necessary for project planning, scheduling, finance, and control, as well as to assess the project's feasibility.

B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	**INTRODUCTION** Construction industry and macroeconomics	5	CO1
[2]	**PROJECT FEASIBILITY AND VIABILITY** Project feasibility studies, Life cycle concepts, cost engineering principles, project costs (Material, labor, equipment, fixed, variable, direct, indirect, recurring, non- recurring, etc.,) Economic considerations (interest rate tax, escalation, inflations), Implications of contractual obligations on costs, Economic and financial feasibility analysis, Analysis of risk and uncertainty.	22	CO1, CO2, CO3, CO5
[3]	**PROJECT FINANCING** Project cash flow, Financing models and trends, Modeling capital projects for Successful funding. PPP financial models.	19	CO3, CO4, CO5
[4]	**PROJECT SCHEDULING AND CONTROL** Project scope, project team, subcontract planning and control, Scheduling techniques, application software for project scheduling, Technical performance and monitoring, Accounting, Cost control, learning curve, and variances, PMIS.	21	CO1, CO2, CO5

C. TEXT BOOKS

1) Chandra P.; Project Planning, Analysis, Implementation and review, 9th edition; Tata McGraw-Hill publication, 2019.

D. REFERENCE BOOKS

1) Sears S. K.; Sears G. A; Clough R. H.; Rounds J. L; Segner R. O; Construction Project Management by Clough and Sears, 6th edition; John Wiley and Sons, 2015.

2) Ritz G. J.; Levy S. M.; Total Construction Project Management, 2nd edition; McGraw-Hill publication, 2013.

3) Chitkara, K. K.; Construction Project Management, 5th edition; Tata McGraw-Hill publication, 2019.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand project scope, characteristics and life cycle of project.
CO2	Comprehension	Implement scheduling and cost control techniques for effective project planning and control.
CO3	Create	Develop financing models and project cash flows.
CO4	Synthesis	Understand the project's viability and conduct an economic, financial, and risk and uncertainty analysis.
CO5	Application	Apply project management tools and methodologies for project scheduling, monitoring and accounting.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	2	2	2	2	2	2	3	1	1	2
CO2	2	2	3	1	3	2	2	3	3	3	3	2	1	2	3
CO3	1	3	3	2	3	3	1	3	3	3	3	2	1	1	3
CO4	-	1	2	1	2	2	1	3	2	2	3	2	1	1	2
CO5	1	3	3	2	3	2	-	3	3	3	3	3	1	1	3
Avg	1.3	2	2.4	1.4	2.4	2.2	1.5	2.8	2.6	2.6	2.8	2.4	1	1.2	2.6