

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Bachelor of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table-I: Course of study for semester I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP105T	Communication skills – Theory *	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP107P	Human Anatomy and Physiology – Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical*	2	-	1
BP112RBP	Remedial Biology – Practical*	2	-	1
Total		32/34^S/36[#]	4	27/29^S/30[#]

[#]Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course.

^SApplicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course.

* Non University Examination (NUE)

Table-II: Course of study for semester II

Course Code	Name of the course	No. of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP203T	Biochemistry – Theory	3	1	4
BP204T	Pathophysiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	3	-	3
BP206T	Environmental sciences – Theory *	3	-	3
BP207P	Human Anatomy and Physiology II –Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry – Practical	4	-	2
BP210P	Computer Applications in Pharmacy – Practical*	2	-	1
Total		32	4	29

*Non University Examination (NUE)

B. PHARM. SEMESTER – I (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY I -THEORY (BP101T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the various experiments related to special senses and nervous system.
- Appreciate coordinated working pattern of different organs of each system

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to human body Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology. Cellular level of organization Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine Tissue level of organization Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.	10	CO1
[2]	Integumentary system Structure and functions of skin Skeletal system Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction Joints Structural and functional classification, types of joints movements and its articulation	10	CO1 CO2 CO3

[3]	Body fluids and blood Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system. □ Lymphatic system Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system	10	CO2 CO3 CO4 CO5
[4]	Peripheral nervous system: Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. Special senses Structure and functions of eye, ear, nose and tongue and their disorders.	08	C01 CO2 CO3 C04 C05
[5]	Cardiovascular system Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart	08	C01 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.

D. REFERENCE BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.
4. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic anatomy and function of the body and remember the position of the various parts of our body
CO2	Remember, Understand and Apply	To know about the working mechanism of the body part and measure the activity of certain body parts by various techniques.
CO3	Understand Apply and Evaluate	To understand about the mechanism behind the action produced by various body part
CO4	Understand	To know about how disease occurs, and for that which organ system is required to defence those disease condition
CO5	Remember, Understand, Apply and evaluate	To get knowledge about functioning and dysfunctioning of various parts of the body/system and disease occur due to these imbalances.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	1	3	1	3	3	1	3	3	3	3	1	1
CO2	3	2	2	3	2	2	2	2	3	1	3	3	3	3	2	2
CO3	3	3	3	3	2	2	2	2	3	2	2	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.6	3	2.4	1.8	2.4	2.2	2.2	2.8	1.6	2.4	2.8	3	3	2.2	1.8

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL ANALYSIS I-THEORY (BP102T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	04	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs

Objectives: Upon completion of the course student shall be able to

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- Develop analytical skills

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	(a) Pharmaceutical analysis Definition and scope i) Different techniques of analysis ii) Methods of expressing concentration iii) Primary and secondary standards. iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate (b)Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures	10	CO1 CO5
[2]	Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl	10	CO2 CO3 CO4 CO5
[3]	Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride. Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.	10	CO2 CO3 CO4 CO5
[4]	Redox titrations (a) Concepts of oxidation and reduction (b) Types of redox titrations (Principles and applications)	08	CO2 CO3 CO4 CO5

	Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate		
[5]	Electrochemical methods of analysis Conductometry - Introduction, Conductivity cell, Conductometric titrations, applications. Potentiometry - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications. Polarography - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications	07	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. G. H. Jeffery J. Bassett J. Mendham R C. Denney, *Vogel's textbook of quantitative chemical analysis*, 5th ed.; Bath press, Avon : Great Britain, 1989.
2. Sharma B. K., *Analytical Chemistry*, 2nd ed.; Krishna Prakashan media (p) Ltd: Delhi, India, 2006.

D. REFERENCE BOOKS

1. P. Gundu Rao, *Inorganic Pharmaceutical Chemistry (Pharma Chemistry-I)*, 2010
2. Arthur Owen Bentley; John Edmund Driver; Lewis Malcolm Atherden. *Bentley and Driver's Textbook of Pharmaceutical Chemistry*.; Oxford University Press: Oxford, 1977.
3. Kennedy, J. H. *Analytical Chemistry : Principles*; Saunders College Pub: New York, 1990.
4. Health, O. Indian Pharmacopoeia 2010. Vol. 1; Ghaziabad Indian Pharmacopoeia Commission, 2010.
5. Skoog, Douglas A, F J. Holler, and Timothy A. Nieman, *Principles of Instrumental Analysis*, 7th ed.; Saunders College Pub: United states of America, 2016.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the importance, scope and fundamentals of analytical chemistry.
CO2	Remember, Understand and learn	Understand and learn different analytical and electroanalytical methods
CO3	Understand, remember Apply	Remember and apply various analytical and electroanalytical methods in pharmaceutical drug analysis
CO4	Understand, analyse and evaluate	Analyse and evaluate various volumetric and electrochemical titrations results
CO5	Development and evaluation	Evaluation of sources of errors, promoting ethical practises and development of analytical skills

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	1	3	1	1	1	-	3	3	3	2	2	-
CO2	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO3	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO4	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO5	3	1	3	1	1	3	1	1	1	-	3	3	3	2	2	-
Avg.	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICS I -THEORY (BP103T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Prepare various conventional dosage forms

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia. • Dosage forms: Introduction to dosage forms, classification and definitions • Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription. • Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.	10	CO1 CO3 CO4
[2]	Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight. • Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions. • Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques	10	CO2 CO5
[3]	Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions. • Biphasic liquids: • Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome. • Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.	10	CO2 CO5

[4]	Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. · Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.	8	CO1 CO2 CO5
[5]	Semisolid dosage forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms	7	CO2 CO5

C. TEXT BOOKS

1. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

D. REFERENCE BOOKS

2. Ansel, H. C.; Allen, L. V.; Popovich, N. G. Pharmaceutical Dosage Forms and Drug Delivery Systems; Philadelphia, Pa Lippincott-Williams & Wilkins, 1999.
3. Arthur Owen Bentley; Ernest Alexander Rawlins. Bentley's Textbook of Pharmaceutics.; All India Traveller Book Seller: New Delhi, 2002.
4. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
5. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.
6. Françoise Nielloud; Marti-Mestres, G. Pharmaceutical Emulsions and Suspensions; Informa Healthcare, Cop: New York, 2010.
7. Ghebre-Sellassie, I. Pharmaceutical Pelletization Technology; Dekker: New York U.A., 1989.
8. Parikh, D. M. Handbook of Pharmaceutical Granulation Technology; Informa Healthcare: New York, N.Y., 2007.
9. Remington, J. P.; Gennaro, A. R. Remington : Volume 1 : The Science and Practice of Pharmacy; Mack Pub. Co: Easton, Pa., 1995.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand and remember the professional way of handling the prescription
CO2	Understand and Remember	To understand the basics of different dosage forms and pharmaceutical incompatibilities
CO3	Understand	To understand the history of profession of pharmacy
CO4	Perform	To perform the pharmaceutical calculations
CO5	Prepare and evaluate	To prepare and evaluate various conventional dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	3	3	2	3	3	3	3	3	3
CO2	3	2	3	3	1	2	1	2	2	1	2	3	3	3	2	2
CO3	3	2	2	1	1	3	-	2	2	-	3	2	2	3	3	3
CO4	3	1	3	3	-	1	1	1	1	1	2	3	2	3	2	1
CO5	3	1	3	3	-	1	1	1	1	1	2	3	3	3	1	1
Avg	3	1.8	2.8	2.6	0.6	2	1.2	1.8	1.8	1	2.6	2.8	2.6	3	2.2	2

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL INORGANIC CHEMISTRY -THEORY (BP104T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of the course the student shall be able to

- Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- Understand the medicinal and pharmaceutical importance of inorganic compounds

B. COURSE CONTENT

General methods of preparation, assay for the compounds superscripted with **asterisk (*)**, properties and medicinal uses of inorganic compounds belonging to the following classes

NO	TOPIC	L (Hrs)	COs
[1]	Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate	10	CO1 CO2
[2]	Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity. Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance. Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.	10	CO2 CO3 CO4 CO5
[3]	Gastrointestinal agents Acidifiers: Ammonium chloride* and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations	10	CO2 CO3 CO4 CO5
[4]	Miscellaneous compounds Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate Haematinics: Ferrous sulphate*, Ferrous gluconate Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite Astringents: Zinc Sulphate, Potash Alum	8	CO2 CO3 CO4 CO5

[5]	Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α , β , γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I_{131} , Storage conditions, precautions & pharmaceutical application of radioactive substances.	7	CO2 CO3 CO4 CO5
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C. TEXT BOOKS (LATEST EDITION)

1. Anand & G.R. Chatwal, Inorganic Pharmaceutical Chemistry, India, 2010
2. Suhagia B. N., Inorganic Pharmaceutical Chemistry, Nirav Prakashan, India, 2013

D. REFERENCE BOOKS (LATEST EDITION)

1. Schroff, M. L. Pharmaceutical Chemistry; National Book Centre: Calcutta, 1968.
2. Arthur Owen Bentley; John Edmund Driver; Lewis Malcolm Atherden. Bentley and Driver's Textbook of Pharmaceutical Chemistry.; Oxford University Press: Oxford, 1977.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
CO2	Understand and Remember	To understand the medicinal and pharmaceutical importance of inorganic compounds
CO3	Understand	To understand and learn about various types of inorganic compounds
CO4	Understand and Remember	To study preparation and assay of selected inorganic compounds
CO5	Understand and Remember	To understand and remember synonyms and chemical formula of various inorganic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	1	-	-	1	-	2	1	3	2	3	1	1	1
CO2	3	-	-	1	-	1	-	-	2	1	3	2	3	1	1	1
CO3	3	-	-	1	-	-	-	-	1	1	3	2	2	1	1	1
CO4	3	-	-	1	-	-	-	-	1	-	3	2	2	1	-	-
CO5	3	-	-	1	-	-	-	-	-	-	3	2	-	-	-	-
Avg	3	-	-	1	-	0.2	0.2	-	1.2	0.6	3	2	2	0.8	0.6	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: COMMUNICATION SKILLS -THEORY (BP105T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac.	Total
2	-	-	2	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

Objectives: Upon completion of the course the student shall be able to

- Understand the behavioural needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
- Communicate effectively (Verbal and Non-Verbal)
- Effectively manage the team as a team player
- Develop interview skills
- Develop Leadership qualities and essentials

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment	07	CO1 CO2
[2]	Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style	07	CO1 CO2
[3]	Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message	07	CO1 CO2 CO3
[4]	Interview Skills: Purpose of an interview, Do's and Dont's of an interview	05	CO4

	Giving Presentations: Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery		CO5
[5]	Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion	04	CO3 CO5

C. TEXT BOOKS

1. Mosam Sinha. *Effective Communication Skills*; Aavishkar Publishers, Distributors: Jaipur, 2017.
2. Lisel Erasmus-Kritzinger. *Introductory Communication : The Ultimate Guide to Effective Communication Skills, Study Skills, Life Skills*; Nasou Via Afrika: Cape Town, 2007.

D. REFERENCE BOOKS

1. Rutherford, A. J. *Basic Communication Skills for Technology*; Englewood Cliffs, Nj Prentice Hall, 1991.
2. Worth, R. *Communication Skills*.; Ferguson: New York, 2019.
3. Nira Konar. *Communication Skills for Professionals*; Phi Learning Private Limited: New Delhi, 2011.
4. Mitra, B. K. *Personality Development and Soft Skills*; Oxford University Press: New Delhi, 2011.
5. Wentz, F. H. *Soft Skills Training : A Workbook to Develop Skills for Employment*; Createspace: Charleston, Sc, 2012.
6. Peter, F. S. J. *Soft Skills and Professional Communication*; Tata Mcgraw-Hill: New Delhi, 2012.
7. Araya, M. MTD Training Effective Communication Skills. www.academia.edu.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the behavioural needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
CO2	Learn	Learn to communicate effectively (Verbal and Non Verbal) and apply appropriate communication style in professional context
CO3	Understand	Understand the effective team management as a team player
CO4	Understand and Remember	Understand and remember the requisites for development of an effective interview skills
CO5	Understand and learn	Develop Leadership qualities and essentials

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	1	3	-	3	-	-	3	1	1	-	3	-
CO2	-	-	-	-	3	3	-	3	-	-	3	1	1	-	3	-
CO3	-	-	-	-	3	1	-	1	-	-	3	1	1	-	3	-
CO4	-	-	-	-	-	1	-	1	-	-	3	1	1	-	3	-
CO5	-	-	-	-	3	3	-	3	-	-	3	1	1	-	3	-
Avg.	-	-	-	-	2	2.2	-	2.2	-	-	3	1	1	-0	3	-

B. PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL BIOLOGY -THEORY (BP106RBT)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	--	---	2	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Objectives: Upon completion of the course the student shall be able to

- know the classification and salient features of five kingdoms of life
- Understand the basic components of anatomy & physiology of plant
- Know understand the basic components of anatomy & physiology animal with special reference to human

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Living world: Definition and characters of living organisms <ul style="list-style-type: none"> • Diversity in the living world • Binomial nomenclature • Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus, Morphology of Flowering plants <ul style="list-style-type: none"> • Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed. • General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledones 	7	CO1 CO4 CO5
[2]	Body fluids and circulation <ul style="list-style-type: none"> • Composition of blood, blood groups, coagulation of blood • Composition and functions of lymph • Human circulatory system • Structure of human heart and blood vessels • Cardiac cycle, cardiac output and ECG Digestion and Absorption <ul style="list-style-type: none"> • Human alimentary canal and digestive glands • Role of digestive enzymes • Digestion, absorption and assimilation of digested food Breathing and respiration <ul style="list-style-type: none"> • Human respiratory system • Mechanism of breathing and its regulation • Exchange of gases, transport of gases and regulation of respiration • □ Respiratory 	7	CO2 CO3

[3]	Excretory products and their elimination <ul style="list-style-type: none"> • Modes of excretion • Human excretory system- structure and function • Urine formation • Rennin angiotensin system Neural control and coordination <ul style="list-style-type: none"> • Definition and classification of nervous system • Structure of a neuron • Generation and conduction of nerve impulse • Structure of brain and spinal cord • Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata Chemical coordination and regulation <ul style="list-style-type: none"> • Endocrine glands and their secretions • Functions of hormones secreted by endocrine glands Human reproduction <ul style="list-style-type: none"> • Parts of female reproductive system • Parts of male reproductive system • Spermatogenesis and Oogenesis • □ Menstrual cycle 	07	CO2 CO3
[4]	Plants and mineral nutrition: <ul style="list-style-type: none"> • Essential mineral, macro and micronutrients • Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation Photosynthesis <ul style="list-style-type: none"> • Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis. 	05	CO2 CO3
[5]	Plant respiration: Respiration, glycolysis, fermentation (anaerobic). Plant growth and development <ul style="list-style-type: none"> • Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators Cell - The unit of life <ul style="list-style-type: none"> • Structure and functions of cell and cell organelles. Cell division Tissues <ul style="list-style-type: none"> • Definition, types of tissues, location and functions 	04	CO1 CO4 CO5

C. TEXT BOOKS

1. A Gokhale, S. B.; Kokate, C. K.; Gokhale, A. S.; Kalaskar, M. G. Pharmacognosy of Traditional Drugs - I; Nirali Prakashan, August: Pune, 2014.
2. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.

D. REFERENCE BOOKS

1. Gokhale, S. B.; Kokate, C. K.; Gokhale, A. S.; Kalaskar, M. G. Pharmacognosy of Traditional Drugs - I; Nirali Prakashan, August: Pune, 2014.
2. Dutta, A. C. Botany for Degree Students.; Oxford University Press: Kolkata, 1996.
3. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To get knowledge about the basic part of the living world i.e plants, the parts of plant, its morphology and physiology, classification of kingdom. diversity in the world.
CO2	Remember and understand	To know about the anatomy and function of the various parts of the body
CO3	Understand Remember and Evaluate	To understand about the mechanism behind the action produced by various body part, evaluation of functions of the body part. To know about how disease occurs, and for that which organ system is required to defence those disease condition
CO4	Understand and evaluate	To know about plant photosynthesis, minerals, and factor affecting photosynthesis
CO5	Remember, Understand, Apply and evaluate	To get knowledge about plant respiration, plant growth and detail about the cell and tissue structure and function.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	2	3	3	3	2	3	3	3	2	2	3	2	1
CO2	3	1	2	3	2	2	2	2	3	2	3	3	3	3	2	2
CO3	3	2	3	3	2	2	2	2	3	2	2	3	3	3	2	3
CO4	3	2	3	3	2	3	3	2	3	2	2	3	3	3	3	3
CO5	3	2	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	1.6	2.4	2.6	2.5	2.4	2.6	2	2.8	2.2	2.4	2.6	2.8	3	2.2	2.2

B.PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL MATHEMATICS-THEORY (BP106RMT)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	-	-	2	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and La Place transform.

Objectives: Upon completion of this course the student should be able to

- Know the theory and their application in Pharmacy.
- Solve the different types of problems by applying theory.
- Appreciate the important application of mathematics in Pharmacy.
- Apply mathematics in solving statistical problems in pharmacy.
- Know the basics of mathematical problem-solving skills in Pharmacy.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Partial fraction Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics Logarithms Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems. Function: Real Valued function, Classification of real valued functions. Limits and continuity: Introduction, Limit of a function, Definition of limit of a function. (ϵ - δ definition) $\lim_{x \rightarrow a} \frac{x^2 - a^2}{x - a} = 2a$, $\lim_{x \rightarrow 0} \frac{e^{2x} - 1}{x} = 2$	06	CO1, CO2, CO4.
[2]	Matrices and Determinant: Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoin or adjutant of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear equations using matrix method, Cramer's rule, Characteristics equation and roots of a square matrix, Cayley-Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.	06	CO1, CO2, CO4.
[3]	Calculus Differentiation: Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula)–Without Proof, Derivative of x^n w.r.t. x, where n is any rational number, Derivative of e^x Derivative of log	06	CO1, CO3, CO5.

	e^x , Derivative of a^x , Derivative of trigonometric functions from first principles (without Proof), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application		
[4]	Analytical Geometry Introduction: Signs of the Coordinates, Distance formula, Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope– intercept form of a straight line Integration: Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application	06	CO1, CO3, CO4.
[5]	Differential Equations: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, Application in solving Pharmacokinetic equations Laplace Transform: Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations	06	CO3, CO4, CO5.

C. TEXT BOOKS

1. Hari Kishan. *Differential Calculus*; Atlantic Publishers & Distributors: New Delhi, 2007.
2. Ranganath, G. K. *Remedial Mathematics*. 2017.

D. REFERENCE BOOKS

1. Hari Kishan. *Differential Calculus*; Atlantic Publishers & Distributors: New Delhi, 2007.
2. Ranganath, G. K. *Remedial Mathematics*. 2017.
3. Hyma, P. *Pharmaceutical Mathematics with Application to Pharmacy*; Anmol Publications Pvt. Ltd: New Delhi, India, 2017.
4. H S Govinda Rao. *Higher Engineering Mathematics*; Viva Books: New Delhi, 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Know the theory and their application in Pharmacy.
CO2	Understand and apply	Solve the different types of problems by applying theory.
CO3	Evaluate	Appreciate the important application of mathematics in Pharmacy.
CO4	Apply and Remember	Apply mathematics in solving statistical problems in pharmacy.
CO5	Analyse and Evaluate	Know the basics of mathematical problem solving skills in Pharmacy.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	0	3	1	1	3	3	3	3	1
CO2	3	1	3	3	1	3	3	0	1	1	0	3	3	3	3	1
CO3	3	1	3	3	1	3	3	0	2	1	1	3	3	3	3	1
CO4	3	1	3	3	2	3	3	1	1	1	0	2	3	3	3	1
CO5	3	1	3	3	1	3	3	1	1	1	1	2	3	3	3	1
Avg	3	1.4	3	3	1.2	3	3	0.4	1.6	1	0.6	2.6	3	3	3	1

B. PHARM. SEMESTER – I (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY I-PRACTICAL (BP107 P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
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A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives:

- Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Study of compound microscope. 2. Microscopic study of epithelial and connective tissue 3. Microscopic study of muscular and nervous tissue 4. Identification of axial bones 5. Identification of appendicular bones 6. Introduction to hemocytometry. 7. Enumeration of white blood cell (WBC) count 8. Enumeration of total red blood corpuscles (RBC) 9. Determination of bleeding time 10. Determination of clotting time 11. Estimation of haemoglobin count 12. Determination of blood group 13. Determination of erythrocyte sedimentation rate (ESR) 14. Determination of heart rate and pulse rate 15. Recording of blood pressure.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
2. Sri Nageswari K; Sharma, R. Practical Workbook of Human Physiology; Jaypee Brothers Medical Publishers (P) Ltd, 2006.

D. REFERENCE BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.

3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic instruments used in this subject and how to operate it
CO2	Remember, Understand and evaluate	To know about the working mechanism of the instruments, understanding of models and result evaluation.
CO3	Understand Apply and Evaluate remember	To understand about procedure for measurement of various biochemical parameter, evaluation of result and after interpretation of result
CO4	Understand Apply and Evaluate	To know the value, obtain from the test and apply it in healthy or disease condition and give interpretation
CO5	Remember, Apply and evaluate	To get knowledge about parts of the instrument used in lab, its working principle, measurement and interpretation of result

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	2	3	3	3	2	3	3	3	1
CO2	3	2	2	3	1	3	2	2	3	1	3	3	3	3	2	1
CO3	3	3	3	3	2	2	2	3	3	1	2	3	3	3	2	2
CO4	3	2	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	3	3	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.4	2.8	3	1.6	2.6	2.6	2.2	2.8	1.8	2.4	2.6	3	3	2.4	1.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL ANALYSIS I-PRACTICAL (BP108P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.

Objectives: Upon completion of the course student shall be able to

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- Develop analytical skills

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Preparation and standardization of (1) Sodium hydroxide (2) Sulphuric acid (3) Sodium thiosulfate (4) Potassium permanganate (5) Ceric ammonium sulphate Assay of the following compounds along with Standardization of Titrant (1) Ammonium chloride by acid base titration (2) Ferrous sulphate by Cerimetry (3) Copper sulphate by Iodometry (4) Calcium gluconate by complexometry (5) Hydrogen peroxide by Permanganometry (6) Sodium benzoate by non-aqueous titration (7) Sodium Chloride by precipitation titration Determination of Normality by electro-analytical methods (1) Conductometric titration of strong acid against strong base (2) Conductometric titration of strong acid and weak acid against strong base (3) Potentiometric titration of strong acid against strong base	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Ministry, India.; Indian Pharmacopoeia Commission. *Indian Pharmacopoeia, 2010*; Indian Pharmacopoeia Commission: Ghaziabad, 2010.
2. Jain, D. S. M.; Patel, D. V. B. *Pharmaceutical Analysis*; Nirali Prakashan, 2018.

D. REFERENCE BOOKS

1. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988
2. Muhammad Sajid Hamid Akash; Kanwal Rehman. *Essentials of Pharmaceutical Analysis*; Singapore Springer, 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, learn and remember	Understand, learn and remember various calculations for quantification of drugs by analytical and electroanalytical methods.
CO2	Learn and remember	Learn and remember the concept of calibration of apparatus and instruments
CO3	Understand and apply	Understand and apply the analytical and electroanalytical methods for assay and quantification of drugs in an unknown samples.
CO4	Understand	Understand the importance of data integrity and ethical practices in every steps of drugs quantification
CO5	Develop	Develop skills in performing the volumetric titration and handling electroanalytical instruments

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	1	1	1	1	2	-	3	3	3	2	2	-
CO2	3	3	2	1	1	2	1	1	2	-	3	3	3	2	2	-
CO3	3	3	3	3	2	2	1	1	2	1	3	3	3	2	2	1
CO4	3	1	3	1	2	2	1	1	2	-	3	3	3	2	2	1
CO5	3	3	1	1	1	2	1	1	2	1	3	3	3	2	2	-
Avg	3	2.6	2.2	1.8	1.4	1.8	1	1	2	0.4	3	3	3	2	2	0.4

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICS I-PRACTICAL (BP109P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	-	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Course enables the student to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Prepare various conventional dosage forms

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Syrups a) Syrup IP'66 b) Compound syrup of Ferrous Phosphate BPC'68 2. Elixirs a) Piperazine citrate elixir b) Paracetamol pediatric elixir 3. Linctus a) Terpin Hydrate Linctus IP'66 4. Solutions b) Iodine Throat Paint (Mandles Paint) a) Strong solution of ammonium acetate b) Cresol with soap solution c) Lugol's solution 5. Suspensions a) Calamine lotion b) Magnesium Hydroxide mixture c) Aluminium Hydroxide gel 6. Emulsions a) Turpentine Liniment b) Liquid paraffin emulsion 7. Powders and Granules a) ORS powder (WHO) b) Effervescent granules c) Dusting powder d) Divided powders 8. Suppositories a) Glycero gelatin suppository b) Cocoa butter suppository c) Zinc Oxide suppository 8. Semisolids a) Sulphur ointment b) Non staining-iodine ointment with methyl salicylate c) Carbopol gel	60	CO1 CO2 CO3 CO4 CO5

	9. Gargles and Mouthwashes a) Iodine gargle b) Chlorhexidine mouthwash		
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C. TEXT BOOKS

1. Sanmathi. Dispensing Pharmacy : A Practical Manual.; Pharma Book Syndicate, 2010.
2. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

D. REFERENCE BOOKS

1. Ansel, H. C.; Allen, L. V.; Popovich, N. G. Pharmaceutical Dosage Forms and Drug Delivery Systems; Philadelphia, Pa Lippincott-Williams & Wilkins, 1999.
2. Arthur Owen Bentley; Ernest Alexander Rawlins. Bentley's Textbook of Pharmaceutics.; All India Traveller Book Seller: New Delhi, 2002.
3. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
4. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To convert the values of different parameters in different unit system for the calculation of ingredients in the formulation.
CO2	Apply	To perform the calculation for preparation of different dosage forms.
CO3	Create and prepare	To prepare the conventional dosage forms.
CO4	Evaluate	To evaluate the conventional dosage forms.
CO5	Apply and evaluate	To learn the packaging conditions, labeling and storage conditions for different dosage forms.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	3	3	2	2	-	2	2	-	3	3	3	3	3	1
CO2	3	1	3	3	1	2	1	3	2	2	3	3	3	3	3	2
CO3	3	1	3	3	1	1	-	1	1	1	3	3	3	3	3	1
CO4	3	1	3	3	1	1	-	1	1	1	3	3	3	3	3	1
CO5	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
Avg	3	1.6	3	3	1.6	1.8	0.6	1.8	1.8	1.4	3	3	3	3	3	1.6

B. PHARM. SEMESTER – I (BPH)**SUBJECT: PHARMACEUTICAL INORGANIC CHEMISTRY -PRACTICAL (BP110P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of the course the student shall be able to

- know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- understand the medicinal and pharmaceutical importance of inorganic compounds

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	Limit tests for following ions Limit test for Chlorides and Sulphates Modified limit test for Chlorides and Sulphates Limit test for Iron Limit test for Heavy metals Limit test for Lead Limit test for Arsenic Identification test Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate Test for purity Swelling power of Bentonite Neutralizing capacity of aluminum hydroxide gel Determination of potassium iodate and iodine in potassium Iodide Preparation of inorganic pharmaceuticals Boric acid Potash alum Ferrous sulphate	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Dhake A S, Inorganic pharmaceutical chemistry, First edition, Career publications, India, 2004

D. REFERENCE BOOKS (LATEST EDITION)

1. Ministry, India.; Indian Pharmacopoeia Commission. Indian Pharmacopoeia, 2010. Addendum 2012; Indian Pharmacopoeia Commission: Ghaziabad, 2012.
2. Anand & G.R. Chatwal, Inorganic Pharmaceutical Chemistry, India, 2010

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To study limit tests of various inorganic compounds
CO2	Understand and Remember	To perform identification tests of various inorganic compounds
CO3	Understand and Remember	To understand and remember the preparations of various inorganic pharmaceuticals
CO4	Understand and Remember	To understand and remember the reactions involved in preparation of various inorganic pharmaceuticals
CO5	Understand and Evaluate	To understand and evaluate tests for purity of various inorganic pharmaceuticals

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	-	1	-	1	1	-	2	3	3	3	2	1	1
CO2	3	1	1	-	1	-	-	1	-	-	3	3	2	2	-	-
CO3	2	1	1	-	1	-	-	1	-	-	3	3	2	-	-	1
CO4	2	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-
CO5	3	1	1	-	1	-	1	1	1	-	3	3	3	2	1	1
Avg	2.6	0.8	0.8	-	0.8	-	0.4	0.8	0.2	0.4	3	2.6	2	1.2	0.4	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: COMMUNICATION SKILLS -PRACTICAL (BP111P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac.	Total
-	-	2	2	1	15	5	5	-	25

A. COURSE OVERVIEW

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

Objectives: Upon completion of the course the student shall be able to

- Communicate effectively (Verbal and Non-Verbal)
- Effectively manage the team as a team player
- Develop interview skills, writing skills, Leadership qualities and essentials

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Basic communication covering the following topics Meeting People Asking Questions Making Friends What did you do?</p> <p>Pronunciations covering the following topics Pronunciation (Consonant Sounds) Pronunciation and Nouns Pronunciation (Vowel Sounds)</p> <p>Advanced Learning Listening Comprehension / Direct and Indirect Speech Figures of Speech Effective Communication Writing Skills Effective Writing Interview Handling Skills E-Mail etiquette Presentation Skills</p>	30	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Fujishin, R. *The Art of Communication : Improving Your Fundamental Communication Skills*; Rowman & Littlefield: Lanham, 2016.
2. Pandey, M.; Phil, M.; Lit, E.; Lib, M. *FIRST YEAR B. PHARM. Semester I*

D. REFERENCE BOOKS

1. Burton, L.; Dalley, D.; University Of Learning Ltd. *Developing Your Influencing Skills : A Guide to Developing the 7 Traits of Influential People*; Universe Of Learning: Great Britain, 2010.
2. Shikha Kapoor. *Personality Development and Soft Skills : Preparing for Tomorrow*; I.K. International Publishing House Pvt. Ltd: New Delhi, 2018.
3. Thomson, A. J.; Martinet, A. V. *A Practical English Grammar*; Oxford Univ. Press, 2012.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and learn	Understand and learn the basics of communication and apply it appropriately in professional and social context
CO2	Learn, remember and apply	Learn, remember and apply the key concepts of pronunciations in speaking
CO3	Display/ Demonstrate	Display competence in oral, written, and visual communication
CO4	Learn	Learn to prepare an audience – centric presentation
CO5	Understand, learn and apply	Understand, Learn and apply the requisites for an effective writing skills and listening skills

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	-	3	-	3	1	-	3	1	-	-	3	-
CO2	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO3	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO4	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO5	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
Avg.	-	-	-	-	-	3	-	3	2.6	-	3	1	-	-	3	-

B. PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL BIOLOGY – PRACTICAL (BP112RBP)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
--	--	1	2	1	15	10	5	-	25

A. COURSE OVERVIEW

1. Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Objectives: Upon completion of the course the student shall be able to

- know the classification and salient features of five kingdoms of life
- Understand the basic components of anatomy & physiology of plant
- Know understand the basic components of anatomy & physiology animal with special reference to human

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. Introduction to Experiments in Biology <ol style="list-style-type: none"> A) Study of Microscope B) Section Cutting Techniques C) Mounting and Staining D) Permanent Slide Preparation 2. Study of Cell and Its Inclusions 3. Study of Stem, Root, Leaf, Seed, Fruit, Flower and Their Modifications 4. Detailed Study of Frog by Using Computer Models 5. Microscopic Study and Identification of Tissues Pertinent To Stem, Root 6. Leaf, Seed, Fruit and Flower 7. Identification of Bones 8. Determination of Blood Group 9. Determination of Blood Pressure 10. Determination of Tidal Volume 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.
2. Kale, S. R.; Kale, R. R. Practical Human Anatomy and Physiology for First Year Diploma Course in Pharmacy; Nirali Prakashan: Pune, India, 2007.

D. REFERENCE BOOKS

1. Kale, S. R.; Kale, R. R. Practical Human Anatomy and Physiology for First Year Diploma Course in Pharmacy; Nirali Prakashan: Pune, India, 2007.
2. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.
3. Shafi, M.J.H. Biology practical manual according to National core curriculum .Biology forum of Karnataka.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic instruments used in this subject and how to operate and what is the procedure behind it.
CO2	Remember, Understand and evaluate	To know about the working mechanism of the instruments, understanding of models and result evaluation.
CO3	Understand Apply and Evaluate remember	To understand about parts of the plant and animals, evaluation of study in both animals and plants
CO4	Understand Apply and Evaluate	To know the about the parts and function of the parts of body
CO5	Remember, Apply and evaluate	To get knowledge about parts of the instrument used in lab, its working principle, measurement and interpretation of result

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	2	3	3	3	2	3	3	3	3
CO2	3	2	2	3	2	2	2	2	3	2	3	3	3	3	2	2
CO3	3	3	3	3	2	2	2	2	3	2	2	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.8	2.6	2.8	2	2.4	2.6	2	2.8	2.2	2.4	2.6	3	3	2.4	2.2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY II -THEORY (BP201T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the haematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time, etc. and also record blood pressure, heart rate, pulse and respiratory volume.
- Appreciate coordinated working pattern of different organs of each system.
- Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Nervous system Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)	10	CO1
[2]	Digestive system Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT. Energetics Formation and role of ATP, Creatinine Phosphate and BMR.	06	CO2 CO4

[3]	Respiratory system Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration. Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods. Urinary system Anatomy of urinary tract with special reference to anatomy of kidney and Nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.	10	CO3 CO4
[4]	Endocrine system Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, Adrenal gland, pancreas, pineal gland, thymus and their disorders.	10	C04
[5]	Reproductive system Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition Introduction to genetics Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance	09	CO4 CO5

C. TEXT BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.

D. REFERENCE BOOKS

1. Sembulingam, K. Essentials of Medical Physiology: With Free Review of Medical Physiology. Jaypee Brothers: S.L., 2019.
2. Waugh, A.; Ross, J. S.; Grant, A.; Wilson, K. J. W. Ross and Wilson Anatomy and Physiology in Health and Illness : Anne Waugh, Allison Grant ; Illustrations by Graeme Chambers.; Churchill Livingstone: Edinburgh, 2001.
3. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
4. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
5. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.
6. Singh, I. Textbook of Human Histology: (with Colour Atlas & Practical Guide); Jaypee Brothers Medical Publishers: New Delhi, 2011.
7. Ghai, C. L. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
8. Srinageswari, K.; Sharma, R. Practical workbook of Human Physiology; Jaypee brother's medical publishers, New Delhi
9. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
10. Chatterjee, C. C. Human Physiology: For Preclinical Medical and Degree Courses in Physiology; CBS Publishers & Distributors: New Delhi, 2016.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember, Understand and Apply	To know the basic fundamental structural features of neurons, mechanism of neurotransmitters along with processes of neuroconduction and neurotransmission.
CO2	Remember, Understand and Apply	To understand the basic biochemical processes occurs in the body related to digestion and energy production
CO3	Understand and remember	To understand the structure and basic functioning of the respiratory tract and urinary tract.
CO4	Understand and remember	To know about various hormones in the body and its related disorders
CO5	Understand and remember	To get knowledge about human reproductive system and its importance and know the basic genetics processes

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO2	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO3	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO4	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO5	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
Avg	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY I-THEORY (BP202T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

B. COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

NO	TOPIC	L (Hrs)	COs
[1]	Classification, nomenclature and isomerism Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds	07	CO1 CO2
[2]	Alkanes*, Alkenes* and Conjugated dienes SP ³ hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP ² hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E 1 verses E 2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement	10	CO1 CO3 CO4 CO5
[3]	Alkyl halides SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol	10	CO1 CO3 CO4 CO5
[4]	Carbonyl compounds	10	CO1

	Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.		CO3 CO4 CO5
[5]	Carboxylic acids Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid Aliphatic amines - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine	8	CO1 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

D. REFERENCE BOOKS (LATEST EDITION)

1. Robert Thornton Morrison; Robert Neilson Boyd. Organic Chemistry. 2 : Study Guide; Allyn And Bacon: Boston, Mass., 1987.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Education: India, 2003.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To learn about name, structure, isomerism and uses of organic compound
CO2	Understand and Remember	To understand about various factors which affect the reactions of organic compounds
CO3	Understand and Apply	To know the reaction, name of the reaction and orientation of reactions
CO4	Understand	To understand the reactivity/stability of organic compounds
CO5	Understand and Remember	To understand and remember the preparation of organic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO2	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO3	3	1	1	2	-	-	-	1	1	-	3	3	2	2	1	-
CO4	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO5	3	-	-	2	-	-	-	1	1	3	3	3	2	3	1	-
Avg	3	0.2	0.2	2	-	-	-	1	1	0.6	3	3	2	2.2	1	-

B. PHARM. SEMESTER – II (BPH)
SUBJECT: BIOCHEMISTRY (BP203T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
3	1	-	04	04	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Objectives: Upon completion of course student shall be able to

- Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
- Understand the metabolism of nutrient molecules in physiological and pathological conditions.
- Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Carbohydrate metabolism</p> <p>Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance Hormonal regulation of blood glucose level and Diabetes mellitus</p> <p>Biological oxidation</p> <p>Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate level phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers</p>	10	CO2 CO4
[2]	<p>Lipid metabolism</p> <p>β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.</p> <p>Amino acid metabolism</p> <p>General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders</p>	10	CO2 CO4

	Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alpeptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline Catabolism of heme; hyperbilirubinemia and jaundice		
[3]	Nucleic acid metabolism and genetic information transfer Biosynthesis of purine and pyrimidine nucleotides Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis Genetic code, Translation or Protein synthesis and inhibitors	10	CO3 CO4
[4]	Biomolecules Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. Bioenergetics Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP	08	CO2 CO4 CO5
[5]	Enzymes Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions	07	CO1

C. TEXT BOOKS

1. Murray, R.; Bender, D.; Botham, K.; Kennelly, P.; Rodwell, V.; Weil, P.; York, N.; San, C.; Lisbon, F.; Madrid, L.; City, M.; Delhi, M.; Juan, S. *Twenty-Eighth Edition*..
2. U Satyanarayana. *Biochemistry*; Elsevier India: New Delhi, 2021.

D. REFERENCE BOOKS

1. Cox, D. L. *Lehninger principles of biochemistry: International Edition*.; W H Freeman & Co Ltd: S.L., 2021..
2. Berg, J. M.; Tymoczko, J. L.; J, G.; Lubert Stryer. *Biochemistry*; W.H. Freeman/Mcmillan Learning: New York, 2019..

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and learn	Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
CO2	Understand and learn	Understand the metabolism of nutrient molecules in physiological and pathological conditions.
CO3	Understand and learn	Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.
CO4	Learn and remember	Learn and remember the basic chemical structure of nutrient molecules and biological importance of biological macromolecules
CO5	Understand	Explain biological mechanisms, such as the processes and control of bioenergetics and metabolism, as chemical reactions

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
CO2	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
CO3	3	-	3	1	-	2	1	1	2	-	3	3	3	3	1	1
CO4	3	-	3	1	-	2	1	1	2	-	3	3	3	3	1	1
CO5	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
Avg.	3	-	3	1	-	2	1	1	2.6	-	3	3	3	3	1	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: PATHOPHYSIOLOGY-THEORY (BP 204T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	---	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

Objectives: Upon completion of the course the student shall be able to

- Describe the etiology and pathogenesis of the selected disease states;
- Name the signs and symptoms of the diseases; and
- Mention the complications of the diseases.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Basic principles of Cell injury and Adaptation: Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance Basic mechanism involved in the process of inflammation and repair: Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis	10	CO1
[2]	Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis) • Respiratory system: Asthma, Chronic obstructive airways diseases. • Renal system : Acute and chronic renal failure .	10	CO2 CO3 CO4 CO5

[3]	Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia <ul style="list-style-type: none"> ● Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones ● Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease. ● Gastrointestinal system: Peptic Ulcer 	10	CO2 CO3 CO4 CO5
[4]	Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease. <ul style="list-style-type: none"> ● Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout ● Principles of cancer: classification, etiology and pathogenesis of cancer 	08	CO2 CO3 CO4 CO5
[5]	Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections <ul style="list-style-type: none"> ● Sexually transmitted diseases: AIDS, Syphilis, Gonorrhea 	07	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Harsh Mohan; Damjanov, I. Textbook of Pathology; Jaypee Brothers Medical Publishers: New Delhi, 2019.
2. Walker, R.; Cate Whittlesea. Clinical Pharmacy and Therapeutics; Churchill Livingstone: Edinburgh ; New York, 2007.

D. REFERENCE BOOKS

1. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020
2. Walker, R.; Cate Whittlesea. Clinical Pharmacy and Therapeutics; Churchill Livingstone: Edinburgh ; New York, 2007.
3. Blumenthal, D. K.; Rollins, D. E. Workbook and Casebook for "Goodman and Gilman's the Pharmacological Basis of Therapeutics"; Mcgraw Hill: New York ; Madrid Etc, 2016.
4. Davidson's Principles and Practice of Medicine.; Elsevier Health Sciences: S.L., 2022.

RECOMMENDED JOURNALS

1. Toner, P. G. The Journal of Pathology 1999, 187 (1), 187. [https://doi.org/3.0.co;2-n">10.1002/\(sici\)1096-9896\(199901\)187:1<187::aid-path269>3.0.co;2-n](https://doi.org/3.0.co;2-n).
2. Robbins, J. KCNQ Potassium Channels: Physiology, Pathophysiology, and Pharmacology. Pharmacology & Therapeutics 2001, 90 (1), 1–19. [https://doi.org/10.1016/s0163-7258\(01\)00116-4](https://doi.org/10.1016/s0163-7258(01)00116-4).
3. Quiz Page. Indian Journal of Pathology and Microbiology 2015, 58 (4), 568. <https://doi.org/10.4103/0377-4929.168897>.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the mechanism behind cell death, inflammatory process and repair mechanism in human body
CO2	Remember, Understand and Apply	To know about the system and function of the body and disease associated with dysfunctioning of the system
CO3	Understand Apply and Evaluate	To understand about the mechanism behind generation of the disease and/or cause of diseases
CO4	Understand	To know about cause, and treatment of the communicable and non-communicable diseases.
CO5	Remember, Understand, Apply and evaluate	To get knowledge about medication used to treat the disease according to the pathway of disease production.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2	1	1	3	3	2	2	3	3	3	2	1
CO2	3	2	2	3	1	1	1	3	3	2	2	3	3	3	2	1
CO3	3	2	3	3	2	3	2	3	3	1	2	3	3	3	2	1
CO4	3	1	3	3	1	3	3	3	3	2	2	3	3	3	3	2
CO5	3	3	2	3	2	2	3	3	2	3	2	2	3	3	2	2
Avg	3	2	2.4	2.8	1.6	2	2	3	2.8	2	2	2.8	3	3	2.2	1.4

B. PHARM. SEMESTER – II (BPH)
SUBJECT: COMPUTER APPLICATIONS IN PHARMACY-THEORY (BP205T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	-	-	3	3	50	15	10	-	75

A. COURSE OVERVIEW

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

Objectives: Upon completion of the course the student shall be able to

- Know the various types of application of computers in pharmacy
- Know the various types of databases
- Know the various applications of databases in pharmacy

B. COURSE CONTENT

NO	TOPIC	L(Hrs)	COs
[1]	Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division Concept of Information Systems and Software : Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	06	CO2
[2]	Web technologies: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database	06	CO3 CO4
[3]	Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System	06	CO1
[4]	Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	06	CO5
[5]	Computers as data analysis in Preclinical development: Chromatographic data analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)	06	CO1

C. TEXT BOOKS

1. V. Bhagat, S. Narkhede, D. Kardile, S. Shankar. *Computer Application in Pharmacy*. NiraliPrakashan, Pune. 1st Edition 2018.

D. REFERENCE BOOKS

1. William E Fassett; Dale B Christensen. *Computer Application in Pharmacy*. Lea and Febiger, USA, 1986.
2. Sean Ekins. *Computer Application in Pharmaceutical Research and Development*. Wiley-Interscience, USA, 2006.
3. S.C. Rastogi. *Bioinformatics: Concept, Skills and Applications*. CBS Publishers and Distributors, New Delhi, 2nd Edition 2019.
4. Cary N. Prague. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath*. Wiley Dreamtech India (P) Ltd., New Delhi,

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand various applications of computers in pharmacy
CO2	Understand and apply	Understand and apply concept of Information Systems and Software
CO3	Remember and Evaluate	Remember and evaluate various types of databases
CO4	Understand and Remember	Understand and remember about Web technologies
CO5	Understand and analyse	Understand and analyse concept of Bioinformatics

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	3	-	2	-	-	1	-	3	2	2	1	-	-
CO2	2	1	1	2	-	1	-	-	1	-	2	1	2	1	-	-
CO3	1	-	2	2	-	-	-	-	-	-	1	1	1	-	-	-
CO4	-	-	1	1	-	-	-	1	-	-	2	2	1	-	-	-
CO5	2	1	-	3	-	-	1	-	1	-	-	2	3	1	-	-
Avg	1.4	0.8	1.2	2.2	-	0.6	0.2	0.2	0.6	-	1.6	1.6	1.8	0.6	-	-

B. PHARM. SEMESTER – II (BPH)**SUBJECT: ENVIRONMENTAL SCIENCES- THEORY (BP206T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	-	-	2	3	50	15	10	-	75

A. COURSE OVERVIEW

Scope: Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

Objectives: Upon completion of the course the student shall be able to:

- Create the awareness about environmental problems among learners.
- Impart basic knowledge about the environment and its allied problems.
- Develop an attitude of concern for the environment.
- Motivate learner to participate in environment protection and environment improvement.
- Acquire skills to help the concerned individuals in identifying and solving environmental problems.
- Strive to attain harmony with Nature.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	The Multidisciplinary nature of environmental studies Natural Resources Renewable and non-renewable resources: Natural resources and associated problems a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.	10	CO1 CO3 CO4
[2]	Ecosystems <ul style="list-style-type: none">▪ Concept of an ecosystem.▪ Structure and function of an ecosystem.▪ Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	10	CO1 CO2 CO3
[3]	Environmental Pollution: Air pollution; Water pollution; Soil pollution	10	CO1 CO3 CO5

C. TEXT BOOKS

1. S.S. Randhava, Environmental Sciences, Vikas and Company Medical Publishers, Peevee publication, Jalandhar, 2019.
2. Prof. M. K. Gupta, Prof. Manish Jaimini, Environmental sciences, Vikas Pandey, published by Nirali Prakashan, Pune, 2018

D. REFERENCE BOOKS

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. Environmental Biology, Nidi Publ. Ltd. Bikaner, 2001
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2001, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and create	Discuss environmental problems among learners and create the awareness and strive to attain harmony with Nature.
CO2	Understand and remember	Describe concept of Ecosystems and remember structure and function of it.
CO3	Create	To create an attitude of concern for the environment protection and environment improvement.
CO4	Understand and remember	Explain Natural Resources of Environment
CO5	Understand and analyse	Describe and analyse the environmental pollution.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	3	2	1	2	2	3	3	3	2	2	2	2
CO2	2	3	3	1	2	2	1	2	2	3	3	3	2	2	2	2
CO3	2	3	3	2	2	2	1	2	2	3	3	3	3	2	2	2
CO4	2	3	2	2	2	2	2	2	2	3	3	3	3	2	2	2
CO5	2	3	3	2	3	2	2	2	2	3	3	3	3	2	2	2
Avg	2.2	3	2.8	1.6	2.4	2	1.4	2	2	3	3	3	2.6	2	2	2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY II - PRACTICAL (BP207P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Practical physiology is complimentary to the theoretical discussions in physiology.

Objectives: Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	1. To study the integumentary and special senses using specimen, models, etc., 2. To study the nervous system using specimen, models, etc., 3. To study the endocrine system using specimen, models, etc 4. To demonstrate the general neurological examination 5. To demonstrate the function of olfactory nerve 6. To examine the different types of taste. 7. To demonstrate the visual acuity 8. To demonstrate the reflex activity 9. Recording of body temperature 10. To demonstrate positive and negative feedback mechanism. 11. Determination of tidal volume and vital capacity. 12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens. 13. Recording of basal mass index 14. Study of family planning devices and pregnancy diagnosis test. 15. Demonstration of total blood count by cell analyser 16. Permanent slides of vital organs and gonads.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

- Ghai, C. L. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
- Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991

D. REFERENCE BOOKS

- Waugh, A.; Ross, J. S.; Grant, A.; Wilson, K. J. W. Ross and Wilson Anatomy and Physiology in Health and Illness : Anne Waugh, Allison Grant ; Illustrations by Graeme Chambers.; Churchill Livingstone: Edinburgh, 2001.
- Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about basic anatomy and physiology of the human organ systems
CO2	Remember, Understand and evaluate	To know about performance of experiments like neurological reflex, body temperature measurement, body mass index, olfaction, gestation reflex and eye sight, etc.
CO3	Understand Apply and Evaluate remember	To understand about procedure for measurement of various haematological parameter, evaluation and interpretation of result
CO4	Understand Apply and Evaluate	To know about family planning
CO5	Remember, Apply and evaluate	To know the histological structures of the body organs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	3	3	3	1	3	3	1	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	1	1	3	3	3	1	3	3	3	3	3	3	3	3	3
Avg	3	2.2	2.2	3	3	3	2.2	3	3	2.6	2.8	3	3	3	3	3

B. PHARM. SEMESTER – II (BPH)**SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY I-PRACTICAL (BP208P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Systematic qualitative analysis of unknown organic compounds like Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc. 2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test 3. Solubility test 4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides. 5. Melting point/Boiling point of organic compounds 6. Identification of the unknown compound from the literature using melting point/ boiling point. 7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point. 8. Minimum 5 unknown organic compounds to be analysed systematically. 2. Preparation of suitable solid derivatives from organic compounds 3. Construction of molecular models	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav & Roopal Prakashan, India, 2008

D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.

3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand the various preliminary test for organic compounds
CO2	Understand and apply	To perform nature identification test for various organic compounds
CO3	Understand and evaluate	Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
CO4	Understand and evaluate	To study about various functional groups identification for organic compounds
CO5	Understand & Apply	Identification of unknown organic compound from the literature using melting point/boiling point

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO2	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO3	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO4	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO5	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
Avg	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: BIOCHEMISTRY PRACTICAL (BP209P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4		35	10	5	-	50

A. COURSE OVERVIEW

Scope: The scope of the subject deals with complete understanding of different qualitative test to be performed for identification of carbohydrates, lipids and proteins. It is also emphasizing on quantitative estimation of sugars and proteins, preparation of buffers and studying the activity of enzyme.

Objectives: Upon completion of course, student shell able to

- Perform various qualitative tests for identification of carbohydrates, proteins and abnormal constituents.
- Understand the Principles for quantitative estimation of glucose and cholesterol.
- Understand and evaluate activity of salivary amylase enzyme

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch) Identification tests for Proteins (albumin and Casein) Qualitative analysis of urine for abnormal constituents Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method) Determination of blood creatinine Determination of blood sugar Determination of serum total cholesterol Preparation of buffer solution and measurement of pH Study of enzymatic hydrolysis of starch. Determination of Salivary amylase activity Study the effect of Temperature on Salivary amylase activity. Study the effect of substrate concentration on salivary amylase activity.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. G. Raval, H. Practicals in biochemistry
2. Gupta, R. C. *Practical Biochemistry*; Cbs Publishers And Distributors: New Delhi, 2006.

D. REFERENCE BOOKS

1. Plummer David T. *An Introduction to Practical Biochemistry*; Tata Mcgraw Hill: New Delhi, 1990.
2. G Rajagopal; Es Rāmakiruşṇan. *Practical Biochemistry for Medical Students*; Orient Longman ; New York, Ny: Hyderabad, 1983.
3. Varley, H. *Practical Clinical Biochemistry*; Cbs Publishers & Distributors: Delhi, 1988.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, remember and learn	Understand, remember, learn principles and perform various test ethically for qualitative analysis of carbohydrates, proteins and abnormal constituent in urine.
CO2	Understand, learn and apply and evaluate	Understand, learn and perform the quantitative test for analysis of reducing sugars and protein.
CO3	Understand Apply and Evaluate	Analyse and evaluate the factors affecting enzyme activity
CO4	Understand Apply and Evaluate	Understand and learn the concept of buffers
CO5	Understand Apply and Evaluate	Evaluation and interpretation of data emanating from a pathological lab for various carbohydrates, lipids and protein.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO2	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO3	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO4	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO5	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
Avg.	3	3	3	1	2	2	1	1	3	-	3	3		-	2	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: COMPUTER APPLICATIONS IN PHARMACY-PRACTICAL(BP210P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	2	2	1	15	5	5	-	25

A. COURSE OVERVIEW

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

Objectives: Upon completion of the course the student shall be able to

- Know the various types of office tools and their applications
- Create the various databases
- Know the various applications of databases in pharmacy

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	CO
[1]	1. Design a questionnaire using a word processing package to gather information about a particular disease. 2. Create a HTML web page to show personal information 3. Retrieve the information of a drug and its adverse effects using online tools 4. Creating mailing labels Using Label Wizard , generating label in MS WORD 5. Create a database in MS Access to store the patient information with the required fields Using access 6. Design a form in MS Access to view, add, delete and modify the patient record in the database 7. Generating report and printing the report from patient database 8. Creating invoice table using – MS Access 9. Drug information storage and retrieval using MS Access 10. Creating and working with queries in MS Access 11. Exporting Tables, Queries, Forms and Reports to web pages 12. Exporting Tables, Queries, Forms and Reports to XML pages	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. V. Bhagat, S. Narkhede, D. Kardile, S. Shankar. *Computer Application in Pharmacy*. NiraliPrakashan, Pune. 1st Edition 2018.

D. REFERENCE BOOKS

1. William E Fassett; Dale B Christensen. *Computer Application in Pharmacy*. Lea and Febiger, USA, 1986.

2. Sean Ekins. *Computer Application in Pharmaceutical Research and Development*. Wiley-Interscience, USA, 2006.
3. S.C. Rastogi. *Bioinformatics: Concept, Skills and Applications*. CBS Publishers and Distributors, New Delhi, 2nd Edition 2019.
4. Cary N. Prague. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath*. Wiley Dreamtech India (P) Ltd., New Delhi,

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	Understand basic tools of MS Word, MS Excel and MS Power point and apply them to create documents.
CO2	Remember, Understand and Create	Remember and Understand HTML tags and create HTML web page.
CO3	Create	Create mailing labels Using Label Wizard, generating label in MS WORD
CO4	Design	Design questionnaire/reports using a word processing package to gather information about a particular disease.
CO5	Understand and Apply	Understand tools of MS Access and apply in creating database, queries, relationship and reports from patient database

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	-	1	2	-	-	-	2	-	-	1	1	2	-	-	-
CO2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	1	-	-	-	1	-	-	1	1	-	-	1	-
CO4	1	-	1	2	-	-	-	1	1	-	-	1	1	-	-	-
CO5	1	-	1	2	-	-	-	-	-	-	-	1	-	-	-	-
Avg	0.6	-	0.6	1.6	-	-	-	0.8	0.2	-	0.4	0.8	0.6	-	0.2	-

Bachelor of Pharmacy Program

Semester III

Scheme of Teaching & Examination

SEMESTER – III

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH311	Pharmaceutics-V (Physical Pharmacy)	100	100	3	3
PH312	Dispensing Pharmacy	100	100	3	3
PH313	Pharmaceutical Chemistry- III (Organic)	100	100	3	3
PH314	Pharmaceutical Chemistry- IV (Biochemistry)	100	-	3	-
PH315	Pharmacognosy-I	100	100	2	3
PH316	Pharmacology-I	100	100	3	3
	Total	600	500	17	15

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH311 Pharmaceutics - V (Physical Pharmacy-I)

Theory

3 hours/Week

No.	Chapter	Hours
01	State of Matter: Properties of matter, Binding forces between molecules, State of matter, gaseous, liquid, liquefaction of gases, liquefaction, aerosols, Change in state of matter, latent heats and vapor pressure, sublimation-critical point, eutectic mixtures, gases, aerosols inhalers, relative humidity, liquid complexes, liquid crystals, glassy state, solid crystalline and amorphous, polymorphism. System containing one, two and three components.	10
02	Micromeritics and Powder Rheology: Introduction and significance, Particle size and distribution, average particle size, number and weight distribution, particle number, methods of determining area, permeability, adsorption, derived properties of powders, porosity, packing arrangement densities, bulkiness and flow properties, rheological parameter of powders	12
03	Compaction, Compression, Consolidation and Granulation of powdered solids	04
04	Solutions of non-electrolytes and electrolytes: Types of solutions, True, ideal and real solutions, Properties of solutions, lowering of vapor pressure, determination of v. p., depression of F.P., determination of F. P. lowering, elevation of B.P., determination of B.P. elevation	08
05	Surface and Interfacial Phenomenon: Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid gas and solid liquid interfaces, complex film, electrical properties of interface	11

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Determination of latent heat, vapor pressure, critical point.
- Studies on polymorphs, their identification and properties.
- Determination of particle size, particle size distribution and surface areas using various methods of particle size analysis.
- Determination of derived properties of powders: density, porosity, compressibility, angle of repose etc.
- Determination of surface/interfacial tension, HLB value and critical micellar concentration of surfactants.

Books Recommended

1. Martin's Physical pharmacy by Patrick J. Sinko, Lippincott Williams & Wilkins, New York,

2. Pharmaceutics: The Science of Dosage Form Design, Aulton, Michael E., Chrchill Livingstone.
3. Remington: The Science and Practice of Pharmacy, Vol-I & II, Gennaro, Alfonso R., Lippincott Williams & Wilkins, New York.
4. Physicochemical Principles of Pharmacy, Florence, A. T. Atwood, D. Macmillan Press Ltd., London .
5. Pharmaceutical Dosage Forms and Drug Delivery Systems, Ansel, Howard. C., Allen, Loyd V., Popovich, Nicholas G. Lippincott Williams & Wilkins, New York.
6. Cooper and Gunn's Tutorial Pharmacy, ed. Carter, S. J., CBS Publishers & Distributors, Delhi, .
7. Bentley's textbook of Pharmaceutics by E. A. Rawlins.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH312 Dispensing Pharmacy

Theory

3 hours/Week

No.	Chapter	Hours
01	Definition and scope	01
02	The prescription: Handling of prescription, source of errors in prescription, care required in dispensing procedures including labeling at dispensed products.	04
03	Dispensing techniques: Compounding and dispensing procedures, packaging, storage and stability of medicines, labeling of dispensed product.	04
04	Pharmaceutical calculations: Posology, Calculation of doses for infants, adults and elderly patients, enlarging and reducing recipes, percentage solutions, allegation, alcohol dilution, proof spirit, isotonic solutions, displacement value etc.	08
05	Principles involved and procedures adopted in dispensing of Mixtures, solutions, emulsions, external preparations, suppositories & pessaries, powders and granules, oral unit dosage forms, inhalations.	16
06	Incompatibilities: Physical, chemical and therapeutic incompatibilities observed in prescriptions of above products: <ul style="list-style-type: none">- Identification and correction of incompatibilities.- Inorganic incompatibilities including incompatibility of metals and their salts, non metals, acids, alkalis.- Organic incompatibilities: purine bases, alkaloids, ammonium compounds, carbohydrates, glycosides, anaesthetics, surface active agents	12

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Dispensing of prescription falling under the categories: Mixtures, solutions, emulsions, external preparations, powders, suppositories, oral unit dosage forms, inhalations.
- Dispensing procedures involving pharmaceutical calculations, pricing of prescriptions and dosage calculations for pediatric and geriatric patients.
- Dispensing of prescriptions involving adjustment of tonicity.
- Identification of various types of incompatibilities in prescription, correction and dispensing.

Books Recommended

1. Dispensing for Pharmaceutical students by Cooper and Gunn By S.J. carter, 12Th Edn. CBS Publishers.
2. Pharmaceutical Dosage form and Drug delivery system by Howard C. Ansel, Lippincot Williams & Wilkins.

3. Pharmaceutical Calculations by Mitchell J. Stoklosa and Howard C. Ansel By B.I. Waverly Pvt. Ltd., New Delhi.
4. Pharmaceutical Practice Edited by A.J. Winfield& R.M.E. Richards.
5. Hospital Pharmacy by William E Hassan, Henry Kimpton Publisher, London.
6. Hospital Organization and Management by Kurt Dan Jonathan S. Ratich, 4 th Edn. CBS Publishers.
7. Remington: The science and Practice of Pharmacy, Latest Edn., By Mack Publishing company.
8. Drug and Cosmetic Act. And Rules by Vijay Malik.
9. Pharmaceutical Practice By Diana M. Collett and Michale E. Aulton ELBS Publishers.
10. "Dispensing Pharmacy (Pharmaceutics-II)" By Dr. G.K. Jani, B.S. Shah Publication.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH313 Pharmaceutical Chemistry-III (Organic)

Theory

3 hours/Week

No.	Chapter	Hours
01	Structure, Nomenclature, physical properties, preparations and reactions of <ul style="list-style-type: none">– Alkyl halides [6],– Aldehydes and Ketones [10],– Carboxylic acids and its derivatives (acid chlorides, acid anhydrides, esters, amides) [7], Benzene [5],– Polynuclear aromatic compounds (Naphthalene & Anthracene) [2],– Arenes [3],– Amines [4],– Phenols [4]	41
02	Reactive intermediates of carbon: Free radical, Carbocation, Carbanion, carbenes	04

Practical

3 hours/Week

Systematic qualitative analysis of organic compounds and preparation of their derivatives (Organic compounds of all types of functional groups should be cover).

Books Recommended

1. Organic Chemistry by Morrison & Boyd, 6th edition, Pearson Education.
2. Advanced Organic Chemistry: Reaction, Mechanism and Structure by Jerry March 4th edition, A Wiley-Interscience Publication.
3. Vogl's Text Book of Practical Organic Chemistry- Brian Furniss, Antony Hannaford, Peter Smith, Austrin (Eds), 5th edition, ELBS Publication, Singapore, 1997.
4. Experimental Pharmaceutical Organic Chemistry, A Becnhtop Manual by K. S. Jain, P. B. Miniyar & T. S. Chitre, 2nd Edition Carrier publications,.
5. Organic Chemistry by I. A. Finar
6. A Guidebook to Mechanism in Organic Chemistry by Peter Sykes
7. Organic Chemistry, G. Marc Loudon, 4th Ed., Oxford University Press, 2004.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH314 Pharmaceutical Chemistry-IV (Biochemistry)

Theory

3 hours/Week

No.	Chapter	Hours
01	Biochemical organization of the cell and transport processes across cell membrane	04
02	The concept of free energy, determination of change in free energy from equilibrium constant and reduction potential, bioenergetics, production of ATP and its biological significance	05
03	Biological Oxidation, Redox-Potential, enzymes and co-enzymes involved in oxidation reduction & its control. The respiratory chain, its role in energy capture and its control, Energetics of oxidative phosphorylation, Inhibitors of respiratory chain and oxidative phosphorylation, Mechanism of oxidative phosphorylation	06
04	Enzymes: Nomenclature, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis. Co-enzymes: Vitamins as co-enzymes and their significance. Metals as co-enzymes and their significance.	08
05	Introduction to Lipids & Lipids metabolism: Oxidation of fatty acids, Beta-oxidation & energetics, alpha oxidation, omega-oxidation, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, Essential fatty acids & eicosanoids (prostaglandins, thromboxanes) phospholipids, and sphingolipids.	12
06	Techniques used in Biochemistry: Spectrophotometry, Centrifugation, Electrophoresis, Chromatography, Extraction & purification of nucleic acids.8. Complexing and chelating agents (Disodium edetate, dimercaprol).	05
07	Water and Mineral Metabolism - A brief introduction	05

Books Recommended

1. E.E. Conn and P.K. Stumpf, Outlines of Biochemistry, John Wiley & Sons, New York.
2. A.L. Lehninger, Principles of Biochemistry, CBS Publishers and Distributors.
3. R.K. Murray, D.K. Granner, P.A. Mayes, V.W. Rodwell,
4. Harper's Biochemistry, Prentice Hall International Inc., Latest Edition.
5. S.C. Rastogi, Biochemistry, Tata McGraw Hill, New Delhi, Latest Edition.
6. M.Cohn, K.S. Roth, Biochemistry and Disease, William and Wilkins Co., Baltimore, Latest Edition.
7. U. Satyanarayana, Biochemistry, Books and Allied (P) Ltd., Calcutta, Latest Edition.
8. G.F. Zubay, W.W. Parson, D.E. Vance, Principles of Biochemistry, WCB Publishers, England, Latest Edition.
9. S. Ramakrishnan, K.G. Prasannan, R. Rajan, Textbook of
10. Medical Biochemistry, Orient Longman, Madras, Latest Edition.
11. S.K. Sawhney, Randhir Singh Eds, Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
12. D.T. Plummer, An Introduction to Practical Biochemistry, Tata McGraw Hill, New Delhi.
13. J. Jayaraman, Laboratory Manual in Biochemistry, Wiley Eastern Limited, New Delhi.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH315 Pharmacognosy – I

Theory

2 hours/Week

No.	Chapter	Hours
01	Plant cell, living and non-living inclusion; plant tissues and their functions.	04
02	Definition, History and Scope of Pharmacognosy.	01
03	Classification of drugs.	01
04	Sources of drugs.	01
05	Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed. Modification of root and stem.	11
06	Cultivation, collection, processing and storage of crude drugs. Factors influencing cultivation of medicinal plants. Types of soils and fertilizers of common use. Plant hormones and their applications. Polyploidy, Mutation and Hybridization with reference to medicinal plants.	05
07	Systemic Pharmacognostic study of Carbohydrates and derived products: - Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia, Tragacanth and sodium alginate	04
08	Systemic Pharmacognostic study of Lipids:- Beeswax, Castor oil, Cocoa butter, Cod liver oil, sesame oil, and Wool fat, Linseed oil.	03

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Morphology of plant parts indicated in theory.
- Microscopy of monocot and dicot root, stem and leaf.
- Microscopic measurements of cell and cell contents: starch grains, calcium oxalate crystals and phloem fibers.
- Identification of crude drugs belonging to carbohydrates and lipids.
- Preparation of herbarium sheets.

Books Recommended

1. Pharmacognosy; C. K. Kokate, A. P. Purohit, S. B. Gokhale; Nirali prakashan, Pune; 39th Edition; 2007.
2. Botany for degree students; A. C. Dutta; Calcutta Oxford university press, New Delhi; 15 impressions; 1994.
3. A textbook of Pharmacognosy; Mamta Shah, Urvashi Shah, Sangita Marfatia; Nirav and Roopal Prakashan; 2008-09.
4. Pharmacognosy; J. S. Quadry; B. S. Shah Prakashan, Ahmedabad; 14th edition; 2008-09.
5. Pharmacognosy; V. E. Tylar, L. R. Brady, J. E. Habbars; Lea and Febgir Philadelphia; 8th edition; 1981.
6. Trease and Evan's Pharmacognosy; W. C. Evans; W. B. Saunders Co., Singapore; 15th, Edition; 2008.
7. Text Book Pharmacognosy; T.E. Wallis; CBS Publishers and Distributors, Delhi; 5th Edition; Reprint-2005.
8. Practical Pharmacognosy by C. K. Kokate, Vallabh Prakashan, Delhi, 4th edition, 1997.
9. Practical Pharmacognosy, Technique and Experiment by C. K. Kokate and S. B. Gokhale, Nirali Prakashan, Pune, 3rd edition, 1996.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH316 Pharmacology – I

Theory

3 hours/Week

No.	Chapter	Hours
01	General pharmacology: A. Introduction to pharmacology, sources of drug, dosage forms and routes of administration, mechanism of drug action, drug receptor interactions, combined effects of drugs, factors modifying drug action, tolerance, dependence, pharmacogenetics. B. Absorption, Distribution, Metabolism and Excretion of drugs, principles of basic and clinical pharmacokinetics, adverse drug reactions and ADME drug interactions, treatment of poisoning C. General principles of bioassay and biostandardization, evaluation of drug in man(clinical trials).Measurement of toxicity, discovery and development of new drugs.	25
02	Pharmacology of peripheral nervous system: A. Neurohumoral transimission (autonomic and somatic). B. Parasympathomimetics, parasympatholytics, sympathomimetics including bronchodilators and antiasthamtics, adrenergic receptors and neuron blocking agents, ganglionic stimulants and blocking agents. C. Neuromuscular blocking agents. D. Local anaesthetic.	20

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Introduction to experimental pharmacology: preparation of different solutions for experiments. Drug dilutions, use of molar and W/V solutions in experimental pharmacology, common laboratory animals, Legal regulations for the use of experimental animals, anesthetics used in animal studies, commonly used instruments in experimental pharmacology. Some common and standard techniques for drug administration (intravenous injection, intra gastric administration) and collection of blood samples. Euthanasia of laboratory animals.

2. To study the effects of various agonists (pD2) using isolated preparations.

- a) To record the concentration response curve (CRC) of acetylcholine using rat/chicken ileum preparation.
- b) To record the concentration response curve (CRC) of Histamine on rat/chicken ileum.
- c) To study the effects of acetylcholine, Histamine, BaCl₂, physostigmine, atropine, mepyramine and papaverine using rat/guinea pig/chicken ileum preparation.

3. Demonstration Experiments

- a) To study the effects of autonomic drugs on rabbits eye.

- b) To study the effects of various drugs on rat fundus preparation.
- c) To study the effects of various drugs on rat anococcygeus muscle preparations.
- d) To study the effects of various drugs on rat vas deference preparations.
- e) To study the effects of various drugs on rat tracheal chain preparations.

Books Recommended

1. Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
 2. Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
 3. Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn.Vallabh Prakashan, New Delhi.
 4. Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
 5. Rang h.P., dale M.M., etal-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
 6. Satoskar R.S., etal-Pharmacology and pharmacotherapeutics (1999)16th Edn. Popular Prakashan, Mumbai.
 7. Harvel, R.A., Champe P.C. etal –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
 8. Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.
 9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn. Pergamon Press, Singapore.
- Seth,S.D. text Book of pharmacology,B.I.Churchill,1997.

Bachelor of Pharmacy Program

Semester IV

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH411	Pharmaceutics-VI (Physical Pharmacy)	100	100	3	3
PH412	Hospital Pharmacy & Biopharmaceuticals	100	-	2	-
PH413	Pharmaceutical Chemistry- V (Organic)	100	100	3	3
PH414	Pharmaceutical Chemistry- VI (Biochemistry)	100	100	3	3
PH415	Pharmacognosy-II	100	100	3	3
PH416	Pharmacology-II	100	100	3	3
	Total	600	500	17	15

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH411 Pharmaceutics-VI (Physical Pharmacy-II)

Theory

3 hours/Week

No.	Chapter	Hours
01	Viscosity and Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, Non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy measurement and applications in formulation, determination of viscosity by capillary, falling ball, rotational viscometers, Brookfield viscometer, applications of rheology in pharmacy	12
02	Dispersion systems: (a) Colloidal Dispersions: Definition types, properties of colloids, protective colloids, application of colloids in pharmacy.(b) Suspension and emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, control flocculation, flocculation in structured vehicles, rheological considerations, emulsions, types, theories, physical stability	14
03	Complexation: Classification of complexes, methods of preparation and analysis, applications, protein binding	04
04	Kinetics: Rates and orders of reaction, determination of order, Influence of temperature and other factors on reaction rates, decomposition and stabilization of medicinal agents, kinetics in solid state, accelerated stability study, expiration dating	08
05	Buffer equations and buffer capacity in general, buffer in pharmaceutical systems, preparations, stability, buffered isotonic solutions, measurements of tonicity calculations and methods of adjusting isotonicity	07

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Study of rheological properties of various types of systems using different Viscometers.
- Studies of different types of colloids and their properties.
- Preparation of various types of suspensions and determination of their sedimentation parameters.
- Preparation and stability studies of emulsions.
- Studies on different types of complexes and determination of their stability constants.
- Preparation of pharmaceutical buffers and determination of buffer capacity.
- Preparation involving tonicity adjustments.
- Determination of C.S.T and partial or mutual solubility.

Books Recommended

1. Martin's Physical pharmacy by Patrick J. Sinko, Lippincott Williams & Wilkins, New York,
2. Pharmaceutics: The Science of Dosage Form Design, Aulton, Michael E., Churchill Livingstone.
3. Remington: The Science and Practice of Pharmacy, Vol-I & II, Gennaro, Alfonso R., Lippincott Williams & Wilkins, New York.
4. Physicochemical Principles of Pharmacy, Florence, A. T. Atwood, D. Macmillan Press Ltd., London .
5. Pharmaceutical Dosage Forms and Drug Delivery Systems, Ansel, Howard. C., Allen, Loyd V., Popovich, Nicholas G. Lippincott Williams & Wilkins, New York.
6. Cooper and Gunn's Tutorial Pharmacy, ed. Carter, S. J., CBS Publishers & Distributors, Delhi, .
7. Bentley's textbook of Pharmaceutics by E. A. Rawlins.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH412 Hospital Pharmacy & Biopharmaceuticals

Theory

2 hours/Week

No.	Chapter	Hours
01	Hospital Pharmacy: <ul style="list-style-type: none"> - Organization and Structure: Organization of hospital and hospital pharmacy, responsibility of hospital pharmacist, Pharmacy and Therapeutic Committee, budget preparations and implementation. - Hospital formulary: contents, preparation and revision of hospital formulary. - Drug store management and inventory control. Organization of drug store, types of material stocked, storage conditions. Purchase and inventory control – principles purchase procedures – purchase orders – procurement and stocking. - Drug distribution system in hospitals. Outpatient dispensing – methods adopted. Inpatient dispensing – methods adopted Ambulatory patient dispensing – methods adopted. Dispensing of controlled drugs - Drug information services: Sources of information on drugs, disease treatment schedules, procurement of information, computerized services, retrieval of information, medication error. - Records and reports: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc. 	15
02	Community Pharmacy: <ul style="list-style-type: none"> - Organization and structure of retail and wholesale drug-store, types of drug store and design, legal requirements for establishment, maintenance of drug store, dispensing of proprietary products, maintenance of records of retail and wholesale. - Patient counseling. Role and contribution of pharmacist in community health care and education. 	05
03	Biopharmaceuticals: <ul style="list-style-type: none"> - Blood products and plasma substitutes: Collection, processing labeling and storage of whole human blood, concentrated human RBC, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin foam, plasma substitutes-ideal requirements, PVP, dextran etc., control of blood products as per I.P and B.P. - Surgical Products: Definition, primary wound dressing, absorbent surgical cotton, surgical gauzes, bandages, adhesive tape, protective cellulosic hemostastics, official dressing, absorbable and nonabsorbable sutures, catgut. Standardization of surgical products, Packaging and labeling of surgical products in general. Medical prosthetics and organ replacement materials 	10

Books Recommended

1. Dispensing for Pharmaceutical students by Cooper and Gunn By S.J. carter, 12Th Edn. CBS Publishers.
2. Pharmaceutical Dosage form and Drug delivery system by Howard C. Ansel, Lippincot Williams & Wilkins.
3. Pharmaceutical Calculations by Mitchell J. Stoklosa and Howard C. Ansel By B.I. Waverly Pvt. Ltd., New Delhi.
4. Pharmaceutical Practice Edited by A.J. Winfield& R.M.E. Richards.
5. Hospital Pharmacy by William E Hassan, Henry Kimpton Publisher, London.
6. Hospital Organization and Management by Kurt Dan Jonathan S. Ratich, 4 th Edn. CBS Publishers.
7. Remington: The science and Practice of Pharmacy, Latest Edn., By Mack Publishing company.
8. Drug and Cosmetic Act. And Rules by Vijay Malik.
9. Pharmaceutical Practice By Diana M. Collett and Michale E. Aulton ELBS Publishers.
10. "Dispensing Pharmacy (Pharmaceutics-II)" By Dr. G.K. Jani, B.S. Shah Publication.
11. Indian Pharmacopoeia 2007, Indian Pharmacopoeial Commission, Ghaziabad.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH413 Pharmaceutical Chemistry-V (Organic)

Theory

3 hours/Week

No.	Chapter	Hours
01	Stereochemistry: Isomerism and nomenclature and associated physicochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, Stereoselective and Stereospecific reactions, conformations, chirality, chiral reagents, stereochemistry of Biphenyls, Allenes, Spirans and Decalins	25
02	Nucleophilic aromatic substitutions, alpha, beta-unsaturated carbonyl compounds conservation of orbital symmetry and rules	06
03	Electrocyclic cycloaddition and Sigmatropic reactions, Neighboring group effects catalysis by transition, metal complexes	06
04	Name Reactions: General reaction, reaction mechanism, factor affecting and synthetic importance of followings. Friedel-Crafts alkylation, Friedel-Crafts acylation, Hofmann Rearrangement/ Hofmann degradation of amides, Gabriel synthesis of primary Amine, Hofmann Elimination, Sandmeyer Reaction, Fries Rearrangement, Reimer-Tiemann Reaction, Williamson ether synthesis, Kolbe Reaction, Malonic ester synthesis, Acetoacetic ester synthesis, Nitrile synthesis, Hell-Volhard-Zelinsky Reaction, Fischer Esterification, Schotten-Boumann Reaction, Claisen Condensation, Aldol condensation, Cannizzaro reaction, Wittig reaction, Clemmensen reduction, Wolff kishner reduction, Michal addition, Diels elder reaction	06
05	Introduction to Nanochemistry, Microwave synthesis and green chemistry.	02

Practical

3 hours/Week

Synthesis of Organic compounds as per theory including various chemical reactions like oxidation, reduction, hydrolysis, nitration, bromination, etc.

Introductions to stereo models

Books Recommended

1. Organic Chemistry by Morrison & Boyd, 6th edition, Pearson Education.
2. Advanced Organic Chemistry: Reaction, Mechanism and Structure by Jerry March 4th edition, A Wiley-Interscience Publication.
3. Vogl's Text Book of Practical Organic Chemistry- Brian Furniss, Antony Hannaford, Peter Smith, Austrin (Eds), 5th edition, ELBS Publication, Singapore, 1997.
4. Experimental Pharmaceutical Organic Chemistry, A Becnchtup Manual by K. S. Jain, P. B. Miniyar & T. S. Chitre, 2nd Edition Carrier publications,.
5. Organic Chemistry by I. A. Finar
6. A Guidebook to Mechanism in Organic Chemistry by Peter Sykes
7. Organic Chemistry, G. Marc Loudon, 4th Ed., Oxford University Press, 2004.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH414 Pharmaceutical Chemistry-VI (Biochemistry)

Theory

3 hours/Week

No.	Chapter	Hours
01	Introduction to Carbohydrates & Proteins.	06
02	Carbohydrate metabolism: Conversion of polysaccharide to glucose-1-phosphate, Glycolysis and fermentation and their regulation, Gluconeogenesis and glycogenolysis, Metabolism of galactose and galactosemia, Role of sugar nucleosides in biosynthesis, and Pentosephosphate pathway. The Citric Acid Cycle: Significance, reactions and energetics of the cycle, Amphibolic role of the cycle, and Glyoxalic acid cycle.	15
03	Metabolism of Ammonia and Nitrogen Containing Monomers: Nitrogen balance, Biosynthesis of amino acids, Catabolism of amino acids, Conversion of amino acids to specialized products, Assimilation of ammonia, Urea cycle, metabolic disorders of urea cycle, Metabolism of sulphur containing amino acids, Porphyrin biosynthesis, formation of bile pigments, hyperbilirubinemia, Purine biosynthesis, Purine nucleotide interconversion, Pyrimidine biosynthesis and Formation of deoxyribonucleotides.	12
04	Biosynthesis of Nucleic Acids. Brief introduction of genetic organization of the mammalian genome, alteration and rearrangements of genetic material, Biosynthesis of DNA and its replication, DNA repair mechanism, Biosynthesis of RNA.	07
05	Genetic code and protein synthesis: Genetic code, components of Protein Synthesis, and Inhibition of protein synthesis. Brief account of genetic engineering and polymerase chain reactions. Regulation of gene expression	05

Note: Abnormal metabolism & genetic diseases should be referred to wherever necessary throughout the syllabus.

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Qualitative estimation of Carbohydrates & proteins
- Qualitative & Quantitative analysis of biological samples

Books Recommended

1. E.E. Conn and P.K. Stumpf, Outlines of Biochemistry, John Wiley & Sons, New York.
2. A.L. Lehninger, Principles of Biochemistry, CBS Publishers and Distributors.
3. R.K. Murray, D.K. Granner, P.A. Mayes, V.W. Rodwell,
4. Harper's Biochemistry, Prentice Hall International Inc., Latest Edition.
5. S.C. Rastogi, Biochemistry, Tata McGraw Hill, New Delhi, Latest Edition.
6. M.Cohn, K.S. Roth, Biochemistry and Disease, William and Wilkins Co., Baltimore, Latest Edition.
7. U. Satyanarayana, Biochemistry, Books and Allied (P) Ltd., Calcutta, Latest Edition.

8. G.F. Zubay, W.W. Parson, D.E. Vance, Principles of Biochemistry, WCB Publishers, England, Latest Edition.
9. S. Ramakrishnan, K.G. Prasannan, R. Rajan, Textbook of
10. Medical Biochemistry, Orient Longman, Madras, Latest Edition.
11. S.K. Sawhney, Randhir Singh Eds, Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
12. D.T. Plummer, An Introduction to Practical Biochemistry, Tata McGraw Hill, New Delhi.
13. J. Jayaraman, Laboratory Manual in Biochemistry, Wiley Eastern Limited, New Delhi.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH415 Pharmacognosy – I

Theory

3 hours/Week

No.	Chapter	Hours
01	Quality control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical, biological and other methods of evaluation.	03
02	Systemic Pharmacognostic study Resins and resin containing drugs:- Podophyllum, Jalap, Capsicum, Myrrh, Asafoetida, Benzoin, Turmeric and Ginger	05
03	Systemic Pharmacognostic study of tannins and tannin containing drugs like Gambir, Black catechu, Gall, Myrobalan and Harde.	03
04	Systemic Pharmacognostic study volatile oil and Volatile oils containing drugs:-Mentha, Coriander, Caraway, Dill, Fennel, Cinnamon, Cassia cinnamon, Lemon peel, Lemon grass, Clove, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, sandalwood.	08
05	General introduction to plant metabolites. General techniques for basic metabolic pathways. Brief introduction to biogenesis of secondary metabolites of pharmaceutical importance.	10
06	Biological source, preparation, identification tests and uses of following enzymes: Diastase, papain, pepsin, trypsin, pancreatin.	03
07	Study of fibers used in pharmacy such as cotton, silk, wool, nylon, and glass wool.	02
08	Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colors.	03
09	Natural allergens and photosensitizing agents and fungal toxins.	08

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Identification of crude drugs mentioned in theory
- Microscopic study of characters of selected drugs given in the theory in entire and powdered form.
- Chemical evaluation of powdered drugs.
- Laboratory experiments on isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.
- Study of fibers and pharmaceutical aids.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.
2. Pharmacognosy and pharmacobiotechnology, Ashutosh Kar, New Age International (P) Ltd, Publishers, 2nd edition 2007.
3. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahmedabad, 8th edition, 1990

4. Trease and Evan's Pharmacognosy: W. C. Evans, W.B.Saunders Co., Singapore, 15th Edition, 2008.
5. Text Book Pharmacognosy: T.E. Wallis, CBS Publishers and Distributors Delhi- 5th Edition, Reprint, 1997.
6. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,.
7. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbars, Lea and Febgir Philadelphia, 8th Edition, 1981.
8. Cultivation and Utilization of Aromatic Plants, Handa S.S. and Kaul M.K., Regional Research Laboraotry, Jammu, 1st Edition, 1997.
9. Pharmacognosy of powdered crude drugs: M. A. Iyenger, Manipal Power Press, 1st Edition, 1974.
10. Mukherji P. K., Quality Control of Herbal Drugs, Business Horizon Pharma. Publishers, 1st Edition, 2002.
11. Herbal drug technology, S. S. Agrawal and M. Paridhavi, Univeristies Press, 1st Edition, 2007.
12. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
13. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
14. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH416 Pharmacology – II

Theory

3 hours/Week

No.	Chapter	Hours
01	Pathophysiology of Cardiovascular disorders: Hypertension, Angina, Congestive Heart Failure, Myocardial Infarction, Cardiac Arrhythmias and Atherosclerosis.	15
02	Drugs acting on Cardiovascular System: A. Digitalis and cardiac glycosides and other cardiotonics B. Antihypertensive drugs C. Anti-anginal and vasodilator drugs including calcium antagonist and β -adrenergic antagonist D. Anti-arrhythmic drugs A. Drug used in coronary artery disease and hyperlipoproteinemia: Antihyperlipidemic agents, Anticoagulants, Vitamin K and haemostatic agents, Fibrinolytic and anti-platelets drug, E. Drug used in the therapy of shock	20
03	Drug acting on urinary system: A. Fluids and electrolyte balance B. Diuretics	05
04	Drugs acting on endothelial cells.	05

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- a) To calculate the PA_2 value of Atropine using acetylcholine as an agonist on rat/chicken ileum.
- b) To calculate the PA_2 value of mepyramine using histamine as an agonist on rat/chicken ileum preparation & rat fundus Preparation.
- c) To study non competitive antagonism of papaverine using acetylcholine as an agonist on rat/ chicken ileum.
- d) Pharmacology of cardiovascular system:
 - a. To study the effect of various drugs on frog's heart using simulated software.
 - b. To demonstrate the effects of various drugs on the rat B.P. and respiration include the Vasomotor Reversal of Dale and Nicotinic action of acetylcholine using simulated software.

Books Recommended

1. Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
2. Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
3. Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn.Vallabh Prakashan, New Delhi.

4. Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
 5. Rang h.P., dale M.M., etal-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
 6. Satoskar R.S., etal-Pharmacology and pharmacotherapeutics (1999)16th Edn. Popular Prakashan, Mumbai.
 7. Harvel, R.A., Champe P.C. etal –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
 8. Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.
 9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn. Pergamon Press, Singapore.
- Seth,S.D. text Book of pharmacology,B.I.Churchill,1997.

Bachelor of Pharmacy Program

Semester V

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH511	Pharmaceutical Technology – I	100	100	3	3
PH512	Pharmaceutical Microbiology	100	100	2	3
PH513	Medicinal Chemistry – I	100	-	3	-
PH514	Pharmaceutical Analysis – I	100	100	3	3
PH515	Pharmacognosy-III	100	100	3	3
PH516	Pharmacology-III	100	100	3	3
PH517	Pharmaceutical Jurisprudence – I	100	-	2	-
	Total	700	500	19	15

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH511 Pharmaceutical Technology – I

Theory

3 hours/Week

No.	Chapter	Hours
01	Tablet: Definition, Advantages and disadvantages, Introduction to types of tablets, formulation of different types of tablets; excipients, granulation techniques, machinery for large scale granulation and compression, physics of tablet making, In process controls, processing problems and remedies, Evaluation (Pharmacopoeial and nonpharmacopoeial test) and equipments., Brief outline on manufacturing method and evaluation of mouth dissolving tablets, buccal tablets, floating tablets, tablets of colon drug delivery, matrix tablets. Coating Of Tablets: objectives, types of coating, film forming materials, formulations of coating solution, equipments for coating, coating process, evaluation of coated tablets , coating defects, specialized coating processes.	15
02	Capsules Hard Capsules: Definitions, Advantages, disadvantages, Ideal requirements, Production of Hard capsules (Gelatin and nongelatin e.g. vegetable), Capsule storage, size of capsules, formulation and methods of capsule filling, problems and remedies, quality control, climatic control in capsule department, I.P capsules. Soft Gelatin Capsules: Formulation of shell and capsule coat, quality control with special emphasis on current dissolution testing.	12
03	Microcapsules/Microspheres: Importance of microcapsule and microsphere in pharmacy, methods of preparation: Phase separation, coacervation, multiorifice centrifugal methods, spray congelling, polymerisation, complex emulsion, Air suspension technique, coating pan and other techniques, evaluation of microcapsules, Applications of biodegradable and nonbiodegradable polymers in Microcapsules/Microspheres.	05
04	Semisolid dosage forms: Definition, Advantages and disadvantages, types, mechanisms of drug penetration through skin, factors influencing penetration, semisolid bases, their selection and ideal requirements of bases. General formulation of semisolids, clear gels, suppositories; Manufacturing procedure, evaluation and packaging. I.P. products.	08
05	Suppositories: Ideal requirements, Bases, Manufacturing procedure, Packaging and evaluation.	05

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

Books Recommended

1. The Theory and Practice of Industrial Pharmacy by L Lachman, H Lieberman and J Kanig.
2. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel & others.
3. Pharmaceutics: The Science of Dosage Form Design by Michael E. Aulton Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York.
4. Pharmaceutical Dosage Forms: Disperse systems: Vol.1, Vol. 2 and Vol.3, Ed. By Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
5. Pharmaceutical Dosage Forms: Parenteral Medication: Vol.1, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
6. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes, Marcel Dekker, Inc., New York.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH512 Pharmaceutical Microbiology

Theory

2 hours/Week

No.	Chapter	Hours
01	Introduction to the science of microbiology Ancient theories concerning the origin of life contribution of great scientists to this science	1
02	General microbiology: <ul style="list-style-type: none">– Structure and Bacterial Cell, Classification and taxonomy of Actinomycetes, Bacteria, Spirochetes, Rickettsia and Viruses– Identification: Electron microscopy and Staining Technique– Nutrition, Cultivation and Isolation of Microbes	10
03	Control of microbes: <ul style="list-style-type: none">– Disinfection: Factor affecting Disinfection, Dynamics of Disinfection, Evaluation of Disinfection.– Sterilization: Methods of Sterilization, Validation of Sterilization Methods and Equipment.	10
04	Analytical microbiology: <ul style="list-style-type: none">– Bacterial Counts– Sterility of Pharmaceuticals– Microbiological Assay of Vitamins and Antibiotics and Amino acids	09

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Preparation of Various Media
- Subculturing of Common Bacteria (Aerobic and Anaerobic)
- Staining of Microorganism
- Methods of Isolation
- Study of Sterilization and Their Validation
- Sterility Testing of Pharmaceuticals as per IP
- Bacterial Counts

Books Recommended

1. Textbook of Microbiology by Tortora.
2. Pharmaceutical Microbiology, sixth edn, edited by W. B. Hugo and A. D. Russell Blackwell science.
3. Principles of Microbiology, Ronald M. Atlas. Second edn. W. C. Brown Publishers.
4. Bergeys manual of Systematic Bacteriology, Williams and Wilkins- A Waverly company.
5. Disinfection, Sterilization and Preservation. Fourth edn, Seymour S. Black. Lea and Febiger Philadelphia, London.
6. Industrial Microbiology. Fourth edn, Prescott and Dunn. CBS Publishers and Distributors.
7. Principles of Fermentation Technology. Second edn. P. F. Stanbury, A. Whishaker and S. J. Hall Aditya Books Pvt Ltd. New Delhi.

8. Microbiology, Pelczar/Chan Kreig Tata McGraw Hill edn.
9. Industrial Microbiology L.E. Casida, Jr. New age International Publishers.
10. Fundamental Principles of Bacteriology. A. J. Sale, Tata McGraw Hill Publishing Company Ltd.
11. Fundamentals of Microbiology by Forbischer.
12. Bentleys Text book of Pharamceutics.
13. Dispensing Pharmacy by Cooper and Gunn, Twelfth edn.
14. Remington Pharmaceutical Scicence, Latest edn.
15. Microbiology by Ronald Atlas.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH513 Medicinal Chemistry – I

Theory

3 hours/Week

No.	Chapter	Hours
01	Heterocyclic Compounds: Chemistry, preparations and properties of some important heterocyclics containing 5 and 6 atoms with 1 or 2 hetero atoms like O,N,S and their condensed derivatives (bicyclic only).	17
02	Basic principles of Medicinal Chemistry: Physico-Chemical aspects (Optical, geometrical and bioisosterism) of drug molecules and biological action, Drug-receptor interaction including transduction mechanisms	10
03	Drugs acting on Respiratory tract: Anti-asthmatics, Anti-tussives, Expectorants, Analeptics (Respiratory stimulants)	10
04	Drugs acting on Gastro-intestinal tract: Anti-ulcers and Antacids, Anti-Emetics, Pro-Kinetic agents, Anti-diarrheals, Laxatives	08

Books Recommended

1. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry. Edited by J.N. Delgado and William A. Remers, J.B. Lippincott Company Philadelphia.
2. Principles of Medicinal Chemistry by W.C. Foye, Lea and Febiger Philadelphia.
3. Bergers Medicinal Chemistry – H.E. Wolf, Jhon Wiley and Sons New York Oxford University Press, Oxford.
4. The Organic Chemistry of Drug Synthesis Volume 1-6 by Deniel Lednoger, John Wiley and sons, Inc. New York.
5. Pharmaceutical Substances Synthesis (two parts), patents, applications by A. Kleemann, J.Engel by Thieme Stuttgart New York.
6. Organic Chemistry volume 1 & 2 by I.L. Finar publishers ELBS/Longman London.
7. Principles of Medicinal Chemistry by Dr. S. S. Kadam, K.G. Bothara, Nirali Prakashan Pune.
8. Medicinal and Pharmaceutical Chemistry by Harkishan Singh, V.K.Kapoor, Vallabh Prakashan New Delhi.
9. Fundamentals of Drug Metabolism and Disposition by H.N. Ladu, H. G. Mandal and E.L. Way Williams and Wilkins Co. Baltimore.
10. Vogale's Text Book of Practical Organic Chemistry, ELBS / Longman, London.
11. Practical Organic Chemistry BY Mann and Saunderson. Orient Longman, UK.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH514 Pharmaceutical Analysis – I

Theory

3 hours/Week

No.	Chapter	Hours
01	Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Significance figure, Rules for retaining significant digits, Types of errors, Mean data sets, Selection of sample, Precision and accuracy, Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards. USP parameters for method validation, rejection criteria, Q test.	06
02	Theoretical considerations, principle, instrumentation, and applications in drug analysis and quality control of the following analytical techniques will be discussed: Non-aqueous titrations, Complexometric titrations, Miscellaneous methods of analysis such as: Diazotization titrations, kjeldahl method of nitrogen estimation, Karl -Fisher titration, Oxygen flask combustion, gasometry.	10
03	Acid Base Titrations: Acid base concepts, Role of solvent, Relative strengths of acids and bases, Law of mass action, Common- ion effect, Ionic product of water, pH, hydrolysis of salts, Henderson-Hasselbach equation, Buffer solutions, Buffer capacity, Neutralization curves, Acids-base indicators, Theory of indicators, Choice of indicators, mixed indicators, Polyprotic system, applications in assays.	12
04	Oxidation-Reduction Titrations: Concepts of oxidation and reduction, redox reactions, Strengths and equivalent weights of oxidizing and reducing agents, Theory of redox titrations, redox indicators, cell representations, Measurement of electrode potential, Oxidation-reduction curves, iodimetry and iodometry, Titrations involving Ceric sulphate, potassium iodate, potassium bromate, potassium permanganate and sodium 2,6 dichlorophenol.	07
05	Precipitation titrations: Precipitation reactions, solubility products, effect of acids, temperature and solvent etc. upon the solubility of a precipitate. Argentometric titrations and titrations involving Ammonium or potassium thiocyanate, mercuric nitrate, and barium sulfate indicators, Gay-lussac Method; Mohr's method, Volhard's method and Fajan's method	05
06	Gravimetric analysis: Precipitation techniques, Solubility products; the crucibles state, supersaturation co-precipitation, Post-precipitation, Digestional washing of the precipitate, Filtration, Filter papers and crucibles, Ignition. Applications of gravimetry. Brief introduction of thermogravimetric methods, Thermogravimetric curves	05

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Acid base Titration: Preparation and standardization of acids and bases; some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures e.g. boric acid should also be covered.

2.Oxidation-reduction Titrations: Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate etc., some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, and ceric ammonium sulphate.

3.Precipitation titrations: preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, titrations according to Mohr's, Volhard's and Fajan's methods.

4.Gravimetric analysis: preparation of Gooch crucible for filtration and use of sintered glass crucible, determination of water of hydration, some exercises related to gravimetric analysis should be covered.

5.Non aqueous titration: preparation and standardization of perchloric acid and estimation of some pharmacopoeial products.

6.Complexometric titrations: preparation and standardization of EDTA solution, some exercises related to pharmacopoeial assays by complexometric titrations.

7.Miscellaneous determination: exercises involving diazotization, Karl-Fischer titration..

Books Recommended

1. Pharmaceutical Analysis: Modern Methods, James W. Munson, Marcel Dekker, Inc.
2. Practical Pharmaceutical Chemistry-I, A.H. Beckett and J.B. Stenlake, CBS Publishers.
3. Indian Pharmacopoeia.
4. British Pharmacopoeia.
5. United States Pharmacopoeia.
6. Textbook of quantitative chemical analysis, 6th edition, Pearson publication.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH515 Pharmacognosy – III

Theory

3 hours/Week

No.	Chapter	Hours
01	Extraction and phytochemical screening. Introduction and classification of Extraction. Phytochemical screening of Alkaloids, Glycosides, Tannins, Polyphenols, Phytosterols and Flavonoids in the plant extract by using advanced analytical methods.	07
02	Glycoside containing drugs: Biological sources, cultivation, collection, commercial varieties, diagnostic macroscopic & microscopical features, chemical constituents, uses, substitutes, adulterants, and specific chemical tests. (a) Saponins glycoside: Liquorice, Ginseng, Dioscorea, Sarsaparilla, Senega. (b) Cardiac glycoside: Digitalis, Squill, Strophanthus, Thevetia, Ouabain. (c) Anthraquinone glycoside: Aloe, Senna, Cassia pod, Rhubarb and Cascara. (d) Bitter glycoside: Chirata, Quassia, Kalmegh, Picrorrhiza, Gentian. (e) Coumarine glycoside: Psoralea, Ammi visnaga, Ammi majus. (f) Isothiocynate glycoside: Mustard, Black mustard. (g) Cyanogenetic glycoside: Bitter almond, Linseed. (h) Flavanoids: Ruta graveolens.	28
03	Glycosidal Phytoconstituents: Chemistry, biosynthetic pathway, isolation, estimation and Pharmacological action of Diosgenin, Sennosides, Digoxin, digitoxin, Andrographolides, Glycyrrhithinic acid and Ginsenoside.	06
04	Chromatography: Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs.	04

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Identification of crude drugs mentioned in theory.
- Microscopical study of characters of selected drugs given in the theory in entire and powdered form.
- Chemical evaluation of powdered drugs.
- Laboratory experiments on extraction, isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.

2. Pharmacognosy and pharmacobiotechnology, Ashutosh Kar, New Age International (P) Ltd, Publishers, 2nd edition 2007.
3. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahemedabad, 8th edition, 1990
4. Trease and Evan's Pharmacognosy: W. C. Evans, W.B.Saunders Co., Singapore, 15th Edition, 2008.
5. Text Book Pharmacognosy: T.E. Wallis, CBS Publishers and Distributors Delhi- 5th Edition, Reprint, 1997.
6. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,.
7. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbars, Lea and Febgir Philadelphia, 8th Edition, 1981.
8. Cultivation and Utilization of Aromatic Plants, Handa S.S. and Kaul M.K., Regional Research Laboraotry, Jammu, 1st Edition, 1997.
9. Pharmacognosy of powdered crude drugs: M. A. Iyenger, Manipal Power Press, 1st Edition, 1974.
10. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
11. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
12. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH516 Pharmacology – III

Theory

3 hours/Week

No.	Chapter	Hours
01	Chemotherapy	28
02	Autacoids	05
03	Pathophysiology of various diseases including: <ul style="list-style-type: none">– Infectious diseases: Tuberculosis, urinary tract infection, enteric infections, upper respiratory infections.– Neoplastic Diseases: Acute leukemias, Hodgkin's disease, Prostate cancer, Breast Cancer.	10
04	Gene therapy	02

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Pharmacology of the gastrointestinal tract:
 - a) To study the spasmodic and spasmolytic effect of various drugs on ileum preparation of rat/guinea pig/chicken.
 - b) To find out the unknown drug on ileum preparation of rat/guinea pig/chicken.

Books Recommended

1. Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
 2. Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
 3. Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn. Vallabh Prakashan, New Delhi.
 4. Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
 5. Rang h.P., dale M.M., et al-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
 6. Satoskar R.S., et al-Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.
 7. Harvel, R.A., Champe P.C. et al –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
 8. Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.
 9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn. Pergamon Press, Singapore.
- Seth, S.D. text Book of pharmacology, B.I. Churchill, 1997.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH517 Pharmaceutical Jurisprudence – I

Theory

2 hours/Week

No.	Chapter	Hours
01	Introduction to a. Pharmaceutical Legislation- A brief review b. Drug and Pharmaceuticals Industry – A brief review c. Pharmaceutical Education – A brief review	3
02	An elaborate (practical oriented) study of the following: a. Pharmaceutical Ethics b. Pharmacy Act-1948 c. Medicinal and Toilet preparations (Excise Duties) Act- 1955	12
03	A brief study of the following with special references to the main provisions: a. Drugs and Magic Remedies (Objectionable Advertisements) Act-1954 b. Medical Termination of Pregnancy Act-1970 and Rules-1975 c. Prevention of Cruelty to Animals Act-1960 d. States Sops and Establishment Act and Rules e. Insecticides Act-1968 f. AICTE Act-1987	15

Books Recommended

1. A Text Book of Forensic Pharmacy by B. M. Mithal, 8th edition.
2. A Text Book of Forensic Pharmacy by N. K. Jain, Vallabh Prakashan
3. The Patent Act-1970 with Patens Rules –1972
4. The Narcotic and Psychotropic Substances Act-1985 with the prevention of illicit traffic in narcotic drugs and psychotropic substances act-1988 along with allied rules and orders-1993.
5. The Medical Termination of Pregnancy Act-1971, along with the medical termination of pregnancy rules-1975
6. Insecticides Act-1963 to gather with insecticide rule 1971 and insecticide (Price, Stock, Display and Submission of reports) order-1986 along with selected notifications (5th edition, 1998)
7. The Drugs (Price Control) Order-1987 along with new drug policy-1994 and drugs (Price Control) order-1995
8. The Opium Act-1857 with opium act-1878 and opium and revenue laws act-1950
9. The Standards of Weight and Measures Act-1976
10. The Pharmacy Act-1998

Bachelor of Pharmacy Program

Semester VI

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH611	Pharmaceutical Technology – II	100	100	3	3
PH612	Pharmaceutical Biotechnology	100	-	2	-
PH613	Medicinal Chemistry – II	100	100	3	3
PH614	Pharmaceutical Analysis – II	100	100	3	3
PH615	Pharmacognosy-IV	100	100	3	3
PH616	Pharmacology & Pathophysiology-I	100	100	3	3
PH617	Pharmaceutical Jurisprudence – II	100	-	2	-
	Total	700	500	19	15

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH611 Pharmaceutical Technology – II

Theory

3 hours/Week

No.	Chapter	Hours
01	Sterile dosage forms: Definitions, Advantages, Disadvantages, Ideal requirements and Formulation of sterile dosage forms, Water for injection-Preparation and quality control, Design and requirements for production area- Aseptic techniques, sources of contamination and methods of prevention, design of aseptic area, laminar flow benches, services and maintenance, containers and closures, methods of filling including form fill and seal technology. Evaluation of sterile dosage forms, Parenteral suspensions, Prefilled syringes, Parenteral nutrients, Freeze dried products, Nanosuspensions etc, I.P. Products. Ophthalmic preparations: Requirements, formulations, methods of preparations, containers and evaluation. I.P. Products.	12
02	Liquid dosage forms: Introduction, advantages and disadvantages, types of additives used vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors, etc; manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions (including microemulsion and multiple emulsion) and brief outline of other liquid products such as extracts, tincture, infusion etc., I.P. Products.	09
03	Cosmeticology and cosmetic preparations Fundamentals of cosmetic science, structure and functions of skin and hair, formulation, preparation and packaging of cosmetics for skin - Sunscreen, moisturizers, cold cream, and vanishing cream, hair - Shampoo and conditioners, dentifrice- powders, gels, paste and manicure preparations like- nail polish, lipsticks, eye lashes, brief introduction to cosmaceuticals, baby care products, shaving cream, hygienic products	10
04	Pharmaceutical aerosols: Definition, propellants, general formulation of aerosols, containers, manufacturing (cold filling and pressure filling technique) and packaging methods, pharmaceutical applications, evaluation of aerosol.	07
05	Good Manufacturing Practice for Pharmaceuticals and validation Brief Introduction to GMP (schedule M) and quality assurance, practice of GMP Procedure (SOPs), Building, Equipment, Personnel, Components, Documentation, Containers, Labeling, Laboratory Control, Distribution Records, Recovery & Reprocessing. Introduction to validation, validation of selective unit operations (e.g. granulation, compression) used in tablet manufacturing and steam sterilizer.	07

Practical

3 hours/Week

To illustrate the topics included under theory

Books Recommended

1. The Theory and Practice of Industrial Pharmacy by L Lachman, H Lieberman and J Kanig.
2. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel & others.
3. Pharmaceutics: The Science of Dosage Form Design by Michael E. Aulton Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York.
4. Pharmaceutical Dosage Forms: Disperse systems: Vol.1, Vol. 2 and Vol.3, Ed. By Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
5. Pharmaceutical Dosage Forms: Parenteral Medication: Vol.1, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
6. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes, Marcel Dekker, Inc., New York.
7. Cosmetics by Poucher

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH612 Pharmaceutical Biotechnology

Theory

2 hours/Week

No.	Chapter	Hours
01	Introduction to biotechnology	01
02	Microbial genetics and variation	04
03	Genetic recombination: transformation conjugation Protoplast fusion, gene cloning and their applications, monoclonal antibodies b. Study of drug produced by biotechnology, viz. activase, humulin, Hb tec.	06
04	Immunology and Immunological Preparation: a. Immunity, primary and secondary defense mechanism, interferon b. Principles of immunology, antigen antibody reactions and application, preparations of vaccines, toxoids. Standardization and storage	08
05	Fermentation Techniques: a. Screening of organism, preparation and preservation of master culture, design of fermentor, various parameters and media used for fermentation b. Recovery of fermentation products Flowsheets penicillin, streptomycin, Vit. B2, Vit. B12	08
06	Immobilization of Enzymes: a. Techniques of immobilization b. Factors affecting enzyme kinetics c. Applications	03

Books Recommended

1. Textbook of Microbiology by Tortora.
2. Pharmaceutical Microbiology, sixth edn, edited by W. B. Hugo and A. D. Rusell Blackwell science.
3. Principles of Microbiology, Ronald M. Atlas. Second edn. W. C. Brown Publishers.
4. Bergeys manual of Systematic Bacteriology, Williams and Wilkins- A Waverly company.
5. Disinfection, Sterilization and Preservation. Fourth edn, Symour S. Black. Lea and Febiger Philadelphia, London.
6. Industrial Microbiology. Fourth edn, Prescott and Dunn. CBS Publishers and Distributors.
7. Principles of Fermentation Tehchnology. Second edn. P. F. Stanbury, A. Whiteshaker and S. J. Hall Aditya Books Pvt Ltd. New Delhi.
8. Microbiology, Pelczar/Chan Kreig Tata McGraw Hill edn.
9. Industrial Microbiology L.E. Casida, Jr. New age International Publishers.
10. Fundamental Principles of Bacteriology. A. J. Sale, Tata McGraw Hill Publishing Company Ltd.
11. Fundamentals of Microbiology by Forbischer.

12. Bentley's Text book of Pharmaceutics.
13. Dispensing Pharmacy by Cooper and Gunn, Twelfth edn.
14. Remington Pharmaceutical Science, Latest edn.
15. Microbiology by Ronald Atlas.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH613 Medicinal Chemistry – II

Theory

3 hours/Week

No.	Chapter	Hours
01	Drugs acting on Autonomic Nervous System: Cholinergics, Anti-cholinergics and Anti-cholinesterases, Adrenergics, Sympatholytics, Neuro-muscular junction blocking agents	10
02	Drugs acting on Central Nervous System: General Anesthetics, Local Anesthetics, Hypnotics & Sedatives, Opioid analgesics, anti-convulsants, Antiparkinsonism drugs, CNS stimulants Psycho-pharmacological agents (neuroleptics, anti-depressants, anxiolytics).	22
03	Drugs acting on Autocoids: Eicosanoids and their Synthesis, inhibitors, NSAID'S., Anti-Allergic drugs (H1-receptor antagonists)	06
04	Diagnostic agents.	03
05	Pharmaceutical aids	04

Practical

3 hours/Week

Qualitative analysis of Binary Organic mixture and Synthesis of Compounds

Books Recommended

1. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry. Edited by J.N. Delgado and William A. Remers, J.B. Lippincott Company Philadelphia.
2. Principles of Medicinal Chemistry by W.C. Foye, Lea and Febiger Philadelphia.
3. Bergers Medicinal Chemistry – H.E. Wolf, John Wiley and Sons New York Oxford University Press, Oxford.
4. The Organic Chemistry of Drug Synthesis Volume 1-6 by Daniel Lednicher, John Wiley and Sons, Inc. New York.
5. Pharmaceutical Substances Synthesis (two parts), patents, applications by A. Kleemann, J. Engel by Thieme Stuttgart New York.
6. Organic Chemistry volume 1 & 2 by I.L. Finar publishers ELBS/Longman London.
7. Principles of Medicinal Chemistry by Dr. S. S. Kadam, K.G. Bothara, Nirali Prakashan Pune.
8. Medicinal and Pharmaceutical Chemistry by Harkishan Singh, V.K. Kapoor, Vallabh Prakashan New Delhi.
9. Fundamentals of Drug Metabolism and Disposition by H.N. Ladu, H. G. Mandal and E.L. Way Williams and Wilkins Co. Baltimore.
10. Vogale's Text Book of Practical Organic Chemistry, ELBS / Longman, London.
11. Practical Organic Chemistry BY Mann and Saunders. Orient Longman, UK.
12. The Systematic Identification of Organic Compounds by Shriner, Hermann, Morrill, Curtin & Fuson, John Wiley and Sons, USA.
13. An Introduction to the Chemistry of heterocyclic Compounds by R.M. Acheson Wiley Eastern Ltd. New Delhi.
14. Spectrometric identification Of Organic Compounds by R. M. Silverstein, G. Claytor Bassel's. T.C. Mivvill. John Wiley & Sons, USA.
15. Organic spectroscopy by William Kemp. ELBS, London.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH614 Pharmaceutical Analysis – II

Theory

3 hours/Week

No.	Chapter	Hours
01	Extraction procedure including separation of drugs from excipients by single extraction, multiple extraction, counter current distribution, batch extraction, continuous extraction, solid-liquid and liquid-liquid extraction	05
02	Classification, principle, theories and parameters of chromatography.	06
03	Chromatographic techniques: TLC, HPTLC, Paper chromatography and column Chromatography	06
04	Principle, Instrumentation, calibration and applications of following electro analytical techniques: pHmetry [2], Potentiometry [3], Conductometry [3], Calorimetry [3], Polarography [4], Amperometry and Biamperometry [2] Polarimetry [3].	20
05	Radiochemical techniques: Radiochemical Laboratories, Instrumentation. Radiochemical methods of analysis	08

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Practicals involving electro analytical methods like pHmetry, Potentiometry, Conductometry.
2. Practicals involving chromatographic techniques like TLC and paper chromatography.
3. Extraction techniques.

Books Recommended

- 1.Principles of Instrumental Analysis - Skoog, Holler, Nieman, Saunders College Publishing.
- 2.Textbook of Pharmaceutical Analysis - Kenneth A. Connors,, John Wiley & Sons.
- 3.Instrumental Methods of Chemical Analysis - Galin W. Ewing, McGraw Hill International Editions.
- 4.Principles of Instrumental Analysis - Skoog, Leary, 4th Ed., Saunders college Publishing.
- 5.Instrumental Methods of Analysis - Willard, Merritt, Dean, Settle, CBS Publishers.
- 6.Textbook of quantitative chemical analysis, 6th edition, Pearson publication.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH615 Pharmacognosy – IV

Theory

3 hours/Week

No.	Chapter	Hours
01	Pharmacognostical study of following alkaloid containing crude drugs: (a) Pyridine piperidine: Tobacco, Areca and Lobelia. (b) Tropane: Belladonna, Hyoscyamus, Datura, Duboisia, Coca. (c) Isoquinoline: Ipecac, Opium. (d) Quinoline: Cinchona, Camptotheca. (e) Indol: Ergot, Rauwolfia, Catharanthus, Nux-vomica and Physostigma. (f) Imidazole: Pilocarpus. (g) Steroidal: Kurchi, Veratrum and Ashwagandha. (h) Alkaloidal amine: Ephedra, Colchicum. (i) Glycoalkaloid: Solanum. (j) Purines: Coffee, Tea and Cola. (k) Quinazoline: Vasaka.	27
02	Alkaloidal Phyto-constituents: Chemistry, biosynthetic pathways, Isolation, Estimation and pharmacological action of Atropine, Scopolamine, Morphine, Papaverine, Ephedrine, Reserpine, Caffeine, Ergotamine and Quinine.	10
03	Chemotaxonomy of medicinal plants.	05
04	Herbs as health food.	03

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Identification of crude drugs mentioned in theory.
- Microscopical study of characters of selected drugs given in the theory in entire and powdered form.
- Chemical evaluation of powdered drugs.
- Laboratory experiments on extraction, isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.
2. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahmedabad, 8th edition, 1990
3. Trease and Evan's Pharmacognosy: W. C. Evans, W.B.Saunders Co., Singapore, 15th Edition, 2008.
4. Text Book Pharmacognosy: T.E. Wallis, CBS Publishers and Distributors Delhi- 5th Edition, Reprint, 1997.

5. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,
6. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbers, Lea and Febgir Philadelphia, 8th Edition, 1981.
7. Cultivation and Utilization of Aromatic Plants, Handa S.S. and Kaul M.K., Regional Research Laboraotry, Jammu, 1st Edition, 1997.
8. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
9. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhanand Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
10. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar.
11. Textbook of Industrial Pharmacognosy, By A.N. Kalia, CBS Publishers & Distributors.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH616 Pharmacology and Pathophysiology – I

Theory

3 hours/Week

No.	Chapter	Hours
01	Pathophysiology: <ul style="list-style-type: none">– Cell injury and repair mechanism– Inflammation– Healing– Apoptosis & Necrosis.	20
02	Pathophysiology of various diseases including: <ul style="list-style-type: none">– Respiratory disease: Asthma, COPD.– Gastrointestinal disorders: Peptic Ulcer, Ulcerative Colitis, Hepatitis, Cirrhosis	13
03	Drug acting on respiratory system: <ul style="list-style-type: none">– Antiasthmatic drugs including bronchodilators– Antitussive and expectorants– Respiratory stimulants	06
04	Drug acting on gastrointestinal tract: <ul style="list-style-type: none">– Antacid anti-secretory and anti-ulcer drugs– Laxatives and anti-diarrheal drug– Appetite stimulant and suppressant– Emetics and anti-emetics– Miscellaneous agents	06

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- A. To study the anti-secretory and anti-ulcer activity using pylorus ligated rats.
- B. To estimate the strength of test sample of agonist/drug (e.g. Acetylcholine, Histamine, 5-HT & Oxytocin etc.) using a suitable muscle preparation of employing Matching bioassay, End Point bioassay, Graphical bio-assay, three point & Four point methods of Bioassay

Books Recommended

1. Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
2. Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
3. Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn. Vallabh Prakashan, New Delhi.
4. Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
5. Rang h.P., dale M.M., et al-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
6. Satoskar R.S., et al-Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.

7. Harvel, R.A., Champe P.C. etal –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
 8. Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.
 9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn. Pergamon Press, Singapore.
- Seth,S.D. text Book of pharmacology,B.I.Churchill,1997.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH617 Pharmaceutical Jurisprudence – II

Theory

2 hours/Week

No.	Chapter	Hours
01	An elaborate (practical oriented) study of the following: a. Drugs and Cosmetics Act-1940 and Rules –1945 b. Narcotic Drugs and Psychotropic Substances Act-1985 and rules c. Drug Price Control Order.	18
02	A brief study of the following with special references to the main provisions: a. Factories Act-1948 b. Minimum Wages Act-1948 c. Patents Act d. Trade and Merchandise Act e. Industrial Regulation Act (Pollution) f. I. Poisons Act-1919	12

Books Recommended

1. A Text Book of Forensic Pharmacy by B. M. Mithal, 8th edition.
2. A Text Book of Forensic Pharmacy by N. K. Jain, Vallabh Prakashan
3. The Patent Act-1970 with Patens Rules –1972
4. The Narcotic and Psychotropic Substances Act-1985 with the prevention of illicit traffic in narcotic drugs and psychotropic substances act-1988 along with allied rules and orders-1993.
5. The Medical Termination of Pregnancy Act-1971, along with the medical termination of pregnancy rules-1975
6. Insecticides Act-1963 to gather with insecticide rule 1971 and insecticide (Price, Stock, Display and Submission of reports) order-1986 along with selected notifications (5th edition, 1998)
7. The Drugs (Price Control) Order-1987 along with new drug policy-1994 and drugs (Price Control) order-1995
8. The Opium Act-1857 with opium act-1878 and opium and revenue laws act-1950
9. The Standards of Weight and Measures Act-1976
10. The Pharmacy Act-1998

Bachelor of Pharmacy Program

Semester VII

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH711	Dosage Form Design	100	100	3	3
PH712	Medicinal Chemistry – III	100	100	3	3
PH713	Pharmaceutical Analysis – III	100	100	3	3
PH714	Pharmacognosy-V	100	100	3	3
PH715	Pharmacology & Pathophysiology-II	100	100	3	3
PH716	Pharmaceutical Management	100	-	2	-
	Total	600	500	17	15

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH711 Dosage Form Design

Theory

3 hours/Week

No.	Chapter	Hours
01	Preformulation studies: a) Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability. b) Study of chemical properties of drugs like hydrolysis, oxidation, reduction, polymorphisms, racemization, polymerization etc., and their influence on formulation and stability of products. c) Study of prodrugs in solving problems related to stability, bioavailability and elegance of formulations.	11
02	Pharmaceutical necessities: Effect of following adjuvants on formulation of different pharmaceutical products: Antioxidants, preservatives, colours, flavours, diluents, binders, disintegrants, antifirctional agents, emulsifiers, suspending agents, ointment bases, solvents etc. and other formulation additives.	6
03	Stability of pharmaceuticals: a) Kinetic principles and stability testing: Reaction rate and order, acid base catalysis, decomposition reactions and stabilization of pharmaceuticals. b) Stability of formulation, factors affecting formulation stability, MKT, climatic zones, matrixing and bracketing instability study, accelerated stability testing, real time stability. Current WHO, USFDA and stability testing as per ICH guidelines for pharmaceutical drug substances and drug products. c) Product stability: Requirements, shelf-life, overages, containers, closures. d) Overage calculations	8
04	Controlled and sustained release dosage forms Design of oral sustained release systems: Biological factors, Physicochemical factors Diffusional systems: - Reservoir system, Lag time, Burst effect, Matrix system, Effect of porosity and tortuosity Dissolution controlled system, Cube root dissolution equation, Diffusion layer controlled dissolution. Bioerodible and Combination of diffusion and dissolution systems. Design, development and evaluation of oral and parenteral controlled release formulations.	8
05	Novel drug delivery system (a) Modified drug delivery systems: Fundamentals, rationale of modified release drug delivery, factors influencing the design and performance, pharmacokinetic and pharmacodynamic basis for modified drug delivery systems, estimation of loading and maintenance dose. (b) Design and development of oral modified release dosage forms:	22

	<p>Matrix tablets, microspheres, hydrogels, osmotic pressure controlled systems, gastro retentive systems, colon targeting.</p> <p>(c) Fabrication of parenteral drug delivery systems: Parenteral emulsions & parenteral suspensions, microspheres, liposomes, niosomes, nanoparticles.</p> <p>(d) Formulation and evaluation of Transdermal drug delivery systems.</p> <p>(e) A brief study of site specific and targeted drug delivery systems, transmucosal and ocular drug delivery systems.</p>	
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Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

Books Recommended

1. The Theory & Practice of industrial pharmacy by Leon Lachmen et al., Lea & Febiger, Philadelphia.
2. Remington's Pharmaceutical Sciences, ed. A.R. Gennaro, Mack Publishing Co.
3. Modern Pharmaceutics ed. G.S. Banker & C.T. Rhodes, Marcel Dekker Inc. N.Y.
4. Pharmaceutical dosage forms: Tablets, Parenterals, Disperse systems. Vol.: 1,2,3 Leon, Lachman. Et.al.
5. Pharmaceutics: The science of dosage form design. M.E. Aulton. ELBS/Churchill Livingstone.
6. Drug Stability, T. Carstensen, Marcel Dekker Inc. N.Y.
7. Physical Pharmacy, A.N. Martin et al, K.M. Verghese & Co.
8. Pharmacokinetics, Gibaldi & D. Perrier Marcel Dekker Inc., N.Y.
9. Pharmaceutical calculation, N.J. Stoklosa, Lea & Febiger, Philadelphia.
10. Pharmaceutical Statistics, Sanford Bolton. Marcel Dekker Inc.
11. Novel drug delivery systems: Fundamentals & Developmental concepts. Y.W. Chien, Marcel Dekker Inc.
12. Biopharmaceutics & Pharmacokinetics - an introduction. R.E. Notary, Marcel Dekker Inc., N.Y.
13. Controlled drug Delivery, Fundamentals and applications, J.R. Robinson & Lee, Marcel Dekker Inc.
14. Handbook of Pharmaceutical Excipients" By James C. Boylan, Pub., American Pharmaceutical Association & The Pharmaceutical Society of Great Britain.
15. Pharmaceutical Dissolution testing, Umesh V. Bankar, Marcel Dekker Inc.

DHARMSINH DESAI UNIVERSITY

BACHELOR OF PHARMACY

PH712 Medicinal Chemistry – III

Theory

3 hours/Week

No.	Chapter	Hours
01	Drug Metabolism - Various processes of drug metabolism and its importance in drug design with specific examples and concepts in prodrugs	07
02	Drug design - Introduction various approaches for lead optimization, physicochemical parameters used in QSAR and different methods of QSAR. Introduction to Molecular modeling	06
03	Synthetic procedures of official drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs: A. Anti-hypertensives (03) B. Anti-arrythmic agents (03) C. Anti-anginal agents (02) D. Anti-hyperlipaemic agents (02) E. Cardiotonics (02) F. Anti-coagulants, Anti-Platelets and Anti-thrombolytic agents (03) G. Diuretics (03)	18
04	Thyroid and Antithyroid drugs	04
05	Insulin and hypoglycemic agents.	05
06	Steroid hormones: Detailed study of sex hormones and adrenal cortex hormones including synthetic substitutes, SAR in synthetic substitutes.	05

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Selected drug synthesis from the course content.
2. Special analysis of the drug synthesized.
3. Organic spotting of binary mixtures with derivative preparation and TLC.
4. Establishing the Pharmacopoeial standards of the drugs synthesized.

Books Recommended

1. J.N.Delagado and W.A.R. Remers, Eds, Wilson and Giswild's Text book of Organic, Medicinal and Pharmaceutical Chemistry, J.Lipincott., Philadelphia.
2. H.E.Wolf,Ed., Burger's Medicinal Chemistry, John Wiley & Sons, New York.
4. B.N.Ladu, H.G.Mandel & E.L.Way, Fundamentals of Drug Metabolism & Disposition, William & Wilkins Co., Baltimore.
5. Popst and Perrum, "Computer Aided Drug Design", Acedemic Press, New York.
6. C.Hanch, Compresive Medicinal, Vol:IV, Quantitive Drug Design, Pregamon Peress, Oxford.
7. Y.C.Martin, Quatitative Drug Design - A Critical Introduction (Medicinal Research Monograph, Vol:8). Marcel Dekker.Inc., New York.

8. Exploring QSAR: Vol:I, Fundamentals and Applications in Chemistry and Biology by C.Hansch and A.Leo. and Vol:II, Hydrophobic, Electronic and Steric constants by C.Hansch, A.Leo. and D.Hockman.
9. P.C.Jurs, Computer Software Application in Chemistry, John Wiley & Sons, New York.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH713 Pharmaceutical Analysis – III

Theory

3 hours/Week

No.	Chapter	Hours
01	Ultraviolet and Visible Spectrophotometry: Electromagnetic Radiation (EMR), properties of EMR, Mechanism of Absorption of EMR by molecules, Factors affecting absorption position and absorption intensity, Laws of photochemistry, Deviations from Beer's Law, Instrumentation (components and their general working principles), single beam and double beam instruments, sample handling, selection of wavelength and band width, Applications (direct methods, indirect methods, analysis of mixtures)	13
02	Fluorimetry: Origin of fluorescence and phosphorescence, Factors affecting fluorescence intensity, Relationship of fluorescence and phosphorescence to molecular structure, Instrumentation (components and their general working principles), Applications	06
03	Infrared Spectrophotometry Origin of an I.R. spectrum, Instrumentation (components and their general working principles), Sample handling, A brief introduction to Fourier transform infrared spectroscopy (FTIR), Applications, Analytical shortcomings	10
04	Nuclear Magnetic Resonance Spectroscopy: Magnetic properties of the nucleus, Origin of NMR spectrum, Chemical shift, Coupling, Factors affecting chemical shift and coupling, Instrumentation (CW and FTNMR), Brief introduction to ¹³ CNMR	08
05	Mass Spectrometry Origin of mass spectra, Fragmentation rules, Recognition of molecular ion peak, Instrumentation, Applications	08

Practical

3 hours/Week

To illustrate the topics included under theory

Quantitative estimation and general tests of formulations containing single drug, using instrumental techniques based on theory.

Books Recommended

1. Principles of Instrumental Analysis - Skoog, Holler, Nieman, 5th Ed. Saunders College Publishing.
2. A Textbook of Pharmaceutical Analysis - Kenneth A. Connors, 3rd Ed., John Wiley & Sons.
3. Instrumental Methods of Chemical Analysis - Galin W. Ewing, 5th Ed., McGraw Hill International Editions.
4. Principles of Instrumental Analysis - Skoog, Leary, 4th Ed., Saunders college Publishing
5. Instrumental Methods of Analysis - Willard, Merritt, Dean, Settle, CBS Publishers 7th Ed.
6. Spectrometric Identification of Organic compounds-Silverstein, Morrill, 5th Ed., John Wiley & Sons, Inc.

7. Pharmaceutical Analysis: Modern Methods, James W. Munson, Marcel Dekker, Inc.
8. Practical Pharmaceutical Chemistry-I & II, A.H. Beckett and J.B. Stenlake, 4th Ed. CBS Publishers.
9. Indian Pharmacopoeia.
10. British Pharmacopoeia.
11. United States Pharmacopoeia.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH714 Pharmacognosy-V

Theory

3 hours/Week

No.	Chapter	Hours
01	Plant Tissue Culture Techniques & its Application in Pharmacy : Introduction and types of PTC. Equipment and facilities require for PTC. Media composition. Immobilized cell techniques, Micropropagation, protoplast, static, suspension, hairy root cultures and some other new techniques in PTC. Biotransformation studies including recent developments in production of biological active constituents in PTC.	09
02	Marine Pharmacognosy, novel medicinal agents from marine sources.	05
03	Role of medicinal plant and aromatic plants in national economy.	01
04	Chemical and spectral approaches to simple molecules of natural origin.	03
05	Concept of stereoisomerism taking examples of Natural Products such as Sennoside, hyoscyamine, citral, menthol, quinine, ephedrine & papaverine.	03
06	Terpenoids: Chemistry, Biogenesis and Pharmacological activity of Geraniol, Menthone, Carvone, Pinene, Abietic acid, β -amyrin, Oleanolic acid, Vitamin – A.	08
07	Traditional drugs: Common vernacular names, botanical sources, morphology, microscopy, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs: Entire herb: Punarnava, Apamarg, Brahmi, Shankhapusphi, Kantakari. Root & Rhizomes: Satavari, Majith, Chitrak, Vaj, Rasna, Nagarmotha Bark: Arjuna , Ashoka. Flower: Palash. Unorganised drugs: Guggal, Shilajit.	16

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Identification of crude drugs mentioned in theory.
2. Microscopical study of characters of selected drugs given in the theory in entire and powdered form.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.

2. Pharmacognosy and pharmacobiotechnology, Ashutosh Kar, New Age International (P) Ltd, Publishers, 2nd edition 2007.
3. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahmedabad, 8th edition, 1990
4. Trease and Evan's Pharmacognosy: W. C. Evans, W.B.Saunders Co., Singapore, 15th Edition, 2008.
5. Text Book Pharmacognosy: T.E. Wallis, CBS Publishers and Distributors Delhi- 5th Edition, Reprint, 1997.
6. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,.
7. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbars, Lea and Febgir Philadelphia, 8th Edition, 1981.
8. Cultivation and Utilization of Aromatic Plants, Handa S.S. and Kaul M.K., Regional Research Laboraotry, Jammu, 1st Edition, 1997.
9. Pharmacognosy of powdered crude drugs: M. A. Iyenger, Manipal Power Press, 1st Edition, 1974.
10. Mukherji P. K., Quality Control of Herbal Drugs, Business Horizon Pharma. Publishers, 1st Edition, 2002.
11. Herbal drug technology, S. S. Agrawal and M. Paridhavi, Univeristies Press, 1st Edition, 2007.
12. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
13. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
14. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH715 Pharmacology & Pathophysiology-II

Theory

3 hours/Week

No.	Chapter	Hours
01	Pathophysiology of various diseases including: <ul style="list-style-type: none"> • CNS disorders: Epilepsy, Parkinsonism, Schizophrenia, Depression • Joint and connective tissue disorders: Rheumatoid arthritis, Gout and Hyperuricemia • Renal disorders: Acute Renal Failure & Chronic Renal Failure • Haematopoietic disorders: Anemia • Endocrine: Diabetes mellitus and thyroid disorders 	15
02	Central Nervous system: <ul style="list-style-type: none"> • Neurohumoral transmission in the C.N.S • General anesthetics • Alcohols and disulfiram • Sedatives, hypnotics & anxiolytics agents • Antiepileptic drugs • Anti-parkinsonian drugs • Psychopharmacological agents (Antipsychotic, antidepressants, antimaniacs and hallucinogens) • Opioid analgesics • Non- opioid analgesics • C.N.S stimulants • Drug addiction and drug abuse • Drug used in Alzheimer's disease • Drug used in migraine 	26
03	Immunopharmacology	04

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Experiments on CNS:

- a) Spontaneous motor activity
- b) Analgesic activity
- c) Anti-convulsant activity
- d) Anti-parkinsonism activity
- e) CNS stimulant and CNS depressant activity
- f) Sedative and hypnotics activity
- g) Anti-inflammatory activity
- h) Muscle relaxant activity of drugs using simple experiments.

2. Experiments on clinical pharmacy:

- a) To audit given prescription for format of prescription, essentiality and rationality and suggest carry home message (three experiments containing three prescriptions each, in totality nine prescriptions, covering various diseases or organ-systems).

- b) To evaluate formulations on anemia, diarrhoea and cough for their essentiality and rationality and also provide carry home message.
- c) To suggest appropriate parenteral nutrition for hospitalized patients after proper nutritional assessments in different conditions, and enlist importance of medications necessary in a pharmacy for Intensive Care Unit management.
- d) To evaluate drug-drug interactions for the type of drug interaction, the mechanism responsible for drug interactions, possible outcomes or clinical manifestations of interaction and suggestion corrective measure to overcome or prevent the drug interaction.
- e) To evaluate case for Interpretation of laboratory data.
- f) To evaluate case involving skills of pharmacist for patient counseling.
- g) To evaluate case for dose adjustment in geriatrics, pediatrics and pregnant women.
- h) To evaluate case for Therapeutic Drug Monitoring (TDM).

Books Recommended

1. Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
2. Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
3. Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn. Vallabh Prakashan, New Delhi.
4. Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
5. Rang h.P., dale M.M., etal-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
6. Satoskar R.S., etal-Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.
7. Harvel, R.A., Champe P.C. etal –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
8. Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.
9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn. Pergamon Press, Singapore.
10. Seth, S.D. text Book of pharmacology, B.I. Churchill, 1997.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH716 Pharmaceutical Management

Theory

2 hours/Week

No.	Chapter	Hours
01	Concept of Management: Administrative Management (Planning, Organizing, Staffing, Directing and Controlling), entrepreneurship development, Principles of Management (Co-ordination, Communication, Motivation, Decision-making, leadership, Innovation, Creativity, Delegation of Authority/Responsibility, Record Keeping). Identification of key points to give maximum thrust for development and perfection, total quality management (TQM).	05
02	Accountancy : Principles of Accountancy, Brief introduction to Ledger, book entries, Trial balance, Cash book, Bank reconciliation statement, Profits and loss account, Balance sheet.	03
03	Economics: Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves.	02
04	Pharmaceutical Marketing: Functions buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.	04
05	Salesmanship: Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing.	02
06	Market Research: Recruitment, training, evaluation, compensation to the pharmacist , Pre-requisition: Basic information services.	02
07	Materials Management: A brief exposure of the basic principles of Materials. Management Purchase, stores and inventory control (Eligibility, Efficiency Evaluation, Recruitment Methodology, Service Conditions, Termination Performance Evaluation, etc.).	06
08	Production Management: A brief exposure of the different aspects of Production Management Visible and Invisible inputs, Methodology of Activities, Performance Evaluation Technique, Process-Flow, Process Know-how, Maintenance Management.	06

Books Recommended

1. J.A. Stoner, R.E. Freeman & D.R. Gilbert "Management" Prentice Hall, New Delhi.
2. P. Kotler, "Marketing Management analysis, planning, implementation & control, Prentice hall. New Delhi,

3. H.A. Smith, "Principles and Method of Pharmacy Management", Lea & Febiger, Philadelphia,
4. P. Gopalkrishnan and M. Sundaresan, "Material management: An integrated approach", Prentice hall, New Delhi.
5. C.B. Mannoria, "Personal management", Himalaya publishing house, Bombay, Latest edition.
6. L. Lachman, H.A. Liberman and J.L. Kanic, "Theory & practice of Industrial Pharmacy", Lea & Febiger, U.S.A.
7. P. Kotler, "Principles of marketing" Prentice Hall, New Delhi.

Bachelor of Pharmacy Program

Semester VIII

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH811	Biopharmaceutics & Pharmacokinetics	100	100	3	3
PH812	Medicinal Chemistry – IV	100	100	3	3
PH813	Pharmaceutical Analysis – IV	100	100	3	3
PH814	Pharmacognosy-VI	100	100	3	3
PH815	Clinical Pharmacy	100	-	3	-
PH816	Elective	-	100	-	3
	Total	500	500	15	15

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH811 Biopharmaceutics & Pharmacokinetics

Theory

3 hours/Week

No.	Chapter	Hours
01	Introduction to Biopharmaceutics and pharmacokinetics and their role in formulation development and clinical setting	02
02	Biopharmaceutics: a) Introduction to biopharmaceutics and its role in formulation development. b) Passage of drugs across biological barriers (passive diffusion, active transport, facilitated diffusion and pinocytosis). c) Factors influencing absorption- physiochemical, physiological and pharmaceutical. d) Drug distribution in the body, plasma protein binding and drug excretion.	15
03	Pharmacokinetics (a) Definition and scope, significance of plasma drug concentration measurement. (b) Compartment model: Pharmacokinetics of drug absorption Zero order and first order absorption rate constant using Wagner- Nelson and Loo-Riegelman method. (c) Volume of distribution and distribution coefficient. (d) Compartment kinetics- one compartment and two compartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intra vascular and oral route. (e) Curve fitting (Method of Residuals), regression procedures. (f) Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance. (g) Hepatic elimination of drugs, first pass effect, extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation. (h) Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaelis Menten Equation, detection of nonlinearity (Saturation mechanism). (i) Numericals related to pharmacokinetic parameters using one compartmental model.	20
03	Bioavailability and Bioequivalence: a) Measures of bioavailability, C _{max} , t _{max} and area under the curve (AUC). b) Design of single dose bio-equivalence study and relevant statistics. c) Review of regulatory requirements for conduction of bio-equivalent studies.	8

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

Books Recommended

1. The Theory & Practice of industrial pharmacy by Leon Lachmen et al., Lea & Febiger, Philadelphia.
2. Remington's Pharmaceutical Sciences, ed. A.R. Gennaro, Mack Publishing Co.
3. Modern Pharmaceutics ed. G.S. Banker & C.T. Rhodes, Marcel Dekker Inc. N.Y.
4. Pharmaceutical dosage forms: Tablets, Parenterals, Disperse systems. Vol.: 1,2,3 Leon, Lachman. Et.al.
5. Pharmaceutics: The science of dosage form design. M.E. Aulton. ELBS/Churchill Livingstone.
6. Drug Stability, T. Carstensen, Marcel Dekker Inc. N.Y.
7. Physical Pharmacy, A.N. Martin et al, K.M. Verghese & Co.
8. Pharmacokinetics, Gibaldi & D. Perrier Marcel Dekker Inc., N.Y.
9. Pharmaceutical calculation, N.J. Stoklosa, Lea & Febiger, Philadelphia.
10. Pharmaceutical Statistics, Sanford Bolton. Marcel Dekker Inc.
11. Novel drug delivery systems: Fundamentals & Developmental concepts. Y.W. Chien, Marcel Dekker Inc.
12. Biopharmaceutics & Pharmacokinetics - an introduction. R.E. Notary, Marcel Dekker Inc., N.Y.
13. Controlled drug Delivery, Fundamentals and applications, J.R. Robinson & Lee, Marcel Dekker Inc.
14. Handbook of Pharmaceutical Excipients" By James C. Boylan, Pub., American Pharmaceutical Association & The Pharmaceutical Society of Great Britain.
15. Pharmaceutical Dissolution testing, Umesh V. Bankar, Marcel Dekker Inc.

DHARMSINH DESAI UNIVERSITY

BACHELOR OF PHARMACY

PH812 Medicinal Chemistry – IV

Theory

3 hours/Week

No.	Chapter	Hours
01	Synthetic procedures of official drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs A. Sulphonamides and Fluoroquinolones (03) B. Anti-malarial drugs (03) C. Anti-Leprotic drugs (02) D. Anti-tubercular drugs (02) E. Anti-septics and Disinfectants (03) F. Anti-fungal agents (02) G. Anti-amoebic agents (02) H. Anti-viral Drugs including anti-HIV agents (08) I. Anti-Neoplastic agents (08) J. Immunosuppressive agents (02)	35
02	Antibiotics: General Chemistry of (β -lactum antibiotics, Aminoglycoside antibiotics Tetracyclines, Chloramphenicol, Macrolide antibiotics, Polyene and Polypeptide antibiotics	10

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Selected drug synthesis from the course content.
2. Special analysis of the drug synthesized.
3. Organic spotting of binary mixtures with derivative preparation and TLC.
4. Establishing the Pharmacopoeial standards of the drugs synthesized.

Books Recommended

1. J.N.Delagado and W.A.R. Remers, Eds, Wilson and Giswild's Text book of Organic, Medicinal and Pharmaceutical Chemistry, J.Lipincott., Philadelphia.
2. H.E.Wolf,Ed., Burger's Medicinal Chemistry, John Wiley & Sons, New York.
3. T.Nogradydey, Medicinal Chemistry - A Biochemical approach, Oxford University Press, New York
4. B.N.Ladu, H.G.Mandel and E.L.Way. Fundamentals of Drug Metabolism & Disposition, William & Welkins Co. 428E, Prestone street, Baltimore.
5. Vogel's Textbook of Practical Organic Chemistry, ELBS, Longman, London.
6. Mann & Saunder, Practical Organic Chemistry, Orient Longman, UK.
7. Shriner, Heremann, Morrill, Curtin & Fusion, The Systemic identification of Organic Compounds, John Wiley & Sons, New York.
8. W.C.Foye, Principles of Medicinal Chemistry, Lea and Feiber, Philadelphia.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH813 Pharmaceutical Analysis – IV

Theory

3 hours/Week

No.	Chapter	Hours
01	Atomic Absorption and Atomic Emission Spectroscopy: Origin of atomic absorption and atomic emission spectra, Instrumentation, Qualitative and quantitative application of flame photometry	06
02	Quality Assurance: Introduction to Basic principles and applications of QA and GLP: Importance and applications of ISO 9000 & 14000. Quality review and documentation in QC laboratory and analytical method validation	04
03	Harmonization of Pharmaceutical Standards, Outsourcing of pharmaceuticals, SUPAC guidelines, etc.	04
04	Validation	04
05	High Performance Liquid Chromatography Introduction, theory – migration equation, theoretical plate, measurement of column performance and its optimization, instruments for liquid chromatography including column packing for various types of chromatography, mobile phase characteristics for normal and reversed phases, polarity and selectivity of the solvents, scope and applications. Super critical fluid chromatography, exclusion chromatography	10
06	Gas Chromatography: Introduction, principles of Gas – Liquid Chromatography, instruments for Gas –Liquid Chromatography, columns and stationary phases, qualitative and quantitative applications to pharmaceuticals, brief introduction to hyphenated techniques like GC-MS, LC-MS, etc.	08
07	X – Ray Crystallography: Introduction, X-ray absorption and X-ray diffraction methods, Instrumentation for relevant instruments	04
08	Principle, instrumentation, types and applications of electrophoresis.	03

Practical

3 hours/Week

1. Quantitative estimation and general tests of formulations containing single drug, using instrumental techniques based on theory.

Books Recommended

- 1.Principles of Instrumental Analysis - Skoog, Holler, Nieman, 5th Ed. Saunders College Publishing.
- 2.A Textbook of Pharmaceutical Analysis - Kenneth A. Connors, 3rd Ed., John Wiley & Sons.
- 3.Instrumental Methods of Chemical Analysis - Galin W. Ewing, 5th Ed., McGraw Hill International Editions.
- 4.Principles of Instrumental Analysis - Skoog, Leary, 4th Ed., Saunders college Publishing
- 5.Instrumental Methods of Analysis - Willard, Merritt, Dean, Settle, CBS Publishers 7th Ed.

6. Understanding ISO 9000 and implementing the basics to Quality-D.H. Stamatis, Marcel Dekker, Inc.
7. Guidelines for Laboratory Quality Auditing - Donald C. Singer, Ronald P. Upton, Marcel Dekker, Inc.
8. Good Manufacturing Practices for Pharmaceuticals: A plan for total quality control - Sidney H Willing, James R. Stoker, Marcel Dekker, Inc.
10. O.P.P.I. Manual.
11. Good Laboratory Practice Regulations - Ed. by Sandy Weinberg, Marcel Dekker, Inc.
12. Pharmaceutical Analysis: Modern Methods, James W. Munson, Marcel Dekker, Inc.
13. Practical Pharmaceutical Chemistry-I & II, A.H. Beckett and J.B. Stenlake, 4th Ed. CBS Publishers.
14. Indian Pharmacopoeia.
15. British Pharmacopoeia.
16. United States Pharmacopoeia.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH814 Pharmacognosy-VI

Theory

3 hours/Week

No.	Chapter	Hours
01	Herbal Cosmetics: Introduction, classification, importance, preparation and evaluation of herbal cosmetics.	04
02	Standardisation of Herbal Drugs: <ul style="list-style-type: none"> Importance of Standardisation and problem involved in the standardisation of herbs. Standardisation of single drugs and compound formulations. WHO Guidelines for quality standardized herbal formulation. Estimation of the parameter limits used for standardisation. Preparation and evaluation of Herbal Extract. 	06
03	Herbal formulations: The holistic concept of drug administration in traditional system & modern system of medicine. <ul style="list-style-type: none"> General introduction, their importance, Classification. Principles of Siddha, Ayurveda, Homeopathy, Unani & Naturopathy systems of medicine. Introduction for different Ayurvedic dosage forms. Toxicity studies of different complimentary medicine. Rules and regulatory requirements for the production of the Ayurvedic medicines as per FDA. General introduction and different stages required for herbal formulation. Dosage forms and its Evaluation parameters. 	12
04	Traditional drugs : Common vernacular names, botanical sources, morphology, microscopy, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs: Stem: Galo Underground stem: Garlic Leaf: Tylophora, Nagod, Adusa, Karen, Gymnema, Neem. Fruit: Amla, Gokhru, Pepper, Bhilama, Kalijiri. Seed: Methi, Chakramadu, Malkangni, Karanj.	17
05	World - wide trade in medicinal plants and derived products with special reference to diosgenin (Dioscorea), taxol (Taxus spp.), digitalis, tropane alkaloid containing plants, papain, cinchona, Ipecac, Liquorice, ginseng, aloe, valerian, rauwolfia and plants containing laxatives, artemisia, camptotheca.	04
06	A brief account of plant based industries and institution involved in work on medicinal and aromatic plants in India.	02

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Demonstration of various traditional dosage forms.
2. Microscopical study of characters of selected drugs given in the theory in entire and powdered form.
3. Preparation and evaluation herbal cosmetics.
4. Preparation and evaluation of Ayurvedic formulation.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.
2. Pharmacognosy and pharmacobiotechnology, Ashutosh Kar, New Age International (P) Ltd, Publishers, 2nd edition 2007.
3. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahemedabad, 8th edition, 1990.
4. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,.
5. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbars, Lea and Febgir Philadelphia, 8th Edition, 1981.
6. Pharmacognosy of powdered crude drugs: M. A. Iyenger, Manipal Power Press, 1st Edition, 1974.
7. Mukherji P. K., Quality Control of Herbal Drugs, Business Horizon Pharma. Publishers, 1st Edition, 2002.
8. Herbal drug technology, S. S. Agrawal and M. Paridhavi, Univeristies Press, 1st Edition, 2007.
9. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
10. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
11. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar.
12. Herbal cosmetics, hand book By H. Panda
13. Cosmetics formulation, manufacturing and their quality control by P.P. Sharma
14. Textbook of Pharmacognosy and Phytochemistry by Edwin Jarald and Sheeja Jarald
15. Modern Methods of Plant Analysis by Peach & Tracey
16. Biotechnology by S.S. Purohit

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH815 Clinical Pharmacy

Theory

3 hours/Week

No.	Chapter	Hours
01	Endocrine system: <ul style="list-style-type: none">Hypothalamic and pituitary hormonesThyroid hormones and anti-thyroid drugsInsulin and oral hypoglycemic agents and glucagon.ACTH and corticosteroidsAndrogen and anabolic steroidsEstrogen, progesterone and oral contraceptivesDrug acting on uterus	15
02	Introduction to clinical pharmacy: <ul style="list-style-type: none">Development and scope of clinical pharmacyConcept of health care teamRole of clinical pharmacist as a member of health care team and important function.	05
03	Basic concept of pharmacotherapy: <ul style="list-style-type: none">Therapeutic Drug Monitoring.Critical care Unit: Blood and Plasma Volume expandersDrug used during infancy and in the elderly (Pediatrics and Geriatrics)Drug used during pregnancyDrug induced diseasesThe basics of drug interactionsGeneral principle of toxicology: Heavy Metals and Antagonists.Interpretation of clinical Laboratory test	22
04	Clinical Trials & GCP guidelines.	03

Books Recommended

1. Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
2. Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
3. Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn. Vallabh Prakashan, New Delhi.
4. Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
5. Rang h.P., dale M.M., et al-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
6. Satoskar R.S., et al-Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.
7. Harvel, R.A., Champe P.C. et al –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
8. Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.

9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn.
Pergamon Press, Singapore.
10. Seth, S.D. text Book of pharmacology, B.I. Churchill, 1997.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH816 Elective

3 hours/Week

- ❖ Topics for preparation of project report will be given on the basis of result of B. Pharm Semester - VI (merit list is to be prepared)
- ❖ Topics will be given from all the area of pharmaceutical sciences viz. pharmaceutical technology, pharmacology, pharmaceutical analysis, medicinal chemistry, Pharmacognosy, etc
- ❖ Preparation and submission of project report should be mandatory for all the students of B. Pharm semester-VIII.
- ❖ Evaluation of students will be done at the end of the year by preparing a power point presentation by students
- ❖ Presentations will be evaluated by external referee.

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Bachelor of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table-I: Course of study for semester I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP105T	Communication skills – Theory *	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP107P	Human Anatomy and Physiology – Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical*	2	-	1
BP112RBP	Remedial Biology – Practical*	2	-	1
Total		32/34^S/36[#]	4	27/29^S/30[#]

[#]Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course.

^SApplicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course.

* Non University Examination (NUE)

Table-II: Course of study for semester II

Course Code	Name of the course	No. of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP203T	Biochemistry – Theory	3	1	4
BP204T	Pathophysiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	3	-	3
BP206T	Environmental sciences – Theory *	3	-	3
BP207P	Human Anatomy and Physiology II –Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry – Practical	4	-	2
BP210P	Computer Applications in Pharmacy – Practical*	2	-	1
Total		32	4	29

*Non University Examination (NUE)

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Bachelor of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table-III: Course of study for semester III

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP302T	Physical Pharmaceutics I – Theory	3	1	4
BP303T	Pharmaceutical Microbiology – Theory	3	1	4
BP304T	Pharmaceutical Engineering – Theory	3	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP306P	Physical Pharmaceutics I – Practical	4	-	2
BP307P	Pharmaceutical Microbiology – Practical	4	-	2
BP 308P	Pharmaceutical Engineering –Practical	4	-	2
Total		28	4	24

Table-IV: Course of study for semester IV

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	4
BP402T	Medicinal Chemistry I – Theory	3	1	4
BP403T	Physical Pharmaceutics II – Theory	3	1	4
BP404T	Pharmacology I – Theory	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	4
BP406P	Medicinal Chemistry I – Practical	4	-	2
BP407P	Physical Pharmaceutics II – Practical	4		2
BP408P	Pharmacology I – Practical	4	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	4	-	2
Total		31	5	28

B. PHARM. SEMESTER – I (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY I -THEORY (BP101T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the various experiments related to special senses and nervous system.
- Appreciate coordinated working pattern of different organs of each system

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to human body Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology. Cellular level of organization Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine Tissue level of organization Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.	10	CO1
[2]	Integumentary system Structure and functions of skin Skeletal system Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction Joints Structural and functional classification, types of joints movements and its articulation	10	CO1 CO2 CO3

[3]	Body fluids and blood Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system. □ Lymphatic system Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system	10	CO2 CO3 CO4 CO5
[4]	Peripheral nervous system: Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. Special senses Structure and functions of eye, ear, nose and tongue and their disorders.	08	C01 CO2 CO3 C04 C05
[5]	Cardiovascular system Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart	08	C01 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.

D. REFERENCE BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.
4. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic anatomy and function of the body and remember the position of the various parts of our body
CO2	Remember, Understand and Apply	To know about the working mechanism of the body part and measure the activity of certain body parts by various techniques.
CO3	Understand Apply and Evaluate	To understand about the mechanism behind the action produced by various body part
CO4	Understand	To know about how disease occurs, and for that which organ system is required to defence those disease condition
CO5	Remember, Understand, Apply and evaluate	To get knowledge about functioning and dysfunctioning of various parts of the body/system and disease occur due to these imbalances.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	1	3	1	3	3	1	3	3	3	3	1	1
CO2	3	2	2	3	2	2	2	2	3	1	3	3	3	3	2	2
CO3	3	3	3	3	2	2	2	2	3	2	2	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.6	3	2.4	1.8	2.4	2.2	2.2	2.8	1.6	2.4	2.8	3	3	2.2	1.8

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL ANALYSIS I-THEORY (BP102T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	04	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs

Objectives: Upon completion of the course student shall be able to

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- Develop analytical skills

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	(a) Pharmaceutical analysis Definition and scope i) Different techniques of analysis ii) Methods of expressing concentration iii) Primary and secondary standards. iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate (b)Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures	10	CO1 CO5
[2]	Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl	10	CO2 CO3 CO4 CO5
[3]	Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride. Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.	10	CO2 CO3 CO4 CO5
[4]	Redox titrations (a) Concepts of oxidation and reduction (b) Types of redox titrations (Principles and applications)	08	CO2 CO3 CO4 CO5

	Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate		
[5]	Electrochemical methods of analysis Conductometry - Introduction, Conductivity cell, Conductometric titrations, applications. Potentiometry - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications. Polarography - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications	07	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. G. H. Jeffery J. Bassett J. Mendham R C. Denney, *Vogel's textbook of quantitative chemical analysis*, 5th ed.; Bath press, Avon : Great Britain, 1989.
2. Sharma B. K., *Analytical Chemistry*, 2nd ed.; Krishna Prakashan media (p) Ltd: Delhi, India, 2006.

D. REFERENCE BOOKS

1. P. Gundu Rao, *Inorganic Pharmaceutical Chemistry (Pharma Chemistry-I)*, 2010
2. Arthur Owen Bentley; John Edmund Driver; Lewis Malcolm Atherden. *Bentley and Driver's Textbook of Pharmaceutical Chemistry*.; Oxford University Press: Oxford, 1977.
3. Kennedy, J. H. *Analytical Chemistry : Principles*; Saunders College Pub: New York, 1990.
4. Health, O. Indian Pharmacopoeia 2010. Vol. 1; Ghaziabad Indian Pharmacopoeia Commission, 2010.
5. Skoog, Douglas A, F J. Holler, and Timothy A. Nieman, *Principles of Instrumental Analysis*, 7th ed.; Saunders College Pub: United states of America, 2016.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the importance, scope and fundamentals of analytical chemistry.
CO2	Remember, Understand and learn	Understand and learn different analytical and electroanalytical methods
CO3	Understand, remember Apply	Remember and apply various analytical and electroanalytical methods in pharmaceutical drug analysis
CO4	Understand, analyse and evaluate	Analyse and evaluate various volumetric and electrochemical titrations results
CO5	Development and evaluation	Evaluation of sources of errors, promoting ethical practises and development of analytical skills

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	1	3	1	1	1	-	3	3	3	2	2	-
CO2	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO3	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO4	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO5	3	1	3	1	1	3	1	1	1	-	3	3	3	2	2	-
Avg.	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICS I -THEORY (BP103T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Prepare various conventional dosage forms

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia. • Dosage forms: Introduction to dosage forms, classification and definitions • Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription. • Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.	10	CO1 CO3 CO4
[2]	Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight. • Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions. • Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques	10	CO2 CO5
[3]	Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions. • Biphasic liquids: • Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome. • Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.	10	CO2 CO5

[4]	Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. · Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.	8	CO1 CO2 CO5
[5]	Semisolid dosage forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms	7	CO2 CO5

C. TEXT BOOKS

1. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

D. REFERENCE BOOKS

2. Ansel, H. C.; Allen, L. V.; Popovich, N. G. Pharmaceutical Dosage Forms and Drug Delivery Systems; Philadelphia, Pa Lippincott-Williams & Wilkins, 1999.
3. Arthur Owen Bentley; Ernest Alexander Rawlins. Bentley's Textbook of Pharmaceutics.; All India Traveller Book Seller: New Delhi, 2002.
4. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
5. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.
6. Françoise Nielloud; Marti-Mestres, G. Pharmaceutical Emulsions and Suspensions; Informa Healthcare, Cop: New York, 2010.
7. Ghebre-Sellassie, I. Pharmaceutical Pelletization Technology; Dekker: New York U.A., 1989.
8. Parikh, D. M. Handbook of Pharmaceutical Granulation Technology; Informa Healthcare: New York, N.Y., 2007.
9. Remington, J. P.; Gennaro, A. R. Remington : Volume 1 : The Science and Practice of Pharmacy; Mack Pub. Co: Easton, Pa., 1995.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand and remember the professional way of handling the prescription
CO2	Understand and Remember	To understand the basics of different dosage forms and pharmaceutical incompatibilities
CO3	Understand	To understand the history of profession of pharmacy
CO4	Perform	To perform the pharmaceutical calculations
CO5	Prepare and evaluate	To prepare and evaluate various conventional dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	3	3	2	3	3	3	3	3	3
CO2	3	2	3	3	1	2	1	2	2	1	2	3	3	3	2	2
CO3	3	2	2	1	1	3	-	2	2	-	3	2	2	3	3	3
CO4	3	1	3	3	-	1	1	1	1	1	2	3	2	3	2	1
CO5	3	1	3	3	-	1	1	1	1	1	2	3	3	3	1	1
Avg	3	1.8	2.8	2.6	0.6	2	1.2	1.8	1.8	1	2.6	2.8	2.6	3	2.2	2

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL INORGANIC CHEMISTRY -THEORY (BP104T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of the course the student shall be able to

- Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- Understand the medicinal and pharmaceutical importance of inorganic compounds

B. COURSE CONTENT

General methods of preparation, assay for the compounds superscripted with **asterisk (*)**, properties and medicinal uses of inorganic compounds belonging to the following classes

NO	TOPIC	L (Hrs)	COs
[1]	Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate	10	CO1 CO2
[2]	Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity. Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance. Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.	10	CO2 CO3 CO4 CO5
[3]	Gastrointestinal agents Acidifiers: Ammonium chloride* and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations	10	CO2 CO3 CO4 CO5
[4]	Miscellaneous compounds Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate Haematinics: Ferrous sulphate*, Ferrous gluconate Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite Astringents: Zinc Sulphate, Potash Alum	8	CO2 CO3 CO4 CO5

[5]	Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α , β , γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I_{131} , Storage conditions, precautions & pharmaceutical application of radioactive substances.	7	CO2 CO3 CO4 CO5
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C. TEXT BOOKS (LATEST EDITION)

1. Anand & G.R. Chatwal, Inorganic Pharmaceutical Chemistry, India, 2010
2. Suhagia B. N., Inorganic Pharmaceutical Chemistry, Nirav Prakashan, India, 2013

D. REFERENCE BOOKS (LATEST EDITION)

1. Schroff, M. L. Pharmaceutical Chemistry; National Book Centre: Calcutta, 1968.
2. Arthur Owen Bentley; John Edmund Driver; Lewis Malcolm Atherden. Bentley and Driver's Textbook of Pharmaceutical Chemistry.; Oxford University Press: Oxford, 1977.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
CO2	Understand and Remember	To understand the medicinal and pharmaceutical importance of inorganic compounds
CO3	Understand	To understand and learn about various types of inorganic compounds
CO4	Understand and Remember	To study preparation and assay of selected inorganic compounds
CO5	Understand and Remember	To understand and remember synonyms and chemical formula of various inorganic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	1	-	-	1	-	2	1	3	2	3	1	1	1
CO2	3	-	-	1	-	1	-	-	2	1	3	2	3	1	1	1
CO3	3	-	-	1	-	-	-	-	1	1	3	2	2	1	1	1
CO4	3	-	-	1	-	-	-	-	1	-	3	2	2	1	-	-
CO5	3	-	-	1	-	-	-	-	-	-	3	2	-	-	-	-
Avg	3	-	-	1	-	0.2	0.2	-	1.2	0.6	3	2	2	0.8	0.6	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: COMMUNICATION SKILLS -THEORY (BP105T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac.	Total
2	-	-	2	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

Objectives: Upon completion of the course the student shall be able to

- Understand the behavioural needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
- Communicate effectively (Verbal and Non-Verbal)
- Effectively manage the team as a team player
- Develop interview skills
- Develop Leadership qualities and essentials

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment	07	CO1 CO2
[2]	Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style	07	CO1 CO2
[3]	Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message	07	CO1 CO2 CO3
[4]	Interview Skills: Purpose of an interview, Do's and Dont's of an interview	05	CO4

	Giving Presentations: Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery		CO5
[5]	Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion	04	CO3 CO5

C. TEXT BOOKS

1. Mosam Sinha. *Effective Communication Skills*; Aavishkar Publishers, Distributors: Jaipur, 2017.
2. Lisel Erasmus-Kritzinger. *Introductory Communication : The Ultimate Guide to Effective Communication Skills, Study Skills, Life Skills*; Nasou Via Afrika: Cape Town, 2007.

D. REFERENCE BOOKS

1. Rutherford, A. J. *Basic Communication Skills for Technology*; Englewood Cliffs, Nj Prentice Hall, 1991.
2. Worth, R. *Communication Skills*.; Ferguson: New York, 2019.
3. Nira Konar. *Communication Skills for Professionals*; Phi Learning Private Limited: New Delhi, 2011.
4. Mitra, B. K. *Personality Development and Soft Skills*; Oxford University Press: New Delhi, 2011.
5. Wentz, F. H. *Soft Skills Training : A Workbook to Develop Skills for Employment*; Createspace: Charleston, Sc, 2012.
6. Peter, F. S. J. *Soft Skills and Professional Communication*; Tata Mcgraw-Hill: New Delhi, 2012.
7. Araya, M. MTD Training Effective Communication Skills. www.academia.edu.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the behavioural needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
CO2	Learn	Learn to communicate effectively (Verbal and Non Verbal) and apply appropriate communication style in professional context
CO3	Understand	Understand the effective team management as a team player
CO4	Understand and Remember	Understand and remember the requisites for development of an effective interview skills
CO5	Understand and learn	Develop Leadership qualities and essentials

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	1	3	-	3	-	-	3	1	1	-	3	-
CO2	-	-	-	-	3	3	-	3	-	-	3	1	1	-	3	-
CO3	-	-	-	-	3	1	-	1	-	-	3	1	1	-	3	-
CO4	-	-	-	-	-	1	-	1	-	-	3	1	1	-	3	-
CO5	-	-	-	-	3	3	-	3	-	-	3	1	1	-	3	-
Avg.	-	-	-	-	2	2.2	-	2.2	-	-	3	1	1	-0	3	-

B. PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL BIOLOGY -THEORY (BP106RBT)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	--	---	2	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Objectives: Upon completion of the course the student shall be able to

- know the classification and salient features of five kingdoms of life
- Understand the basic components of anatomy & physiology of plant
- Know understand the basic components of anatomy & physiology animal with special reference to human

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Living world: Definition and characters of living organisms <ul style="list-style-type: none"> • Diversity in the living world • Binomial nomenclature • Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus, Morphology of Flowering plants <ul style="list-style-type: none"> • Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed. • General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledones 	7	CO1 CO4 CO5
[2]	Body fluids and circulation <ul style="list-style-type: none"> • Composition of blood, blood groups, coagulation of blood • Composition and functions of lymph • Human circulatory system • Structure of human heart and blood vessels • Cardiac cycle, cardiac output and ECG Digestion and Absorption <ul style="list-style-type: none"> • Human alimentary canal and digestive glands • Role of digestive enzymes • Digestion, absorption and assimilation of digested food Breathing and respiration <ul style="list-style-type: none"> • Human respiratory system • Mechanism of breathing and its regulation • Exchange of gases, transport of gases and regulation of respiration • □ Respiratory 	7	CO2 CO3

[3]	Excretory products and their elimination <ul style="list-style-type: none"> • Modes of excretion • Human excretory system- structure and function • Urine formation • Rennin angiotensin system Neural control and coordination <ul style="list-style-type: none"> • Definition and classification of nervous system • Structure of a neuron • Generation and conduction of nerve impulse • Structure of brain and spinal cord • Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata Chemical coordination and regulation <ul style="list-style-type: none"> • Endocrine glands and their secretions • Functions of hormones secreted by endocrine glands Human reproduction <ul style="list-style-type: none"> • Parts of female reproductive system • Parts of male reproductive system • Spermatogenesis and Oogenesis • □ Menstrual cycle 	07	CO2 CO3
[4]	Plants and mineral nutrition: <ul style="list-style-type: none"> • Essential mineral, macro and micronutrients • Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation Photosynthesis <ul style="list-style-type: none"> • Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis. 	05	CO2 CO3
[5]	Plant respiration: Respiration, glycolysis, fermentation (anaerobic). Plant growth and development <ul style="list-style-type: none"> • Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators Cell - The unit of life <ul style="list-style-type: none"> • Structure and functions of cell and cell organelles. Cell division Tissues <ul style="list-style-type: none"> • Definition, types of tissues, location and functions 	04	CO1 CO4 CO5

C. TEXT BOOKS

1. A Gokhale, S. B.; Kokate, C. K.; Gokhale, A. S.; Kalaskar, M. G. Pharmacognosy of Traditional Drugs - I; Nirali Prakashan, August: Pune, 2014.
2. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.

D. REFERENCE BOOKS

1. Gokhale, S. B.; Kokate, C. K.; Gokhale, A. S.; Kalaskar, M. G. Pharmacognosy of Traditional Drugs - I; Nirali Prakashan, August: Pune, 2014.
2. Dutta, A. C. Botany for Degree Students.; Oxford University Press: Kolkata, 1996.
3. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To get knowledge about the basic part of the living world i.e plants, the parts of plant, its morphology and physiology, classification of kingdom. diversity in the world.
CO2	Remember and understand	To know about the anatomy and function of the various parts of the body
CO3	Understand Remember and Evaluate	To understand about the mechanism behind the action produced by various body part, evaluation of functions of the body part. To know about how disease occurs, and for that which organ system is required to defence those disease condition
CO4	Understand and evaluate	To know about plant photosynthesis, minerals, and factor affecting photosynthesis
CO5	Remember, Understand, Apply and evaluate	To get knowledge about plant respiration, plant growth and detail about the cell and tissue structure and function.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	2	3	3	3	2	3	3	3	2	2	3	2	1
CO2	3	1	2	3	2	2	2	2	3	2	3	3	3	3	2	2
CO3	3	2	3	3	2	2	2	2	3	2	2	3	3	3	2	3
CO4	3	2	3	3	2	3	3	2	3	2	2	3	3	3	3	3
CO5	3	2	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	1.6	2.4	2.6	2.5	2.4	2.6	2	2.8	2.2	2.4	2.6	2.8	3	2.2	2.2

B.PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL MATHEMATICS-THEORY (BP106RMT)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	-	-	2	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and La Place transform.

Objectives: Upon completion of this course the student should be able to

- Know the theory and their application in Pharmacy.
- Solve the different types of problems by applying theory.
- Appreciate the important application of mathematics in Pharmacy.
- Apply mathematics in solving statistical problems in pharmacy.
- Know the basics of mathematical problem-solving skills in Pharmacy.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Partial fraction Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics Logarithms Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems. Function: Real Valued function, Classification of real valued functions. Limits and continuity: Introduction, Limit of a function, Definition of limit of a function. (ϵ - δ definition) $\lim_{x \rightarrow a} \frac{x^2 - a^2}{x - a} = 2a$, $\lim_{x \rightarrow 0} \frac{e^{2x} - 1}{x} = 2$	06	CO1, CO2, CO4.
[2]	Matrices and Determinant: Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoin or adjutant of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear equations using matrix method, Cramer's rule, Characteristics equation and roots of a square matrix, Cayley-Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.	06	CO1, CO2, CO4.
[3]	Calculus Differentiation: Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula)–Without Proof, Derivative of x^n w.r.t. x, where n is any rational number, Derivative of e^x Derivative of log	06	CO1, CO3, CO5.

	e^x , Derivative of a^x , Derivative of trigonometric functions from first principles (without Proof), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application		
[4]	Analytical Geometry Introduction: Signs of the Coordinates, Distance formula, Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope– intercept form of a straight line Integration: Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application	06	CO1, CO3, CO4.
[5]	Differential Equations: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, Application in solving Pharmacokinetic equations Laplace Transform: Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations	06	CO3, CO4, CO5.

C. TEXT BOOKS

1. Hari Kishan. *Differential Calculus*; Atlantic Publishers & Distributors: New Delhi, 2007.
2. Ranganath, G. K. *Remedial Mathematics*. 2017.

D. REFERENCE BOOKS

1. Hari Kishan. *Differential Calculus*; Atlantic Publishers & Distributors: New Delhi, 2007.
2. Ranganath, G. K. *Remedial Mathematics*. 2017.
3. Hyma, P. *Pharmaceutical Mathematics with Application to Pharmacy*; Anmol Publications Pvt. Ltd: New Delhi, India, 2017.
4. H S Govinda Rao. *Higher Engineering Mathematics*; Viva Books: New Delhi, 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Know the theory and their application in Pharmacy.
CO2	Understand and apply	Solve the different types of problems by applying theory.
CO3	Evaluate	Appreciate the important application of mathematics in Pharmacy.
CO4	Apply and Remember	Apply mathematics in solving statistical problems in pharmacy.
CO5	Analyse and Evaluate	Know the basics of mathematical problem solving skills in Pharmacy.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	0	3	1	1	3	3	3	3	1
CO2	3	1	3	3	1	3	3	0	1	1	0	3	3	3	3	1
CO3	3	1	3	3	1	3	3	0	2	1	1	3	3	3	3	1
CO4	3	1	3	3	2	3	3	1	1	1	0	2	3	3	3	1
CO5	3	1	3	3	1	3	3	1	1	1	1	2	3	3	3	1
Avg	3	1.4	3	3	1.2	3	3	0.4	1.6	1	0.6	2.6	3	3	3	1

B. PHARM. SEMESTER – I (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY I-PRACTICAL (BP107 P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
---	--	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives:

- Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Study of compound microscope. 2. Microscopic study of epithelial and connective tissue 3. Microscopic study of muscular and nervous tissue 4. Identification of axial bones 5. Identification of appendicular bones 6. Introduction to hemocytometry. 7. Enumeration of white blood cell (WBC) count 8. Enumeration of total red blood corpuscles (RBC) 9. Determination of bleeding time 10. Determination of clotting time 11. Estimation of haemoglobin count 12. Determination of blood group 13. Determination of erythrocyte sedimentation rate (ESR) 14. Determination of heart rate and pulse rate 15. Recording of blood pressure.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
2. Sri Nageswari K; Sharma, R. Practical Workbook of Human Physiology; Jaypee Brothers Medical Publishers (P) Ltd, 2006.

D. REFERENCE BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.

3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic instruments used in this subject and how to operate it
CO2	Remember, Understand and evaluate	To know about the working mechanism of the instruments, understanding of models and result evaluation.
CO3	Understand Apply and Evaluate remember	To understand about procedure for measurement of various biochemical parameter, evaluation of result and after interpretation of result
CO4	Understand Apply and Evaluate	To know the value, obtain from the test and apply it in healthy or disease condition and give interpretation
CO5	Remember, Apply and evaluate	To get knowledge about parts of the instrument used in lab, its working principle, measurement and interpretation of result

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	2	3	3	3	2	3	3	3	1
CO2	3	2	2	3	1	3	2	2	3	1	3	3	3	3	2	1
CO3	3	3	3	3	2	2	2	3	3	1	2	3	3	3	2	2
CO4	3	2	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	3	3	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.4	2.8	3	1.6	2.6	2.6	2.2	2.8	1.8	2.4	2.6	3	3	2.4	1.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL ANALYSIS I-PRACTICAL (BP108P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.

Objectives: Upon completion of the course student shall be able to

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- Develop analytical skills

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Preparation and standardization of (1) Sodium hydroxide (2) Sulphuric acid (3) Sodium thiosulfate (4) Potassium permanganate (5) Ceric ammonium sulphate Assay of the following compounds along with Standardization of Titrant (1) Ammonium chloride by acid base titration (2) Ferrous sulphate by Cerimetry (3) Copper sulphate by Iodometry (4) Calcium gluconate by complexometry (5) Hydrogen peroxide by Permanganometry (6) Sodium benzoate by non-aqueous titration (7) Sodium Chloride by precipitation titration Determination of Normality by electro-analytical methods (1) Conductometric titration of strong acid against strong base (2) Conductometric titration of strong acid and weak acid against strong base (3) Potentiometric titration of strong acid against strong base	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Ministry, India.; Indian Pharmacopoeia Commission. *Indian Pharmacopoeia, 2010*; Indian Pharmacopoeia Commission: Ghaziabad, 2010.
2. Jain, D. S. M.; Patel, D. V. B. *Pharmaceutical Analysis*; Nirali Prakashan, 2018.

D. REFERENCE BOOKS

1. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988
2. Muhammad Sajid Hamid Akash; Kanwal Rehman. *Essentials of Pharmaceutical Analysis*; Singapore Springer, 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, learn and remember	Understand, learn and remember various calculations for quantification of drugs by analytical and electroanalytical methods.
CO2	Learn and remember	Learn and remember the concept of calibration of apparatus and instruments
CO3	Understand and apply	Understand and apply the analytical and electroanalytical methods for assay and quantification of drugs in an unknown samples.
CO4	Understand	Understand the importance of data integrity and ethical practices in every steps of drugs quantification
CO5	Develop	Develop skills in performing the volumetric titration and handling electroanalytical instruments

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	1	1	1	1	2	-	3	3	3	2	2	-
CO2	3	3	2	1	1	2	1	1	2	-	3	3	3	2	2	-
CO3	3	3	3	3	2	2	1	1	2	1	3	3	3	2	2	1
CO4	3	1	3	1	2	2	1	1	2	-	3	3	3	2	2	1
CO5	3	3	1	1	1	2	1	1	2	1	3	3	3	2	2	-
Avg	3	2.6	2.2	1.8	1.4	1.8	1	1	2	0.4	3	3	3	2	2	0.4

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICS I-PRACTICAL (BP109P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	-	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Course enables the student to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Prepare various conventional dosage forms

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Syrups a) Syrup IP'66 b) Compound syrup of Ferrous Phosphate BPC'68 2. Elixirs a) Piperazine citrate elixir b) Paracetamol pediatric elixir 3. Linctus a) Terpin Hydrate Linctus IP'66 4. Solutions b) Iodine Throat Paint (Mandles Paint) a) Strong solution of ammonium acetate b) Cresol with soap solution c) Lugol's solution 5. Suspensions a) Calamine lotion b) Magnesium Hydroxide mixture c) Aluminium Hydroxide gel 6. Emulsions a) Turpentine Liniment b) Liquid paraffin emulsion 7. Powders and Granules a) ORS powder (WHO) b) Effervescent granules c) Dusting powder d) Divided powders 8. Suppositories a) Glycero gelatin suppository b) Cocoa butter suppository c) Zinc Oxide suppository 8. Semisolids a) Sulphur ointment b) Non staining-iodine ointment with methyl salicylate c) Carbopol gel	60	CO1 CO2 CO3 CO4 CO5

	9. Gargles and Mouthwashes a) Iodine gargle b) Chlorhexidine mouthwash		
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C. TEXT BOOKS

1. Sanmathi. Dispensing Pharmacy : A Practical Manual.; Pharma Book Syndicate, 2010.
2. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

D. REFERENCE BOOKS

1. Ansel, H. C.; Allen, L. V.; Popovich, N. G. Pharmaceutical Dosage Forms and Drug Delivery Systems; Philadelphia, Pa Lippincott-Williams & Wilkins, 1999.
2. Arthur Owen Bentley; Ernest Alexander Rawlins. Bentley's Textbook of Pharmaceutics.; All India Traveller Book Seller: New Delhi, 2002.
3. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
4. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To convert the values of different parameters in different unit system for the calculation of ingredients in the formulation.
CO2	Apply	To perform the calculation for preparation of different dosage forms.
CO3	Create and prepare	To prepare the conventional dosage forms.
CO4	Evaluate	To evaluate the conventional dosage forms.
CO5	Apply and evaluate	To learn the packaging conditions, labeling and storage conditions for different dosage forms.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	3	3	2	2	-	2	2	-	3	3	3	3	3	1
CO2	3	1	3	3	1	2	1	3	2	2	3	3	3	3	3	2
CO3	3	1	3	3	1	1	-	1	1	1	3	3	3	3	3	1
CO4	3	1	3	3	1	1	-	1	1	1	3	3	3	3	3	1
CO5	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
Avg	3	1.6	3	3	1.6	1.8	0.6	1.8	1.8	1.4	3	3	3	3	3	1.6

B. PHARM. SEMESTER – I (BPH)**SUBJECT: PHARMACEUTICAL INORGANIC CHEMISTRY -PRACTICAL (BP110P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of the course the student shall be able to

- know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- understand the medicinal and pharmaceutical importance of inorganic compounds

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	Limit tests for following ions Limit test for Chlorides and Sulphates Modified limit test for Chlorides and Sulphates Limit test for Iron Limit test for Heavy metals Limit test for Lead Limit test for Arsenic Identification test Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate Test for purity Swelling power of Bentonite Neutralizing capacity of aluminum hydroxide gel Determination of potassium iodate and iodine in potassium Iodide Preparation of inorganic pharmaceuticals Boric acid Potash alum Ferrous sulphate	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Dhake A S, Inorganic pharmaceutical chemistry, First edition, Career publications, India, 2004

D. REFERENCE BOOKS (LATEST EDITION)

1. Ministry, India.; Indian Pharmacopoeia Commission. Indian Pharmacopoeia, 2010. Addendum 2012; Indian Pharmacopoeia Commission: Ghaziabad, 2012.
2. Anand & G.R. Chatwal, Inorganic Pharmaceutical Chemistry, India, 2010

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To study limit tests of various inorganic compounds
CO2	Understand and Remember	To perform identification tests of various inorganic compounds
CO3	Understand and Remember	To understand and remember the preparations of various inorganic pharmaceuticals
CO4	Understand and Remember	To understand and remember the reactions involved in preparation of various inorganic pharmaceuticals
CO5	Understand and Evaluate	To understand and evaluate tests for purity of various inorganic pharmaceuticals

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	-	1	-	1	1	-	2	3	3	3	2	1	1
CO2	3	1	1	-	1	-	-	1	-	-	3	3	2	2	-	-
CO3	2	1	1	-	1	-	-	1	-	-	3	3	2	-	-	1
CO4	2	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-
CO5	3	1	1	-	1	-	1	1	1	-	3	3	3	2	1	1
Avg	2.6	0.8	0.8	-	0.8	-	0.4	0.8	0.2	0.4	3	2.6	2	1.2	0.4	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: COMMUNICATION SKILLS -PRACTICAL (BP111P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac.	Total
-	-	2	2	1	15	5	5	-	25

A. COURSE OVERVIEW

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

Objectives: Upon completion of the course the student shall be able to

- Communicate effectively (Verbal and Non-Verbal)
- Effectively manage the team as a team player
- Develop interview skills, writing skills, Leadership qualities and essentials

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Basic communication covering the following topics Meeting People Asking Questions Making Friends What did you do?</p> <p>Pronunciations covering the following topics Pronunciation (Consonant Sounds) Pronunciation and Nouns Pronunciation (Vowel Sounds)</p> <p>Advanced Learning Listening Comprehension / Direct and Indirect Speech Figures of Speech Effective Communication Writing Skills Effective Writing Interview Handling Skills E-Mail etiquette Presentation Skills</p>	30	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Fujishin, R. *The Art of Communication : Improving Your Fundamental Communication Skills*; Rowman & Littlefield: Lanham, 2016.
2. Pandey, M.; Phil, M.; Lit, E.; Lib, M. *FIRST YEAR B. PHARM. Semester I*

D. REFERENCE BOOKS

1. Burton, L.; Dalley, D.; University Of Learning Ltd. *Developing Your Influencing Skills : A Guide to Developing the 7 Traits of Influential People*; Universe Of Learning: Great Britain, 2010.
2. Shikha Kapoor. *Personality Development and Soft Skills : Preparing for Tomorrow*; I.K. International Publishing House Pvt. Ltd: New Delhi, 2018.
3. Thomson, A. J.; Martinet, A. V. *A Practical English Grammar*; Oxford Univ. Press, 2012.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and learn	Understand and learn the basics of communication and apply it appropriately in professional and social context
CO2	Learn, remember and apply	Learn, remember and apply the key concepts of pronunciations in speaking
CO3	Display/ Demonstrate	Display competence in oral, written, and visual communication
CO4	Learn	Learn to prepare an audience – centric presentation
CO5	Understand, learn and apply	Understand, Learn and apply the requisites for an effective writing skills and listening skills

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	-	3	-	3	1	-	3	1	-	-	3	-
CO2	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO3	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO4	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO5	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
Avg.	-	-	-	-	-	3	-	3	2.6	-	3	1	-	-	3	-

B. PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL BIOLOGY – PRACTICAL (BP112RBP)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
--	--	1	2	1	15	10	5	-	25

A. COURSE OVERVIEW

1. Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Objectives: Upon completion of the course the student shall be able to

- know the classification and salient features of five kingdoms of life
- Understand the basic components of anatomy & physiology of plant
- Know understand the basic components of anatomy & physiology animal with special reference to human

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. Introduction to Experiments in Biology <ol style="list-style-type: none"> A) Study of Microscope B) Section Cutting Techniques C) Mounting and Staining D) Permanent Slide Preparation 2. Study of Cell and Its Inclusions 3. Study of Stem, Root, Leaf, Seed, Fruit, Flower and Their Modifications 4. Detailed Study of Frog by Using Computer Models 5. Microscopic Study and Identification of Tissues Pertinent To Stem, Root 6. Leaf, Seed, Fruit and Flower 7. Identification of Bones 8. Determination of Blood Group 9. Determination of Blood Pressure 10. Determination of Tidal Volume 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.
2. Kale, S. R.; Kale, R. R. Practical Human Anatomy and Physiology for First Year Diploma Course in Pharmacy; Nirali Prakashan: Pune, India, 2007.

D. REFERENCE BOOKS

1. Kale, S. R.; Kale, R. R. Practical Human Anatomy and Physiology for First Year Diploma Course in Pharmacy; Nirali Prakashan: Pune, India, 2007.
2. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.
3. Shafi, M.J.H. Biology practical manual according to National core curriculum .Biology forum of Karnataka.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic instruments used in this subject and how to operate and what is the procedure behind it.
CO2	Remember, Understand and evaluate	To know about the working mechanism of the instruments, understanding of models and result evaluation.
CO3	Understand Apply and Evaluate remember	To understand about parts of the plant and animals, evaluation of study in both animals and plants
CO4	Understand Apply and Evaluate	To know the about the parts and function of the parts of body
CO5	Remember, Apply and evaluate	To get knowledge about parts of the instrument used in lab, its working principle, measurement and interpretation of result

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	2	3	3	3	2	3	3	3	3
CO2	3	2	2	3	2	2	2	2	3	2	3	3	3	3	2	2
CO3	3	3	3	3	2	2	2	2	3	2	2	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.8	2.6	2.8	2	2.4	2.6	2	2.8	2.2	2.4	2.6	3	3	2.4	2.2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY II -THEORY (BP201T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the haematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time, etc. and also record blood pressure, heart rate, pulse and respiratory volume.
- Appreciate coordinated working pattern of different organs of each system.
- Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Nervous system Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)	10	CO1
[2]	Digestive system Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT. Energetics Formation and role of ATP, Creatinine Phosphate and BMR.	06	CO2 CO4

[3]	Respiratory system Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration. Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods. Urinary system Anatomy of urinary tract with special reference to anatomy of kidney and Nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.	10	CO3 CO4
[4]	Endocrine system Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, Adrenal gland, pancreas, pineal gland, thymus and their disorders.	10	C04
[5]	Reproductive system Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition Introduction to genetics Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance	09	CO4 CO5

C. TEXT BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.

D. REFERENCE BOOKS

1. Sembulingam, K. Essentials of Medical Physiology: With Free Review of Medical Physiology. Jaypee Brothers: S.L., 2019.
2. Waugh, A.; Ross, J. S.; Grant, A.; Wilson, K. J. W. Ross and Wilson Anatomy and Physiology in Health and Illness : Anne Waugh, Allison Grant ; Illustrations by Graeme Chambers.; Churchill Livingstone: Edinburgh, 2001.
3. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
4. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
5. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.
6. Singh, I. Textbook of Human Histology: (with Colour Atlas & Practical Guide); Jaypee Brothers Medical Publishers: New Delhi, 2011.
7. Ghai, C. L. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
8. Srinageswari, K.; Sharma, R. Practical workbook of Human Physiology; Jaypee brother's medical publishers, New Delhi
9. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
10. Chatterjee, C. C. Human Physiology: For Preclinical Medical and Degree Courses in Physiology; CBS Publishers & Distributors: New Delhi, 2016.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember, Understand and Apply	To know the basic fundamental structural features of neurons, mechanism of neurotransmitters along with processes of neuroconduction and neurotransmission.
CO2	Remember, Understand and Apply	To understand the basic biochemical processes occurs in the body related to digestion and energy production
CO3	Understand and remember	To understand the structure and basic functioning of the respiratory tract and urinary tract.
CO4	Understand and remember	To know about various hormones in the body and its related disorders
CO5	Understand and remember	To get knowledge about human reproductive system and its importance and know the basic genetics processes

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO2	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO3	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO4	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO5	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
Avg	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY I-THEORY (BP202T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

B. COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

NO	TOPIC	L (Hrs)	COs
[1]	Classification, nomenclature and isomerism Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds	07	CO1 CO2
[2]	Alkanes*, Alkenes* and Conjugated dienes SP ³ hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP ² hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E 1 verses E 2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement	10	CO1 CO3 CO4 CO5
[3]	Alkyl halides SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol	10	CO1 CO3 CO4 CO5
[4]	Carbonyl compounds	10	CO1

	Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.		CO3 CO4 CO5
[5]	Carboxylic acids Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid Aliphatic amines - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine	8	CO1 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

D. REFERENCE BOOKS (LATEST EDITION)

1. Robert Thornton Morrison; Robert Neilson Boyd. Organic Chemistry. 2 : Study Guide; Allyn And Bacon: Boston, Mass., 1987.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Education: India, 2003.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To learn about name, structure, isomerism and uses of organic compound
CO2	Understand and Remember	To understand about various factors which affect the reactions of organic compounds
CO3	Understand and Apply	To know the reaction, name of the reaction and orientation of reactions
CO4	Understand	To understand the reactivity/stability of organic compounds
CO5	Understand and Remember	To understand and remember the preparation of organic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO2	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO3	3	1	1	2	-	-	-	1	1	-	3	3	2	2	1	-
CO4	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO5	3	-	-	2	-	-	-	1	1	3	3	3	2	3	1	-
Avg	3	0.2	0.2	2	-	-	-	1	1	0.6	3	3	2	2.2	1	-

B. PHARM. SEMESTER – II (BPH)
SUBJECT: BIOCHEMISTRY (BP203T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
3	1	-	04	04	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Objectives: Upon completion of course student shall be able to

- Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
- Understand the metabolism of nutrient molecules in physiological and pathological conditions.
- Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Carbohydrate metabolism</p> <p>Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance Hormonal regulation of blood glucose level and Diabetes mellitus</p> <p>Biological oxidation</p> <p>Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate level phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers</p>	10	CO2 CO4
[2]	<p>Lipid metabolism</p> <p>β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.</p> <p>Amino acid metabolism</p> <p>General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders</p>	10	CO2 CO4

	Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alcaptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline Catabolism of heme; hyperbilirubinemia and jaundice		
[3]	Nucleic acid metabolism and genetic information transfer Biosynthesis of purine and pyrimidine nucleotides Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis Genetic code, Translation or Protein synthesis and inhibitors	10	CO3 CO4
[4]	Biomolecules Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. Bioenergetics Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP	08	CO2 CO4 CO5
[5]	Enzymes Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions	07	CO1

C. TEXT BOOKS

1. Murray, R.; Bender, D.; Botham, K.; Kennelly, P.; Rodwell, V.; Weil, P.; York, N.; San, C.; Lisbon, F.; Madrid, L.; City, M.; Delhi, M.; Juan, S. *Twenty-Eighth Edition*..
2. U Satyanarayana. *Biochemistry*; Elsevier India: New Delhi, 2021.

D. REFERENCE BOOKS

1. Cox, D. L. *Lehninger principles of biochemistry: International Edition*.; W H Freeman & Co Ltd: S.L., 2021..
2. Berg, J. M.; Tymoczko, J. L.; J, G.; Lubert Stryer. *Biochemistry*; W.H. Freeman/Mcmillan Learning: New York, 2019..

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and learn	Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
CO2	Understand and learn	Understand the metabolism of nutrient molecules in physiological and pathological conditions.
CO3	Understand and learn	Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.
CO4	Learn and remember	Learn and remember the basic chemical structure of nutrient molecules and biological importance of biological macromolecules
CO5	Understand	Explain biological mechanisms, such as the processes and control of bioenergetics and metabolism, as chemical reactions

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
CO2	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
CO3	3	-	3	1	-	2	1	1	2	-	3	3	3	3	1	1
CO4	3	-	3	1	-	2	1	1	2	-	3	3	3	3	1	1
CO5	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
Avg.	3	-	3	1	-	2	1	1	2.6	-	3	3	3	3	1	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: PATHOPHYSIOLOGY-THEORY (BP 204T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	---	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

Objectives: Upon completion of the course the student shall be able to

- Describe the etiology and pathogenesis of the selected disease states;
- Name the signs and symptoms of the diseases; and
- Mention the complications of the diseases.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Basic principles of Cell injury and Adaptation: Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance Basic mechanism involved in the process of inflammation and repair: Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis	10	CO1
[2]	Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis) • Respiratory system: Asthma, Chronic obstructive airways diseases. • Renal system : Acute and chronic renal failure .	10	CO2 CO3 CO4 CO5

[3]	Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia <ul style="list-style-type: none"> ● Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones ● Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease. ● Gastrointestinal system: Peptic Ulcer 	10	CO2 CO3 CO4 CO5
[4]	Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease. <ul style="list-style-type: none"> ● Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout ● Principles of cancer: classification, etiology and pathogenesis of cancer 	08	CO2 CO3 CO4 CO5
[5]	Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections <ul style="list-style-type: none"> ● Sexually transmitted diseases: AIDS, Syphilis, Gonorrhea 	07	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Harsh Mohan; Damjanov, I. Textbook of Pathology; Jaypee Brothers Medical Publishers: New Delhi, 2019.
2. Walker, R.; Cate Whittlesea. Clinical Pharmacy and Therapeutics; Churchill Livingstone: Edinburgh ; New York, 2007.

D. REFERENCE BOOKS

1. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020
2. Walker, R.; Cate Whittlesea. Clinical Pharmacy and Therapeutics; Churchill Livingstone: Edinburgh ; New York, 2007.
3. Blumenthal, D. K.; Rollins, D. E. Workbook and Casebook for "Goodman and Gilman's the Pharmacological Basis of Therapeutics"; Mcgraw Hill: New York ; Madrid Etc, 2016.
4. Davidson's Principles and Practice of Medicine.; Elsevier Health Sciences: S.L., 2022.

RECOMMENDED JOURNALS

1. Toner, P. G. The Journal of Pathology 1999, 187 (1), 187. [https://doi.org/3.0.co;2-n">10.1002/\(sici\)1096-9896\(199901\)187:1<187::aid-path269>3.0.co;2-n](https://doi.org/3.0.co;2-n).
2. Robbins, J. KCNQ Potassium Channels: Physiology, Pathophysiology, and Pharmacology. Pharmacology & Therapeutics 2001, 90 (1), 1–19. [https://doi.org/10.1016/s0163-7258\(01\)00116-4](https://doi.org/10.1016/s0163-7258(01)00116-4).
3. Quiz Page. Indian Journal of Pathology and Microbiology 2015, 58 (4), 568. <https://doi.org/10.4103/0377-4929.168897>.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the mechanism behind cell death, inflammatory process and repair mechanism in human body
CO2	Remember, Understand and Apply	To know about the system and function of the body and disease associated with dysfunctioning of the system
CO3	Understand Apply and Evaluate	To understand about the mechanism behind generation of the disease and/or cause of diseases
CO4	Understand	To know about cause, and treatment of the communicable and non-communicable diseases.
CO5	Remember, Understand, Apply and evaluate	To get knowledge about medication used to treat the disease according to the pathway of disease production.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2	1	1	3	3	2	2	3	3	3	2	1
CO2	3	2	2	3	1	1	1	3	3	2	2	3	3	3	2	1
CO3	3	2	3	3	2	3	2	3	3	1	2	3	3	3	2	1
CO4	3	1	3	3	1	3	3	3	3	2	2	3	3	3	3	2
CO5	3	3	2	3	2	2	3	3	2	3	2	2	3	3	2	2
Avg	3	2	2.4	2.8	1.6	2	2	3	2.8	2	2	2.8	3	3	2.2	1.4

B. PHARM. SEMESTER – II (BPH)
SUBJECT: COMPUTER APPLICATIONS IN PHARMACY-THEORY (BP205T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	-	-	3	3	50	15	10	-	75

A. COURSE OVERVIEW

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

Objectives: Upon completion of the course the student shall be able to

- Know the various types of application of computers in pharmacy
- Know the various types of databases
- Know the various applications of databases in pharmacy

B. COURSE CONTENT

NO	TOPIC	L(Hrs)	COs
[1]	Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division Concept of Information Systems and Software : Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	06	CO2
[2]	Web technologies: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database	06	CO3 CO4
[3]	Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System	06	CO1
[4]	Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	06	CO5
[5]	Computers as data analysis in Preclinical development: Chromatographic data analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)	06	CO1

C. TEXT BOOKS

1. V. Bhagat, S. Narkhede, D. Kardile, S. Shankar. *Computer Application in Pharmacy*. NiraliPrakashan, Pune. 1st Edition 2018.

D. REFERENCE BOOKS

1. William E Fassett; Dale B Christensen. *Computer Application in Pharmacy*. Lea and Febiger, USA, 1986.
2. Sean Ekins. *Computer Application in Pharmaceutical Research and Development*. Wiley-Interscience, USA, 2006.
3. S.C. Rastogi. *Bioinformatics: Concept, Skills and Applications*. CBS Publishers and Distributors, New Delhi, 2nd Edition 2019.
4. Cary N. Prague. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath*. Wiley Dreamtech India (P) Ltd., New Delhi,

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand various applications of computers in pharmacy
CO2	Understand and apply	Understand and apply concept of Information Systems and Software
CO3	Remember and Evaluate	Remember and evaluate various types of databases
CO4	Understand and Remember	Understand and remember about Web technologies
CO5	Understand and analyse	Understand and analyse concept of Bioinformatics

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	3	-	2	-	-	1	-	3	2	2	1	-	-
CO2	2	1	1	2	-	1	-	-	1	-	2	1	2	1	-	-
CO3	1	-	2	2	-	-	-	-	-	-	1	1	1	-	-	-
CO4	-	-	1	1	-	-	-	1	-	-	2	2	1	-	-	-
CO5	2	1	-	3	-	-	1	-	1	-	-	2	3	1	-	-
Avg	1.4	0.8	1.2	2.2	-	0.6	0.2	0.2	0.6	-	1.6	1.6	1.8	0.6	-	-

B. PHARM. SEMESTER – II (BPH)**SUBJECT: ENVIRONMENTAL SCIENCES- THEORY (BP206T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	-	-	2	3	50	15	10	-	75

A. COURSE OVERVIEW

Scope: Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

Objectives: Upon completion of the course the student shall be able to:

- Create the awareness about environmental problems among learners.
- Impart basic knowledge about the environment and its allied problems.
- Develop an attitude of concern for the environment.
- Motivate learner to participate in environment protection and environment improvement.
- Acquire skills to help the concerned individuals in identifying and solving environmental problems.
- Strive to attain harmony with Nature.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	The Multidisciplinary nature of environmental studies Natural Resources Renewable and non-renewable resources: Natural resources and associated problems a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.	10	CO1 CO3 CO4
[2]	Ecosystems <ul style="list-style-type: none">▪ Concept of an ecosystem.▪ Structure and function of an ecosystem.▪ Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	10	CO1 CO2 CO3
[3]	Environmental Pollution: Air pollution; Water pollution; Soil pollution	10	CO1 CO3 CO5

C. TEXT BOOKS

1. S.S. Randhava, Environmental Sciences, Vikas and Company Medical Publishers, Peevee publication, Jalandhar, 2019.
2. Prof. M. K. Gupta, Prof. Manish Jaimini, Environmental sciences, Vikas Pandey, published by Nirali Prakashan, Pune, 2018

D. REFERENCE BOOKS

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. Environmental Biology, Nidi Publ. Ltd. Bikaner, 2001
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2001, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and create	Discuss environmental problems among learners and create the awareness and strive to attain harmony with Nature.
CO2	Understand and remember	Describe concept of Ecosystems and remember structure and function of it.
CO3	Create	To create an attitude of concern for the environment protection and environment improvement.
CO4	Understand and remember	Explain Natural Resources of Environment
CO5	Understand and analyse	Describe and analyse the environmental pollution.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	3	2	1	2	2	3	3	3	2	2	2	2
CO2	2	3	3	1	2	2	1	2	2	3	3	3	2	2	2	2
CO3	2	3	3	2	2	2	1	2	2	3	3	3	3	2	2	2
CO4	2	3	2	2	2	2	2	2	2	3	3	3	3	2	2	2
CO5	2	3	3	2	3	2	2	2	2	3	3	3	3	2	2	2
Avg	2.2	3	2.8	1.6	2.4	2	1.4	2	2	3	3	3	2.6	2	2	2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY II - PRACTICAL (BP207P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Practical physiology is complimentary to the theoretical discussions in physiology.

Objectives: Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	1. To study the integumentary and special senses using specimen, models, etc., 2. To study the nervous system using specimen, models, etc., 3. To study the endocrine system using specimen, models, etc 4. To demonstrate the general neurological examination 5. To demonstrate the function of olfactory nerve 6. To examine the different types of taste. 7. To demonstrate the visual acuity 8. To demonstrate the reflex activity 9. Recording of body temperature 10. To demonstrate positive and negative feedback mechanism. 11. Determination of tidal volume and vital capacity. 12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens. 13. Recording of basal mass index 14. Study of family planning devices and pregnancy diagnosis test. 15. Demonstration of total blood count by cell analyser 16. Permanent slides of vital organs and gonads.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

- Ghai, C. L. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
- Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991

D. REFERENCE BOOKS

- Waugh, A.; Ross, J. S.; Grant, A.; Wilson, K. J. W. Ross and Wilson Anatomy and Physiology in Health and Illness : Anne Waugh, Allison Grant ; Illustrations by Graeme Chambers.; Churchill Livingstone: Edinburgh, 2001.
- Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about basic anatomy and physiology of the human organ systems
CO2	Remember, Understand and evaluate	To know about performance of experiments like neurological reflex, body temperature measurement, body mass index, olfaction, gestation reflex and eye sight, etc.
CO3	Understand Apply and Evaluate remember	To understand about procedure for measurement of various haematological parameter, evaluation and interpretation of result
CO4	Understand Apply and Evaluate	To know about family planning
CO5	Remember, Apply and evaluate	To know the histological structures of the body organs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	3	3	3	1	3	3	1	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	1	1	3	3	3	1	3	3	3	3	3	3	3	3	3
Avg	3	2.2	2.2	3	3	3	2.2	3	3	2.6	2.8	3	3	3	3	3

B. PHARM. SEMESTER – II (BPH)**SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY I-PRACTICAL (BP208P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Systematic qualitative analysis of unknown organic compounds like Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc. 2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test 3. Solubility test 4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides. 5. Melting point/Boiling point of organic compounds 6. Identification of the unknown compound from the literature using melting point/ boiling point. 7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point. 8. Minimum 5 unknown organic compounds to be analysed systematically. 2. Preparation of suitable solid derivatives from organic compounds 3. Construction of molecular models	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav & Roopal Prakashan, India, 2008

D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.

3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand the various preliminary test for organic compounds
CO2	Understand and apply	To perform nature identification test for various organic compounds
CO3	Understand and evaluate	Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
CO4	Understand and evaluate	To study about various functional groups identification for organic compounds
CO5	Understand & Apply	Identification of unknown organic compound from the literature using melting point/boiling point

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO2	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO3	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO4	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO5	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
Avg	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: BIOCHEMISTRY PRACTICAL (BP209P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4		35	10	5	-	50

A. COURSE OVERVIEW

Scope: The scope of the subject deals with complete understanding of different qualitative test to be performed for identification of carbohydrates, lipids and proteins. It is also emphasizing on quantitative estimation of sugars and proteins, preparation of buffers and studying the activity of enzyme.

Objectives: Upon completion of course, student shell able to

- Perform various qualitative tests for identification of carbohydrates, proteins and abnormal constituents.
- Understand the Principles for quantitative estimation of glucose and cholesterol.
- Understand and evaluate activity of salivary amylase enzyme

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch) Identification tests for Proteins (albumin and Casein) Qualitative analysis of urine for abnormal constituents Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method) Determination of blood creatinine Determination of blood sugar Determination of serum total cholesterol Preparation of buffer solution and measurement of pH Study of enzymatic hydrolysis of starch. Determination of Salivary amylase activity Study the effect of Temperature on Salivary amylase activity. Study the effect of substrate concentration on salivary amylase activity.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. G. Raval, H. Practicals in biochemistry
2. Gupta, R. C. *Practical Biochemistry*; Cbs Publishers And Distributors: New Delhi, 2006.

D. REFERENCE BOOKS

1. Plummer David T. *An Introduction to Practical Biochemistry*; Tata Mcgraw Hill: New Delhi, 1990.
2. G Rajagopal; Es Rāmakiruşṇan. *Practical Biochemistry for Medical Students*; Orient Longman ; New York, Ny: Hyderabad, 1983.
3. Varley, H. *Practical Clinical Biochemistry*; Cbs Publishers & Distributors: Delhi, 1988.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, remember and learn	Understand, remember, learn principles and perform various test ethically for qualitative analysis of carbohydrates, proteins and abnormal constituent in urine.
CO2	Understand, learn and apply and evaluate	Understand, learn and perform the quantitative test for analysis of reducing sugars and protein.
CO3	Understand Apply and Evaluate	Analyse and evaluate the factors affecting enzyme activity
CO4	Understand Apply and Evaluate	Understand and learn the concept of buffers
CO5	Understand Apply and Evaluate	Evaluation and interpretation of data emanating from a pathological lab for various carbohydrates, lipids and protein.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO2	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO3	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO4	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO5	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
Avg.	3	3	3	1	2	2	1	1	3	-	3	3		-	2	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: COMPUTER APPLICATIONS IN PHARMACY-PRACTICAL(BP210P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	2	2	1	15	5	5	-	25

A. COURSE OVERVIEW

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

Objectives: Upon completion of the course the student shall be able to

- Know the various types of office tools and their applications
- Create the various databases
- Know the various applications of databases in pharmacy

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	CO
[1]	1. Design a questionnaire using a word processing package to gather information about a particular disease. 2. Create a HTML web page to show personal information 3. Retrieve the information of a drug and its adverse effects using online tools 4. Creating mailing labels Using Label Wizard , generating label in MS WORD 5. Create a database in MS Access to store the patient information with the required fields Using access 6. Design a form in MS Access to view, add, delete and modify the patient record in the database 7. Generating report and printing the report from patient database 8. Creating invoice table using – MS Access 9. Drug information storage and retrieval using MS Access 10. Creating and working with queries in MS Access 11. Exporting Tables, Queries, Forms and Reports to web pages 12. Exporting Tables, Queries, Forms and Reports to XML pages	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. V. Bhagat, S. Narkhede, D. Kardile, S. Shankar. *Computer Application in Pharmacy*. NiraliPrakashan, Pune. 1st Edition 2018.

D. REFERENCE BOOKS

1. William E Fassett; Dale B Christensen. *Computer Application in Pharmacy*. Lea and Febiger, USA, 1986.

2. Sean Ekins. *Computer Application in Pharmaceutical Research and Development*. Wiley-Interscience, USA, 2006.
3. S.C. Rastogi. *Bioinformatics: Concept, Skills and Applications*. CBS Publishers and Distributors, New Delhi, 2nd Edition 2019.
4. Cary N. Prague. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath*. Wiley Dreamtech India (P) Ltd., New Delhi,

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	Understand basic tools of MS Word, MS Excel and MS Power point and apply them to create documents.
CO2	Remember, Understand and Create	Remember and Understand HTML tags and create HTML web page.
CO3	Create	Create mailing labels Using Label Wizard, generating label in MS WORD
CO4	Design	Design questionnaire/reports using a word processing package to gather information about a particular disease.
CO5	Understand and Apply	Understand tools of MS Access and apply in creating database, queries, relationship and reports from patient database

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	-	1	2	-	-	-	2	-	-	1	1	2	-	-	-
CO2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	1	-	-	-	1	-	-	1	1	-	-	1	-
CO4	1	-	1	2	-	-	-	1	1	-	-	1	1	-	-	-
CO5	1	-	1	2	-	-	-	-	-	-	-	1	-	-	-	-
Avg	0.6	-	0.6	1.6	-	-	-	0.8	0.2	-	0.4	0.8	0.6	-	0.2	-

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY II -THEORY (BP301T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- prepare organic compounds

B. COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

NO	TOPIC	L (Hrs)	COs
[1]	Benzene and its derivatives A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel crafts alkylation- reactivity, limitations, Friedelcrafts acylation. C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction D. Structure and uses of DDT, Saccharin, BHC and Chloramine	10	CO1 CO3 CO4 CO5
[2]	Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols Aromatic Amines* - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts Aromatic Acids* – Acidity, effect of substituents on acidity and important reactions of benzoic acid.	10	CO1 CO3 CO4 CO5
[3]	Fats and Oils a. Fatty acids – reactions. b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.	10	CO1 CO3 CO5
[4]	Polynuclear hydrocarbons: a. Synthesis, reactions b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives	8	CO1 CO3 CO5

[5]	Cyclo alkanes* Stabilities – Baeyer’s strain theory, limitation of Baeyer’s strain theory, Coulson and Moffitt’s modification, Sachse Mohr’s theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only	7	CO1 CO3 CO4 CO5
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C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

D. REFERENCE BOOKS (LATEST EDITION)

1. Robert Thornton Morrison; Robert Neilson Boyd. Organic Chemistry. 2 : Study Guide; Allyn And Bacon: Boston, Mass., 1987.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Education: India, 2003.

E. COURSE OUTCOMES

CO Number	Skill		Statement
CO1	Understand and Apply		To write the structure, name of organic compound
CO2	Understand and Remember		To understand the type of isomerism of the compound
CO3	Understand and Remember		To know the reaction, name of the reaction and orientation of reactions
CO4	Understand and Remember		To understand the reactivity/stability of organic compounds
CO5	Understand and Remember		To understand and remember the preparation of organic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	1	1	-	1	2	3	3	3	3	1	1	1
CO2	3	1	1	1	1	1	-	1	3	2	3	3	3	1	1	1
CO3	3	1	1	1	1	1	-	1	3	2	3	3	3	3	1	1
CO4	3	1	1	1	1	1	-	1	3	1	3	3	3	3	1	1
CO5	3	1	1	1	1	1	-	1	2	2	3	3	3	2	1	1
Avg	2.8	1	1	1.2	1	1	-	1	2.6	2	3	3	3	2	1	1

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS I-THEORY (BP302T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Understand various physicochemical properties of drug molecules in the designing the dosage forms
- Know the principles of solubility, pH & buffers to use them for designing of formulations

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications	10	CO1
[2]	States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid crystalline, amorphous & polymorphism. Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications	10	CO2 CO3
[3]	Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.	10	CO4
[4]	Complexation and protein binding: Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants	08	CO3
[5]	pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.	07	CO5

C. TEXT BOOKS

1. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	Understand and analyse the principles of solubility and partition coefficient
CO2	Remember, Evaluate and apply	Remember and evaluate various physicochemical properties of drug molecules and apply in the designing the dosage form
CO3	Understand and Apply	Understand and apply physical principles of states of matter and complexation
CO4	Remember and evalaute	Remember and evaluate the role of surfactants, interfacial phenomenon and adsorption
CO5	Understand	Understand the importance of pH and buffers in pharmaceutical dosage forms and maintaining stability

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	1	-	-	-	-	1	-	-	3	1	3	-	1
CO2	3	-	-	1	-	-	-	-	1	-	-	3	1	2	-	-
CO3	3	-	-	-	-	-	-	-	1	-	-	3	1	2	-	1
CO4	3	-	-	-	-	-	-	-	1	-	-	3	1	1	-	-
CO5	3	-	-	-	-	-	-	-	1	-	-	3	1	1	-	-
Avg	3	-	-	0.4	-	-	-	-	1	-	-	3	1	1.8	-	0.4

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL MICROBIOLOGY-THEORY (BP303T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to learn all categories of microorganisms especially for the production of alcohol, antibiotics, vaccines, vitamins, enzymes etc.

Objectives: Upon completion of the course the student shall be able to understand the concepts related to various microorganisms, sterility testing and its application in pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes Study of ultrastructure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.	10	CO1
[2]	Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipment employed in large scale sterilization. Sterility indicators.	10	CO2 CO3
[3]	Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.	10	CO5
[4]	Designing of aseptic area, laminar flow equipment; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.	08	CO2 CO5
[5]	Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.	07	CO4

	Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.		
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C. TEXT BOOKS

1. Pelczar, M. J.; Chan, E. C. S.; Krieg, N. R. *Microbiology*; Tata Mcgraw-Hill: New Delhi, 2010.

D. REFERENCE BOOKS

1. Denyer, S. P.; Hodges, N. A.; Gorman, S. P.; Hugo, W. B.; Russell, A. D. *Pharmaceutical Microbiology*; Blackwell Science: Malden, 2004.
2. Prescott; Dunn. *Industrial Microbiology*, 4th edition.; CBS Publishers & Distributors, Delhi.
3. Denyer, S. P.; Hugo, W. B. *Hugo and Russell's Pharmaceutical Microbiology*; Wiley-Blackwell: Chichester, West Sussex, Uk ; Hoboken, Nj, 2011.
4. Rose, A. H. *Industrial Microbiology*; Butterworths: London, 1961.
5. Probisher; Hinsdill. *Fundamentals of Microbiology*, 9th ed.; Japan.
6. Cooper, J. W.; Gunn, C.; Sidney James Carter. *Cooper and Gunn's Tutorial Pharmacy*; Cbs Publishers: Editorial: New Delhi, 2005.
7. Peppler, H. J.; Perlman, D. *Microbial Technology*; New York, Etc., Academic P, 1979.
8. I.P., B.P., U.S.P.- latest editions.
9. Edward Alcamo. *Fundamentals of Microbiology*; Jones And Bartlett: Sudbury, Mass., 2001.
10. Jain, N. K. *Pharmaceutical Microbiology*; Vallabh Prakashan: Delhi, 2001.
11. Brenner, D. J.; Krieg, N. R.; Staley, J. T.; Garrity, G. M. *Bergey's Manual of Systematic Bacteriology. Volume Two, the Proteobacteria. Part A, Introductory Essays. Part B, the Gammaproteobacteria. Part C, the Alpha-, Beta-, Delta-, and Epsilonproteobacteria*; Springer: New York, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand Apply and Evaluate	To Understand methods of identification, cultivation and preservation of various microorganisms
CO2	Remember, and Understand Evaluate	To understand the importance and implementation of sterilization in pharmaceutical processing and industry
CO3	Understand Apply and Evaluate	To Understand the cell culture technology and its applications in pharmaceutical industries
CO4	Understand and Remember	To understand structure and growth of bacteria, virus and fungi
CO5	Understand Apply and Evaluate	To perform and evaluate microbial assay of various antibiotics and vitamin

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	2	3	3	0	2	0	3	2	3	3	3	1	3	2	3
C02	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
C03	3	-	2	3	2	2	0	2	1	2	2	3	3	3	2	3
C04	3	2	2	2	2	2	2	2	1	3	3	3	1	3	2	3
C05	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
Avg	3	2	2.6	2.8	1.6	2.4	1.6	2.6	2	2.8	2.8	3	2.2	3	2.4	3

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL ENGINEERING - THEORY (BP304T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Objectives: Upon completion of the course student shall be able:

- To know various unit operations used in Pharmaceutical industries.
- To understand the material handling techniques.
- To perform various processes involved in pharmaceutical manufacturing process.
- To carry out various test to prevent environmental pollution.
- To appreciate and comprehend significance of plant lay out design for optimum use of resources.
- To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.</p> <p>Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.</p> <p>Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.</p>	10	CO2 CO3 CO1
[2]	<p>Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.</p> <p>Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator & Economy of multiple effect evaporator.</p> <p>Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation</p>	10	CO2 CO3
[3]	<p>Drying: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits</p>	10	CO2 CO3

	of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer. Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier		
[4]	Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter. Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.	8	CO2 CO3
[5]	Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.	7	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. C V S Subrahmanyam; J Thimma Setty; Suresh, S.; V Kusum Devi. Pharmaceutical Engineering : Principles and Practices.; Vallabh Prakashan: Delhi, 2002.
2. C V S Shubramanyam. Pharmaceutical Engineering : Unit Operations - II; Vallabh Prakashan: Delhi, 2014.

D. REFERENCE BOOKS

1. Badger, W. L. Introduction to Chemical Engineering; Mc Graw Hill: Auckland, 1987.
2. Cooper, J. W.; Gunn, C.; Sidney James Carter. Cooper and Gunn's Tutorial Pharmacy; Cbs Publishers: Editorial: New Delhi, 2005.
3. Joseph Price Remington; Eric Wentworth Martin. Remington's Practice of Pharmacy Easton, Pa. Mack, 1961.
4. Khar, R. K.; Vyas, S. P.; Ahmad, F. J.; Jain, G. K. Lachman/Lieberman's the Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributor, Repr: New Delhi, 2015.
5. McCabe, W. L.; Smith, J. C.; Harriott, P. Unit Operations of Chemical Engineering; Chennai McGraw-Hill Education (India) Private Limited, 2014.
6. Simpson, N. J. K. Solid-Phase Extraction Principles, Techniques, and Applications; New York, N.Y. Dekker, 2000.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember and Understand	To understand and remember the various unit operations used in Pharmaceutical industries.
CO2	Understand	To understand the material handling techniques.
CO3	Apply and Evaluate	To perform various processes involved in pharmaceutical manufacturing process.
CO4	Understand and apply	To appreciate and comprehend significance of plant lay out design for optimum use of resources and to carry out various test to prevent environmental pollution.
CO5	Apply and evaluate	To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	2	-	2	2	2	3	3	3	3	3	3
CO2	3	1	3	3	2	2	-	2	2	2	2	3	3	3	2	2
CO3	3	2	2	3	2	1	2	2	1	2	3	3	3	2	3	2
CO4	3	1	2	3	-	1	1	-	-	3	3	3	2	2	2	3
CO5	3	1	2	3	-	1	1	2	2	3	2	3	3	3	1	3
Avg	3	1.4	2.4	3	1.2	1.4	0.8	1.6	1.4	2.4	2.6	3	2.8	2.6	2.2	2.6

B. PHARM. SEMESTER – III (BPH)**SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY II -PRACTICAL (BP305P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- prepare organic compounds

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Experiments involving laboratory techniques <ul style="list-style-type: none"> • Recrystallization • Steam distillation Determination of following oil values (including standardization of reagents) <ul style="list-style-type: none"> • Acid value • Saponification value • Iodine value Preparation of compounds <ul style="list-style-type: none"> • Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction. • 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/ Acetanilide by halogenation (Bromination) reaction. 1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction. • Benzoic acid from Benzyl chloride by oxidation reaction. • Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction. Benzil from Benzoin by oxidation reaction. • Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction • Cinnamic acid from Benzaldehyde by Perkin reaction, <i>P</i>-Iodo benzoic acid from <i>P</i>-amino benzoic acid 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav & Roopal Prakashan, India, 2008

D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.
3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To understand the experimental laboratory techniques
CO2	Understand and Remember	Determination of oils values for fats and oils
CO3	Understand and Apply	To study the name of the reaction involved in the organic compound
CO4	Understand and Remember	To understand the preparation of organic compound
CO5	Understand & Evaluate	To perform the purification of compound

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	1	1	-	1	1	2	1	1	2	3	3	1	1
CO2	3	1	2	1	1	-	1	1	3	1	2	2	3	3	1	1
CO3	3	1	2	1	1	-	-	1	3	2	1	2	3	2	1	1
CO4	3	1	2	1	1	-	1	1	3	1	2	2	3	2	1	1
CO5	3	1	2	1	1	-	1	1	3	2	1	2	3	3	1	1
Avg	3	1	2	1	1	-	0.8	1	2.8	1.4	1.4	2	3	2.6	1	1

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS I-PRACTICAL (BP306P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principals involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know and determine physical properties such as solubility, surface tension, partition coefficient and pKa and apply in the design of dosage forms.
- Know the principles of solubility, pH & buffers to use them for designing of formulations

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Determination the solubility of drug at room temperature 2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation 3. Determination of Partition co- efficient of benzoic acid in benzene and water 4. Determination of Partition co- efficient of Iodine in CCl ₄ and water 5. Determination of % composition of NaCl in a solution using phenol-water system by CST method 6. Determination of surface tension of given liquids by drop count and drop weight method 7. Determination of HLB number of a surfactant by saponification method 8. Determination of Freundlich and Langmuir constants using activated char coal 9. Determination of critical micellar concentration of surfactants 10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method 11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Sen, K. K., Dutta, S. K. A Laboratory Manual of Physical Pharmaceutics. India: PharmaMed Press. 2019.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.
8. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, Evaluate and Apply	Understand and evaluate physical properties such as solubility, surface tension, partition coefficient and pKa and apply in the design of dosage forms.
CO2	Understand and apply	Understand and apply Henderson – Hasselbalch equation for determination of pKa value of drugs.
CO3	Understand and Evaluate	Understand and evaluate the HLB value and critical micellar concentration of a surfactant.
CO4	Understand and Evaluate	Understand adsorption isotherms and determine Freundlich-Langmuir adsorption isotherm.
CO5	Evaluate	Evaluate the stability constants of complexes by various methods.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO2	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO3	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO4	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO5	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
Avg	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL MICROBIOLOGY-PRACTICAL (BP307P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Course enables the student to learn all categories of microorganisms especially for the production of alcohol, antibiotics, vaccines, vitamins enzymes etc..

Objectives: Upon completion of the course the student shall be able to

- Understand methods of identification, cultivation and preservation of various microorganisms.
- To understand the importance and implementation of sterilization in pharmaceutical processing and industry
- Learn sterility testing of pharmaceutical products.
- Carried out microbiological standardization of Pharmaceuticals.
- Understand the cell culture technology and its applications in pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology. 2. Sterilization of glassware, preparation and sterilization of media. 3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations. 4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical). 5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques 6. Microbiological assay of antibiotics by cup plate method and other methods 7. Motility determination by Hanging drop method. 8. Sterility testing of pharmaceuticals. 9. Bacteriological analysis of water 10. Biochemical test. 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

(1) Arora, B.; Arora, D. R. *Practical Microbiology*; Cbs Publishers & Distributors, Pvt Ptd: New Delhi, 2020.

D. REFERENCE BOOKS

- (1) G Sirockin; Cullimore, S. *Practical Microbiology*; London Mcgraw-Hill C, 1969.
- (2) Pelczar, M. J.; Chan, E. C. S.; Krieg, N. R. *Microbiology*; Tata Mcgraw-Hill: New Delhi, 2010.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Evaluate Apply	To perform and Evaluate sterility testing of pharmaceutical products.
CO2	Understand and Evaluate Apply	To perform microbiological standardization of Pharmaceuticals.
CO3	Understand and Evaluate Apply	To perform staining techniques for different microbes
CO4	Understand and Evaluate Apply	To evaluate motility of microorganism
CO5	Understand and Evaluate Apply	To perform microbial assay of antibiotics

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	1	3	3	3	3	2	3	3	3	2	2
CO3	3	3	3	2	1	1	1	2	1	2	1	2	2	3	2	1
CO4	3	3	3	2	1	1	1	1	1	1	1	1	1	3	1	1
CO5	3	3	3	2	1	1	2	3	3	3	2	3	2	3	2	3
Avg	3	3	3	2.4	1	1	2	2.4	2.2	2.4	1.8	2.4	2.2	3	2	2

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL ENGINEERING-PRACTICAL (BP308P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	-	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Objectives: Upon completion of the course student shall be able:

- To know various unit operations used in Pharmaceutical industries.
- To understand the material handling techniques.
- To perform various processes involved in pharmaceutical manufacturing process.
- To carry out various test to prevent environmental pollution.
- To appreciate and comprehend significance of plant lay out design for optimum use of resources.
- To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Determination of radiation constant of brass, iron, unpainted and painted glass. 2. Steam distillation – To calculate the efficiency of steam distillation. 3. To determine the overall heat transfer coefficient by heat exchanger. 4. Construction of drying curves (for calcium carbonate and starch). 5. Determination of moisture content and loss on drying. 6. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method. 7. Description of Construction working and application of Pharmaceutical 8. Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier. 9. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots. 10. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill. 11. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment. 12. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity) 13. To study the effect of time on the Rate of Crystallization. 14. To calculate the uniformity Index for given sample by using Double Cone Blender.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Momin M, Mehta T, Practical Manual of Pharmaceutical Engineering, B.S. Shah Prakashan, Ahmedabad, Gujarat, 2002.

D. REFERENCE BOOKS

1. C V S Shubramanyam. Pharmaceutical Engineering : Unit Operations - II; Vallabh Prakashan: Delhi, 2014.
2. C V S Subrahmanyam; J Thimma Setty; Suresh, S.; V Kusum Devi. Pharmaceutical Engineering : Principles and Practices.; Vallabh Prakashan: Delhi, 2002.
3. Badger, W. L. Introduction to Chemical Engineering; Mc Graw Hill: Auckland, 1987.
4. Cooper, J. W.; Gunn, C.; Sidney James Carter. Cooper and Gunn's Tutorial Pharmacy; Cbs Publishers: Editorial: New Delhi, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand and convert the values of factors in different units to perform various unit operations in Pharmaceutical industries.
CO2	Apply	To perform basic unit operations such as filtration, centrifugation, drying etc.
CO3	Evaluate	To check the effect of various processing parameters on different unit operations.
CO4	Apply	To create plant lay out design for optimum use of resources and to carry out various tests to prevent environmental pollution.
CO5	Apply and evaluate	To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	-	1	1	2	1	3	3	3	2	2	2
CO2	3	2	3	3	2	2	-	2	2	2	3	3	3	3	1	2
CO3	3	2	3	3	-	2	-	2	2	2	3	3	3	3	2	2
CO4	3	2	3	3	2	-	-	2	1	1	3	3	3	2	3	2
CO5	3	3	3	3	2	3	2	3	3	3	3	3	3	2	3	3
Avg	3	2.2	3	3	1.6	1.4	0.6	2	2	1.8	3	3	3	2.4	2.2	2.2

B. PHARM. SEMESTER – VII (BPH)
SUBJECT: INTRODUCTION TO YOGA (BP309P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	2	2	-	-	-	-	-	-

* Non-University Examination with grading satisfactory/ unsatisfactory

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge and practical skill of Yoga

Objectives: Upon completion of the course student shall be able

- To introduce the student to the fundamentals of a Yoga practice in a safe, supportive and academic environment.
- To learn proper body alignment & the basics of breathing techniques (pranayama)
- To understand various forms of yoga mediation & yogic asanas.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)
[1]	<p>TRAINING IN YOGIC ASANAS, PRANAYAMS AND MUDRAS</p> <ul style="list-style-type: none"> - Kapalbhati, Anulom-vilom, Pranayam, Omkar Pranayam, Bharmari, Pranayam, Body Rotation, Shavasan, Suryanamaskar, - Asans for Meditation: Padmasan, Swastikasan, Siddhasan, Bhadrasan, Vajrasan, Makarasan, Savasan. - Asans to be performed in Standing Position: Trikonasan, Pervatasan, Utkatukasan, Hastapadsan - Asans to be performed while lying in Supine position: Servangasan, Halasan, Savasan, Kosthavishramasan, Matshendrasan, Suptavajrasan - Asans to be performed while lying in Prone position: Uttanpadasan, Uttanadhasan, Serpasan, Bhujasan, Salabhasan, Dhanurasan, Makarasan - Asans to be performed in sitting position: Pavanmuktasan, Hastapadasan, Vajrasan, Ardhamatshyendrasan, Shishuasan, Saptamudrasan, Gomukhasan. - Yoga Mudras (Seven Types) 	30

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY III -THEORY (BP401T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Objectives: At the end of the course, the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

B. COURSE CONTENT

To emphasize on definition, types, mechanisms, examples, uses/applications

NO	TOPIC	L (Hrs)	COs
[1]	Stereo isomerism Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers Reactions of chiral molecules Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute	10	CO3
[2]	Geometrical isomerism Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions	10	CO3
[3]	Heterocyclic compounds: Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene	10	CO1 CO2 CO4
[4]	Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis & medicinal uses of Pyrimidine, Purine, azepines and their dvts	8	CO2 CO3 CO4
[5]	Reactions of synthetic importance	7	CO5

	Metal hydride reduction (NaBH ₄ and LiAlH ₄), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation		
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C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

D. REFERENCE BOOKS (LATEST EDITION)

1. Bansal R, Heterocyclic Chemistry; New Age International (P) Limited, Publishers: New Delhi, 2014.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Education: India, 2003.

E. COURSE OUTCOMES

CO Number	Skill		Statement
CO1	Understand and Remember		To understand the methods of preparation for various organic compounds
CO2	Understand and Remember		To understand chemical properties for various organic compounds
CO3	Understand and Apply		To know the stereo chemical aspects of organic compounds and stereochemical reactions
CO4	Understand and Apply		To know medicinal uses and Other application of organic compounds
CO5	Understand and Remember		To understand and remember the reaction of synthetic importance

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	3	-	-	-	-	1	1	3	3	2	3	1	1
CO2	3	-	-	3	-	-	-	-	1	-	3	3	2	3	1	1
CO3	3	-	-	3	-	-	-	-	1	-	3	3	2	3	1	1
CO4	3	-	-	2	-	-	-	-	1	-	3	3	3	3	1	1
CO5	3	-	-	2	-	-	-	-	1	-	3	3	3	3	2	1
Avg	3	-	-	2.6	-	-	-	-	1	0.2	3	3	2.4	3	1.2	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: MEDICINAL CHEMISTRY I-THEORY (BP402T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

B. COURSE CONTENT

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Medicinal Chemistry History and development of medicinal chemistry Physicochemical properties in relation to biological action Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism. Drug metabolism Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.	10	CO1 CO2
[2]	Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. Sympathomimetic agents: SAR of Sympathomimetic agents Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. <ul style="list-style-type: none"> • Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. • Agents with mixed mechanism: Ephedrine, Metaraminol. Adrenergic Antagonists: Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.	10	CO2 CO3 CO4 CO5
[3]	Cholinergic neurotransmitters:	10	CO2

	<p>Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.</p> <p>Parasympathomimetic agents: SAR of Parasympathomimetic agents</p> <p>Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.</p> <p>Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorophate, Echothiophate iodide, Parathion, Malathion.</p> <p>Cholinesterase reactivator: Pralidoxime chloride.</p> <p>Cholinergic Blocking agents: SAR of cholinolytic agents</p> <p>Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.</p> <p>Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.</p>		CO3 CO4 CO5
[4]	<p>Drugs acting on Central Nervous System</p> <p>A. Sedatives and Hypnotics:</p> <p>Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem</p> <p>Barbiturates: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital</p> <p>Miscellaneous: Amides & imides: Glutethimide. Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.</p> <p>B. Antipsychotics</p> <p>Phenothiazines: SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.</p> <p>Ring Analogues of Phenothiazines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.</p> <p>Fluoro buterophenones: Haloperidol, Droperidol, Risperidone.</p> <p>Beta amino ketones: Molindone hydrochloride.</p> <p>Benzamides: Sulpieride.</p> <p>C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action</p> <p>Barbiturates: Phenobarbitone, Methabarbitol. Hydantoins: Phenytoin*, Mephenytoin, Ethotoin Oxazolidine diones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Phenacemide, Carbamazepine* Benzodiazepines: Clonazepam Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate</p>	8	CO2 CO3 CO4 CO5
[5]	<p>Drugs acting on Central Nervous System</p> <p>General anesthetics:</p> <p>Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.</p>	7	CO2 CO3 CO4 CO5

	<p>Ultra short acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.</p> <p>Dissociative anesthetics: Ketamine hydrochloride.*</p> <p>Narcotic and non-narcotic analgesics</p> <p>Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anileridine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.</p> <p>Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.</p> <p>Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.</p>		
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C. TEXT BOOKS (LATEST EDITION)

1. Kadam S S, Bothara, K G Principles of Medicinal Chemistry, Volume I & II, 17th edition, Nirali Prakashan, India, 2008
2. Alagaraswamy, V Textbook of Medicinal Chemistry, Volume I & II, Elsevier, India 2012

D. REFERENCE BOOKS (LATEST EDITION)

1. Delgado, J. N.; Remers, W. A. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry; Lippincott-Raven: Philadelphia, 1998.
2. Foye, W. O.; Lemke, T. L.; Williams, D. A. Principles of Medicinal Chemistry; Williams & Wilkins, Cop: Baltimore Etc., 1995.
3. Remington, J. P.; Gennaro, A. R. Remington's Pharmaceutical Sciences; Mack Pub. Co: Easton, Pa., 1990.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand the chemistry of drugs with respect to their pharmacological activity
CO2	Understand and Remember	To understand the classification of drugs with their structures
CO3	Understand	To understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
CO4	Understand and Remember	To know the Structural Activity Relationship (SAR) of different class of drugs
CO5	Understand and Apply	To learn about the chemical synthesis of some drugs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	1	1	1	-	-	2	-	3	3	3	2	1	1
CO2	3	-	-	1	1	1	-	-	2	-	3	3	1	2	1	1
CO3	3	-	-	1	1	1	-	-	2	-	3	3	3	2	1	1
CO4	3	-	-	1	1	1	-	-	1	-	3	3	2	2	1	1
CO5	3	-	-	1	1	1	-	-	2	-	3	3	1	2	1	1
Avg	3	-	-	1	1	1	-	-	1.8	-	3	3	2	2	1	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS-II-THEORY (BP403T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Know basics of the dispersed systems and colloidal dispersions.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.	07	CO1
[2]	Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus	08	CO2
[3]	Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.	10	CO1 CO3
[4]	Micromeretics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.	10	CO4
[5]	Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention	10	CO3 CO4

C. TEXT BOOKS

1. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Understand basics of the dispersed systems and apply principles of colloidal dispersions.
CO2	Interpret and Evaluate	Interpret the rheological behaviour of fluids and evaluate the physics of tablet compression.
CO3	Evaluate and apply	Formulate and evaluate coarse dispersions making use of rheological and electrical properties.
CO4	Understand, Evaluate and apply	Understand and evaluate the properties of powders and apply them in formulation development.
CO5	Understand and Analyse	Understand principles of kinetics in the stabilization of dosage forms. Analyze the chemical stability of various drug products

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO2	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO3	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO4	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO5	3	-	2	-	-	-	-	-	3	-	-	3	2	3	-	-
Avg	3	-	1.2	-	-	-	-	-	2.2	-	-	3	2	3	-	-

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACOLOGY I -THEORY (BP401T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	---	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

Objectives: Upon completion of the course the student shall be able to

- Understand the pharmacological actions of different categories of drugs
- Explain the mechanism of drug action at organ system/sub cellular/macromolecular levels.
- Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
- Observe the effect of drugs on animals by simulated experiments
- Appreciate correlation of pharmacology with other bio medical sciences

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	1. General Pharmacology a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination	08	CO1 CO4 CO5
[2]	General Pharmacology a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action. b. Adverse drug reactions. c. Drug interactions (pharmacokinetic and pharmacodynamic) d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance	12	CO1 CO2 CO3 CO4 CO5

[3]	Pharmacology of drugs acting on peripheral nervous system a. Organization and function of ANS. b. Neurohumoral transmission-transmission and classification of neurotransmitters. c. Parasympathomimetic, Parasympatholytic, Sympathomimetics, sympatholytic. d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). e. Local anaesthetic agents. f. Drugs used in myasthenia gravis and glaucoma	10	CO1 CO2 CO3 CO4 CO5
[4]	Pharmacology of drugs acting on central nervous system a. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. b. General anaesthetics and pre-anaesthetics. c. Sedatives, hypnotics and centrally acting muscle relaxants. d. Anti-epileptics e. Alcohols and disulfiram.	08	CO1 CO2 CO3 CO4 CO5
[5]	Pharmacology of drugs acting on central nervous system a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manic and hallucinogens. b. Drugs used in Parkinson's disease and Alzheimer's disease. c. CNS stimulants and nootropics. d. Opioid analgesics and antagonists e. Drug addiction, drug abuse, tolerance and dependence.	07	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.3.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.
4. Bickley, L. S.; Bates, B. Bates' Guide to Physical Examination and History Taking.; Lippincott Williams & Wilkins: Philadelphia, 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To know about general idea of pharmacology subject, the contents of the subject, the basic about the drug and its action inside the body
CO2	Remember, Understand and Apply	To get knowledge about how to body react towards the drug and basic action and adverse effects produced by the drugs
CO3	Understand Apply and Evaluate	To understand about the system, disease and drug used in treatment of that type of disease
CO4	Understand and remember	To know about how disease occurs and drugs used in those diseases and drug interaction with others.
CO5	Remember, Understand, Apply and evaluate	To get knowledge about various agonist and antagonist and drugs dependence abuse and tolerance about certain drugs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3	1
CO2	3	2	3	3	3	3	2	3	3	2	3	3	3	3	3	1
CO3	3	2	3	3	3	3	2	3	3	2	2	3	3	3	3	1
CO4	3	2	3	3	3	3	2	3	3	2	2	3	3	3	3	1
CO5	3	2	3	3	3	3	3	3	3	2	2	2	3	3	3	1
Avg	3	2	3	3	3	3	2.4	3	3	1.8	2.2	2.8	3	3	3	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACOGNOSY AND PHYTOCHEMISTRY -THEORY (BP405T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Objectives: Upon completion of the course, the student shall be able

- To know the techniques in the cultivation and production of crude drugs.
- To know the crude drugs, their uses and chemical nature.
- Know the evaluation techniques for the herbal drugs.
- To carry out the microscopic and morphological evaluation of crude drugs.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Pharmacognosy: (a) Definition, history, scope and development of Pharmacognosy (b) Sources of Drugs – Plants, Animals, Marine & Tissue culture (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins). Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero-taxonomical classification of drugs Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.	10	CO2 CO5
[2]	Cultivation, Collection, Processing and storage of drugs of natural origin: Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants Conservation of medicinal plants	10	CO1
[3]	Plant tissue culture: Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines	07	CO4
[4]	Pharmacognosy in various systems of medicine: Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine. Introduction to secondary metabolites:	10	CO2 CO3 CO5

	Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins		
[5]	<p>Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs</p> <p>Plant Products: Fibers - Cotton, Jute, Hemp Hallucinogens, Teratogens, Natural allergens</p> <p>Primary metabolites: General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic uses and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:</p> <p>Carbohydrates: Acacia, Agar, Tragacanth, Honey</p> <p>Proteins and Enzymes : Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).</p> <p>Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax .</p> <p>Marine Drugs: Novel medicinal agents from marine sources.</p>	08	CO2 CO5

C. TEXT BOOKS

1. Dr. Shukla P., Dr. Shashi, A. & Dr. Shukla P., A textbook of "Pharmacognosy & Phytochemistry-I" 1st Edition, Nirali Prakashan, 2019.
2. Kabra, A., Dr. Ashok PK. & Setia, S., A textbook of "Pharmacognosy & Phytochemistry-I", Pee Vee Book, S. Vikas & Company (Medical Publishers) ,2019.

D. REFERENCE BOOKS

1. Deore SL., "Pharmacognosy & Phytochemistry-I-A Comprehensive Approach" 2nd edition, Pharma Med. Press, 2019.
2. Ali, M., "Pharmacognosy- Pharmacognosy & Phytochemistry-I", Volume-I CBS Publishers & Distributors PVT. Ltd., 2018
3. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry" , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
4. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
5. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
6. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
7. Jarald EE. & Jarald SE., "Textbook of Pharmacognosy & Phytochemistry" 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.
8. Neha Tyagi & Dr. Verma Santosh Kumar "A textbook of Pharmacognosy & Phytochemistry-I", 1st Edition, BFC Publication, 2020.
9. Gokhale, SB., Dr. Kokate CK., Dr. Tatiya AV., Dr. Kalaskar MG., "Pharmacognosy & Phytochemistry-I" 1st Edition, Nirali Prakashan, 2019.
10. Ashutosh Kar, "Pharmacognosy & Phytochemistry-I", 1st Edition, New Age International Private LTD. Publishers. 2020.
11. Dr. Das K., "Pharmacognosy & Phytochemistry-I" 1st Edition, Nirali Prakashan, 2019.
12. Kalia AN., Textbook of "Pharmacognosy & Phytochemistry-I" CBS Publishers & Distributors PVT. Ltd., 2021.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	Identify and analyse the techniques in the cultivation and production of crude drugs.
CO2	Remember and Understand Evaluate	Describe Pharmacognostic parameters & Pharmacognostic study of crude drug with their evaluation.
CO3	Understand and Apply	Explain & apply the basic principle of Indian systems of medicines.
CO4	Understand and apply	Discuss and apply the basic principle and techniques of Plant tissue culture.
CO5	Understand and apply	Discuss primary and secondary metabolites systematically from the source of their pharmaceutical and industrial application.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	-	2	-	2	2	3	2	3	2	2	2	1
CO2	3	2	2	2	-	2	2	1	2	1	2	3	2	3	2	1
CO3	3	2	2	1	-	2	3	2	2	1	2	3	2	3	3	1
CO4	3	2	2	2	-	2	2	1	2	1	2	3	2	2	3	1
CO5	3	2	2	2	-	2	-	2	2	1	2	3	2	2	2	1
Avg	3	2	2	1.8	-	2	1.4	1.6	2	1.4	2	3	2	2.4	2.4	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: MEDICINAL CHEMISTRY I-PRACTICAL (BP406P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Preparation of drugs/ intermediates 1,3-pyrazole 1,3-oxazole Benzimidazole Benztriazole 2,3- diphenyl quinoxaline Benzocaine Phenytoin Phenothiazine Barbiturate Assay of drugs Chlorpromazine Phenobarbitone Atropine Ibuprofen Aspirin Furosemide Determination of Partition coefficient for any two drugs	60	CO1 CO2 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav & Roopal Prakashan, India, 2008

D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.
3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To determine the partition coefficient of some drugs
CO2	Understand and Apply	To carry out the synthesis of drugs
CO3	Understand and Evaluate	To perform the assay of drugs using various analytical methods
CO4	Understand and Apply	To synthesize intermediates using different chemical reaction
CO5	Understand and Apply	To purify synthesized compounds and determine their physical constants

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	1	1	-	1	1	-	3	3	1	2	1	0
CO2	3	1	1	1	1	1	1	1	1	1	3	3	2	3	1	1
CO3	3	1	1	1	1	1	-	1	1	-	3	3	1	1	1	1
CO4	3	1	1	1	1	1	-	1	1	1	3	3	2	2	1	1
CO5	3	1	1	1	1	1	1	1	1	1	3	3	1	2	1	2
Avg	3	1	1	1	1	1	0.4	1	1	0.6	3	3	1.4	2	1	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS-II-PRACTICAL(BP407P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Know basics of the micromeritics, dispersed systems and colloidal dispersions

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Determination of particle size, particle size distribution using sieving method 2. Determination of particle size, particle size distribution using Microscopic method 3. Determination of bulk density, true density and porosity 4. Determine the angle of repose and influence of lubricant on angle of repose 5. Determination of viscosity of liquid using Ostwald's viscometer 6. Determination sedimentation volume with effect of different suspending agent 7. Determination sedimentation volume with effect of different concentration of 8. single suspending agent 9. Determination of viscosity of semisolid by using Brookfield viscometer 10. Determination of reaction rate constant first order. 11. Determination of reaction rate constant second order 12. Accelerated stability studies	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Sen, K. K., Dutta, S. K. A Laboratory Manual of Physical Pharmaceutics. India: PharmaMed Press. 2019.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.
8. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Evaluate	Understand and evaluate basic, derived and flow properties of powders and apply to prepare a stable formulation.
CO2	Understand and Evaluate	Understand and evaluate viscosity of fluids and formulations.
CO3	Remember and Analyse	Remember various type of suspending agent and analyse them to formulate a stable suspension.
CO4	Apply and Analyse	Apply principles of chemical kinetics in determination of rate constants as per the chemical reaction.
CO5	Understand and Analyse	Understand and analyse the shelf life of a formulation by accelerated stability studies.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO2	3	-	1	-	-	-	-	-	1	-	-	3	1	3	-	-
CO3	3	-	1	-	-	-	-	-	1	-	-	3	1	3	-	-
CO4	3	-	2	-	-	-	-	-	1	-	-	3	2	3	-	-
CO5	3	-	2	-	-	-	-	-	1	-	-	3	2	3	-	-
Avg	3	-	1.4	-	-	-	-	-	1.2	-	-	3	1.6	3	-	-

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACOLOGY I-PRACTICAL (B408 P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
--	--	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the various experiments related to special senses and nervous system.
- Appreciate coordinated working pattern of different organs of each system

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. Introduction to experimental pharmacology. 2. Commonly used instruments in experimental pharmacology. 3. Study of common laboratory animals. 4. Maintenance of laboratory animals as per CPCSEA guidelines. 5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anaesthetics and euthanasia used for animal studies. 6. Study of different routes of drugs administration in mice/rats. 7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice. 8. Effect of drugs on ciliary motility of frog oesophagus 9. Effect of drugs on rabbit eye. 10. Effects of skeletal muscle relaxants using rota-rod apparatus. 11. Effect of drugs on locomotor activity using actophotometer. 12. Anticonvulsant effect of drugs by MES and PTZ method. 13. Study of stereotype and anti-catatonic activity of drugs on rats/mice. 14. Study of anxiolytic activity of drugs using rats/mice. 15. Study of local anaesthetics by different methods Microscopic study of epithelial and connective tissue 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.

D. REFERENCE BOOKS

1. Kulkarni, R. S. Index Theorems of Atiyah, Bott, Patodi and Curvature Invariants; Presses De L'université De Montreal: Montreal, 1975.
2. F Hoffmeister; G Stille. Handbook of Experimental Pharmacology. Vol. 55/2, Psychotropic Agents, Part 2, Anxiolytics, Gerontopsychopharmacological Agents, and Psychomotor Stimulants; Springer: Berlin, 1981.
3. Kapadia, S. R.; Chew, D.; Cura, F.; L'allier, P. L.; Roffi, M.; E Murat Tuzcu. Textbook of Interventional Cardiology: A Global Perspective; Jaypee: The Health Sciences Publisher: New Delhi, 2017.
4. Fundamentals of Experimental Pharmacology; Hilton & Company: Kolkata, 2015.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To know about general idea of pharmacology subject, the contents of the subject, the basic instrument used in pharmacology
CO2	Remember, Understand and Apply	To get knowledge about animals used in experimental pharmacology its detail, housing, feeding, dissection etc
CO3	Understand Apply and Evaluate	To understand about the drugs acting on the animals body part and instruments used to check the activity of the animal
CO4	Understand and remember	To know about how diseases are produced in the animals and drug used for those diseases.
CO5	Remember, Understand, Apply and evaluate	To get knowledge about which animals, which instrument and which kind of drug we can used to induce the disease and for treatment of those disease,

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	2	3	2	3	3	3	3	3	3	3	3	3
CO3	3	2	3	3	2	3	2	3	3	1	2	3	3	3	3	3
CO4	3	2	3	3	2	3	2	3	3	1	2	3	3	3	3	3
CO5	3	3	3	3	2	3	3	3	3	2	2	2	3	3	3	2
Avg	3	2.6	3	3	2	3	2.4	3	3	2	2.2	2.8	3	3	3	2.8

B. PHARM. SEMESTER – IV (BPH)**SUBJECT: PHARMACOGNOSY AND PHYTOCHEMISTRY I-PRACTICAL (BP409P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Objectives: Upon completion of the course, the student shall be able

- To know the techniques in the cultivation and production of crude drugs.
- To know the crude drugs, their uses and chemical nature.
- Know the evaluation techniques for the herbal drugs.
- To carry out the microscopic and morphological evaluation of crude drugs.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar 1. (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil. 2. Determination of stomatal number and stomatal index. 3. Determination of vein islet number, vein islet termination and palisade ratio. 4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer. 5. Determination of Fiber length and width 6. Determination of number of starch grains by Lycopodium spore method 7. Determination of Ash value. 8. Determination of Extractive values of crude drugs. 9. Determination of moisture content of crude drugs. 10. Determination of swelling index and foaming index.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Rana, M. & Kabra A., "Practical Manual - Pharmacognosy & Phytochemistry-I" Pee Vee Book, S. Vikas & Company (Medical Publishers), 2019.
2. Dr. Khandelwal, K.R., "Practical Pharmacognosy" 19th edition, Nirali Prakashan, 2008.

D. REFERENCE BOOKS

1. Kabra, A., Dr. Ashok P.K. & Setia, S., A textbook of "Pharmacognosy & Phytochemistry-I", Pee Vee Book, S. Vikas & Company (Medical Publishers), 2019.
2. Deore, S.L., "Pharmacognosy & Phytochemistry-I-A Comprehensive Approach" 2nd edition, Pharma Med. Press, 2019.
3. Ali, M., "Pharmacognosy- Pharmacognosy & Phytochemistry-I", Volume-I CBS Publishers & Distributors PVT. Ltd., 2018.

4. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry" , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
5. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
6. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
7. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
8. Jarald EE. & Jarald SE., "Textbook of Pharmacognosy & Phytochemistry" 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Identify and Analyse	Identify and Analyse unorganised and organized crude drugs by chemical tests.
CO2	Remember, Understand and Evaluate	Evaluation of Crude drug by qualitative and quantitative microscopic method.
CO3	Understand, Evaluate and Analyse	Discuss the evaluation and analyse Physicochemical parameters for crude drugs.
CO4	Understand, Remember and Apply	Describe the principle of different microscopic measurement techniques.
CO5	Apply and Analyse	Explain evaluation of crude drugs.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
CO2	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
CO3	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
CO4	3	3	2	3	-	1	-	1	1	1	3	2	2	3	2	1
CO5	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
Avg	3	3	2	3	-	1.8	-	1	1.8	1	3	2	2	3	2	1

Bachelor of Pharmacy Program

Semester V

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH511	Pharmaceutical Technology – I	100	100	3	3
PH512	Pharmaceutical Microbiology	100	100	2	3
PH513	Medicinal Chemistry – I	100	-	3	-
PH514	Pharmaceutical Analysis – I	100	100	3	3
PH515	Pharmacognosy-III	100	100	3	3
PH516	Pharmacology-III	100	100	3	3
PH517	Pharmaceutical Jurisprudence – I	100	-	2	-
	Total	700	500	19	15

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH511 Pharmaceutical Technology – I

Theory

3 hours/Week

No.	Chapter	Hours
01	Tablet: Definition, Advantages and disadvantages, Introduction to types of tablets, formulation of different types of tablets; excipients, granulation techniques, machinery for large scale granulation and compression, physics of tablet making, In process controls, processing problems and remedies, Evaluation (Pharmacopoeial and nonpharmacopoeial test) and equipments., Brief outline on manufacturing method and evaluation of mouth dissolving tablets, buccal tablets, floating tablets, tablets of colon drug delivery, matrix tablets. Coating Of Tablets: objectives, types of coating, film forming materials, formulations of coating solution, equipments for coating, coating process, evaluation of coated tablets , coating defects, specialized coating processes.	15
02	Capsules Hard Capsules: Definitions, Advantages, disadvantages, Ideal requirements, Production of Hard capsules (Gelatin and nongelatin e.g. vegetable), Capsule storage, size of capsules, formulation and methods of capsule filling, problems and remedies, quality control, climatic control in capsule department, I.P capsules. Soft Gelatin Capsules: Formulation of shell and capsule coat, quality control with special emphasis on current dissolution testing.	12
03	Microcapsules/Microspheres: Importance of microcapsule and microsphere in pharmacy, methods of preparation: Phase separation, coacervation, multistage centrifugal methods, spray congealing, polymerisation, complex emulsion, Air suspension technique, coating pan and other techniques, evaluation of microcapsules, Applications of biodegradable and nonbiodegradable polymers in Microcapsules/Microspheres.	05
04	Semisolid dosage forms: Definition, Advantages and disadvantages, types, mechanisms of drug penetration through skin, factors influencing penetration, semisolid bases, their selection and ideal requirements of bases. General formulation of semisolids, clear gels, suppositories; Manufacturing procedure, evaluation and packaging. I.P. products.	08
05	Suppositories: Ideal requirements, Bases, Manufacturing procedure, Packaging and evaluation.	05

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

Books Recommended

1. The Theory and Practice of Industrial Pharmacy by L Lachman, H Lieberman and J Kanig.
2. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel & others.
3. Pharmaceutics: The Science of Dosage Form Design by Michael E. Aulton Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York.
4. Pharmaceutical Dosage Forms: Disperse systems: Vol.1, Vol. 2 and Vol.3, Ed. By Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
5. Pharmaceutical Dosage Forms: Parenteral Medication: Vol.1, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
6. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes, Marcel Dekker, Inc., New York.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH512 Pharmaceutical Microbiology

Theory

2 hours/Week

No.	Chapter	Hours
01	Introduction to the science of microbiology Ancient theories concerning the origin of life contribution of great scientists to this science	1
02	General microbiology: <ul style="list-style-type: none">– Structure and Bacterial Cell, Classification and taxonomy of Actinomycetes, Bacteria, Spirochetes, Rickettsia and Viruses– Identification: Electron microscopy and Staining Technique– Nutrition, Cultivation and Isolation of Microbes	10
03	Control of microbes: <ul style="list-style-type: none">– Disinfection: Factor affecting Disinfection, Dynamics of Disinfection, Evaluation of Disinfection.– Sterilization: Methods of Sterilization, Validation of Sterilization Methods and Equipment.	10
04	Analytical microbiology: <ul style="list-style-type: none">– Bacterial Counts– Sterility of Pharmaceuticals– Microbiological Assay of Vitamins and Antibiotics and Amino acids	09

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Preparation of Various Media
- Subculturing of Common Bacteria (Aerobic and Anaerobic)
- Staining of Microorganism
- Methods of Isolation
- Study of Sterilization and Their Validation
- Sterility Testing of Pharmaceuticals as per IP
- Bacterial Counts

Books Recommended

1. Textbook of Microbiology by Tortora.
2. Pharmaceutical Microbiology, sixth edn, edited by W. B. Hugo and A. D. Russell Blackwell science.
3. Principles of Microbiology, Ronald M. Atlas. Second edn. W. C. Brown Publishers.
4. Bergeys manual of Systematic Bacteriology, Williams and Wilkins- A Waverly company.
5. Disinfection, Sterilization and Preservation. Fourth edn, Seymour S. Black. Lea and Febiger Philadelphia, London.
6. Industrial Microbiology. Fourth edn, Prescott and Dunn. CBS Publishers and Distributors.
7. Principles of Fermentation Technology. Second edn. P. F. Stanbury, A. Whishaker and S. J. Hall Aditya Books Pvt Ltd. New Delhi.

8. Microbiology, Pelczar/Chan Kreig Tata McGraw Hill edn.
9. Industrial Microbiology L.E. Casida, Jr. New age International Publishers.
10. Fundamental Principles of Bacteriology. A. J. Sale, Tata McGraw Hill Publishing Company Ltd.
11. Fundamentals of Microbiology by Forbischer.
12. Bentleys Text book of Pharamceutics.
13. Dispensing Pharmacy by Cooper and Gunn, Twelfth edn.
14. Remington Pharmaceutical Scicence, Latest edn.
15. Microbiology by Ronald Atlas.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH513 Medicinal Chemistry – I

Theory

3 hours/Week

No.	Chapter	Hours
01	Heterocyclic Compounds: Chemistry, preparations and properties of some important heterocyclics containing 5 and 6 atoms with 1 or 2 hetero atoms like O,N,S and their condensed derivatives (bicyclic only).	17
02	Basic principles of Medicinal Chemistry: Physico-Chemical aspects (Optical, geometrical and bioisosterism) of drug molecules and biological action, Drug-receptor interaction including transduction mechanisms	10
03	Drugs acting on Respiratory tract: Anti-asthmatics, Anti-tussives, Expectorants, Analeptics (Respiratory stimulants)	10
04	Drugs acting on Gastro-intestinal tract: Anti-ulcers and Antacids, Anti-Emetics, Pro-Kinetic agents, Anti-diarrheals, Laxatives	08

Books Recommended

1. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry. Edited by J.N. Delgado and William A. Remers, J.B. Lippincott Company Philadelphia.
2. Principles of Medicinal Chemistry by W.C. Foye, Lea and Febiger Philadelphia.
3. Bergers Medicinal Chemistry – H.E. Wolf, Jhon Wiley and Sons New York Oxford University Press, Oxford.
4. The Organic Chemistry of Drug Synthesis Volume 1-6 by Deniel Lednoger, John Wiley and sons, Inc. New York.
5. Pharmaceutical Substances Synthesis (two parts), patents, applications by A. Kleemann, J.Engel by Thieme Stuttgart New York.
6. Organic Chemistry volume 1 & 2 by I.L. Finar publishers ELBS/Longman London.
7. Principles of Medicinal Chemistry by Dr. S. S. Kadam, K.G. Bothara, Nirali Prakashan Pune.
8. Medicinal and Pharmaceutical Chemistry by Harkishan Singh, V.K.Kapoor, Vallabh Prakashan New Delhi.
9. Fundamentals of Drug Metabolism and Disposition by H.N. Ladu, H. G. Mandal and E.L. Way Williams and Wilkins Co. Baltimore.
10. Vogale's Text Book of Practical Organic Chemistry, ELBS / Longman, London.
11. Practical Organic Chemistry BY Mann and Saunderson. Orient Longman, UK.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH514 Pharmaceutical Analysis – I

Theory

3 hours/Week

No.	Chapter	Hours
01	Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Significance figure, Rules for retaining significant digits, Types of errors, Mean data sets, Selection of sample, Precision and accuracy, Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards. USP parameters for method validation, rejection criteria, Q test.	06
02	Theoretical considerations, principle, instrumentation, and applications in drug analysis and quality control of the following analytical techniques will be discussed: Non-aqueous titrations, Complexometric titrations, Miscellaneous methods of analysis such as: Diazotization titrations, kjeldahl method of nitrogen estimation, Karl -Fisher titration, Oxygen flask combustion, gasometry.	10
03	Acid Base Titrations: Acid base concepts, Role of solvent, Relative strengths of acids and bases, Law of mass action, Common- ion effect, Ionic product of water, pH, hydrolysis of salts, Henderson-Hasselbach equation, Buffer solutions, Buffer capacity, Neutralization curves, Acids-base indicators, Theory of indicators, Choice of indicators, mixed indicators, Polyprotic system, applications in assays.	12
04	Oxidation-Reduction Titrations: Concepts of oxidation and reduction, redox reactions, Strengths and equivalent weights of oxidizing and reducing agents, Theory of redox titrations, redox indicators, cell representations, Measurement of electrode potential, Oxidation-reduction curves, iodimetry and iodometry, Titrations involving Ceric sulphate, potassium iodate, potassium bromate, potassium permanganate and sodium 2,6 dichlorophenol.	07
05	Precipitation titrations: Precipitation reactions, solubility products, effect of acids, temperature and solvent etc. upon the solubility of a precipitate. Argentometric titrations and titrations involving Ammonium or potassium thiocyanate, mercuric nitrate, and barium sulfate indicators, Gay-lussac Method; Mohr's method, Volhard's method and Fajan's method	05
06	Gravimetric analysis: Precipitation techniques, Solubility products; the crucibles state, supersaturation co-precipitation, Post-precipitation, Digestional washing of the precipitate, Filtration, Filter papers and crucibles, Ignition. Applications of gravimetry. Brief introduction of thermogravimetric methods, Thermogravimetric curves	05

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Acid base Titration: Preparation and standardization of acids and bases; some exercises related with determination of acids and bases separately or in mixture form, some official assay procedures e.g. boric acid should also be covered.

2.Oxidation-reduction Titrations: Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate etc., some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, and ceric ammonium sulphate.

3.Precipitation titrations: preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, titrations according to Mohr's, Volhard's and Fajan's methods.

4.Gravimetric analysis: preparation of Gooch crucible for filtration and use of sintered glass crucible, determination of water of hydration, some exercises related to gravimetric analysis should be covered.

5.Non aqueous titration: preparation and standardization of perchloric acid and estimation of some pharmacopoeial products.

6.Complexometric titrations: preparation and standardization of EDTA solution, some exercises related to pharmacopoeial assays by complexometric titrations.

7.Miscellaneous determination: exercises involving diazotization, Karl-Fischer titration..

Books Recommended

1. Pharmaceutical Analysis: Modern Methods, James W. Munson, Marcel Dekker, Inc.
2. Practical Pharmaceutical Chemistry-I, A.H. Beckett and J.B. Stenlake, CBS Publishers.
3. Indian Pharmacopoeia.
4. British Pharmacopoeia.
5. United States Pharmacopoeia.
6. Textbook of quantitative chemical analysis, 6th edition, Pearson publication.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH515 Pharmacognosy – III

Theory

3 hours/Week

No.	Chapter	Hours
01	Extraction and phytochemical screening. Introduction and classification of Extraction. Phytochemical screening of Alkaloids, Glycosides, Tannins, Polyphenols, Phytosterols and Flavonoids in the plant extract by using advanced analytical methods.	07
02	Glycoside containing drugs: Biological sources, cultivation, collection, commercial varieties, diagnostic macroscopic & microscopical features, chemical constituents, uses, substitutes, adulterants, and specific chemical tests. (a) Saponins glycoside: Liquorice, Ginseng, Dioscorea, Sarsaparilla, Senega. (b) Cardiac glycoside: Digitalis, Squill, Strophanthus, Thevetia, Ouabain. (c) Anthraquinone glycoside: Aloe, Senna, Cassia pod, Rhubarb and Cascara. (d) Bitter glycoside: Chirata, Quassia, Kalmegh, Picrorrhiza, Gentian. (e) Coumarine glycoside: Psoralea, Ammi visnaga, Ammi majus. (f) Isothiocynate glycoside: Mustard, Black mustard. (g) Cyanogenetic glycoside: Bitter almond, Linseed. (h) Flavanoids: Ruta graveolens.	28
03	Glycosidal Phytoconstituents: Chemistry, biosynthetic pathway, isolation, estimation and Pharmacological action of Diosgenin, Sennosides, Digoxin, digitoxin, Andrographolides, Glycyrrhithinic acid and Ginsenoside.	06
04	Chromatography: Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs.	04

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Identification of crude drugs mentioned in theory.
- Microscopical study of characters of selected drugs given in the theory in entire and powdered form.
- Chemical evaluation of powdered drugs.
- Laboratory experiments on extraction, isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.

2. Pharmacognosy and pharmacobiotechnology, Ashutosh Kar, New Age International (P) Ltd, Publishers, 2nd edition 2007.
3. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahemedabad, 8th edition, 1990
4. Trease and Evan's Pharmacognosy: W. C. Evans, W.B.Saunders Co., Singapore, 15th Edition, 2008.
5. Text Book Pharmacognosy: T.E. Wallis, CBS Publishers and Distributors Delhi- 5th Edition, Reprint, 1997.
6. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,.
7. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbars, Lea and Febgir Philadelphia, 8th Edition, 1981.
8. Cultivation and Utilization of Aromatic Plants, Handa S.S. and Kaul M.K., Regional Research Laboraotry, Jammu, 1st Edition, 1997.
9. Pharmacognosy of powdered crude drugs: M. A. Iyenger, Manipal Power Press, 1st Edition, 1974.
10. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
11. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
12. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH516 Pharmacology – III

Theory

3 hours/Week

No.	Chapter	Hours
01	Chemotherapy	28
02	Autacoids	05
03	Pathophysiology of various diseases including: <ul style="list-style-type: none">– Infectious diseases: Tuberculosis, urinary tract infection, enteric infections, upper respiratory infections.– Neoplastic Diseases: Acute leukemias, Hodgkin's disease, Prostate cancer, Breast Cancer.	10
04	Gene therapy	02

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Pharmacology of the gastrointestinal tract:
 - a) To study the spasmodic and spasmolytic effect of various drugs on ileum preparation of rat/guinea pig/chicken.
 - b) To find out the unknown drug on ileum preparation of rat/guinea pig/chicken.

Books Recommended

1. Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
 2. Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
 3. Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn. Vallabh Prakashan, New Delhi.
 4. Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
 5. Rang h.P., dale M.M., et al-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
 6. Satoskar R.S., et al-Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.
 7. Harvel, R.A., Champe P.C. et al –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
 8. Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.
 9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn. Pergamon Press, Singapore.
- Seth, S.D. text Book of pharmacology, B.I. Churchill, 1997.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH517 Pharmaceutical Jurisprudence – I

Theory

2 hours/Week

No.	Chapter	Hours
01	Introduction to a. Pharmaceutical Legislation- A brief review b. Drug and Pharmaceuticals Industry – A brief review c. Pharmaceutical Education – A brief review	3
02	An elaborate (practical oriented) study of the following: a. Pharmaceutical Ethics b. Pharmacy Act-1948 c. Medicinal and Toilet preparations (Excise Duties) Act- 1955	12
03	A brief study of the following with special references to the main provisions: a. Drugs and Magic Remedies (Objectionable Advertisements) Act-1954 b. Medical Termination of Pregnancy Act-1970 and Rules-1975 c. Prevention of Cruelty to Animals Act-1960 d. States Sops and Establishment Act and Rules e. Insecticides Act-1968 f. AICTE Act-1987	15

Books Recommended

1. A Text Book of Forensic Pharmacy by B. M. Mithal, 8th edition.
2. A Text Book of Forensic Pharmacy by N. K. Jain, Vallabh Prakashan
3. The Patent Act-1970 with Patens Rules –1972
4. The Narcotic and Psychotropic Substances Act-1985 with the prevention of illicit traffic in narcotic drugs and psychotropic substances act-1988 along with allied rules and orders-1993.
5. The Medical Termination of Pregnancy Act-1971, along with the medical termination of pregnancy rules-1975
6. Insecticides Act-1963 to gather with insecticide rule 1971 and insecticide (Price, Stock, Display and Submission of reports) order-1986 along with selected notifications (5th edition, 1998)
7. The Drugs (Price Control) Order-1987 along with new drug policy-1994 and drugs (Price Control) order-1995
8. The Opium Act-1857 with opium act-1878 and opium and revenue laws act-1950
9. The Standards of Weight and Measures Act-1976
10. The Pharmacy Act-1998

Bachelor of Pharmacy Program

Semester VI

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH611	Pharmaceutical Technology – II	100	100	3	3
PH612	Pharmaceutical Biotechnology	100	-	2	-
PH613	Medicinal Chemistry – II	100	100	3	3
PH614	Pharmaceutical Analysis – II	100	100	3	3
PH615	Pharmacognosy-IV	100	100	3	3
PH616	Pharmacology & Pathophysiology-I	100	100	3	3
PH617	Pharmaceutical Jurisprudence – II	100	-	2	-
	Total	700	500	19	15

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH611 Pharmaceutical Technology – II

Theory

3 hours/Week

No.	Chapter	Hours
01	Sterile dosage forms: Definitions, Advantages, Disadvantages, Ideal requirements and Formulation of sterile dosage forms, Water for injection-Preparation and quality control, Design and requirements for production area- Aseptic techniques, sources of contamination and methods of prevention, design of aseptic area, laminar flow benches, services and maintenance, containers and closures, methods of filling including form fill and seal technology. Evaluation of sterile dosage forms, Parenteral suspensions, Prefilled syringes, Parenteral nutrients, Freeze dried products, Nanosuspensions etc, I.P. Products. Ophthalmic preparations: Requirements, formulations, methods of preparations, containers and evaluation. I.P. Products.	12
02	Liquid dosage forms: Introduction, advantages and disadvantages, types of additives used vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors, etc; manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions (including microemulsion and multiple emulsion) and brief outline of other liquid products such as extracts, tincture, infusion etc., I.P. Products.	09
03	Cosmeticology and cosmetic preparations Fundamentals of cosmetic science, structure and functions of skin and hair, formulation, preparation and packaging of cosmetics for skin - Sunscreen, moisturizers, cold cream, and vanishing cream, hair - Shampoo and conditioners, dentifrice- powders, gels, paste and manicure preparations like- nail polish, lipsticks, eye lashes, brief introduction to cosmaceuticals, baby care products, shaving cream, hygienic products	10
04	Pharmaceutical aerosols: Definition, propellants, general formulation of aerosols, containers, manufacturing (cold filling and pressure filling technique) and packaging methods, pharmaceutical applications, evaluation of aerosol.	07
05	Good Manufacturing Practice for Pharmaceuticals and validation Brief Introduction to GMP (schedule M) and quality assurance, practice of GMP Procedure (SOPs), Building, Equipment, Personnel, Components, Documentation, Containers, Labeling, Laboratory Control, Distribution Records, Recovery & Reprocessing. Introduction to validation, validation of selective unit operations (e.g. granulation, compression) used in tablet manufacturing and steam sterilizer.	07

Practical

3 hours/Week

To illustrate the topics included under theory

Books Recommended

1. The Theory and Practice of Industrial Pharmacy by L Lachman, H Lieberman and J Kanig.
2. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel & others.
3. Pharmaceutics: The Science of Dosage Form Design by Michael E. Aulton Gennaro, Alfonso R., Remington: The Science and Practice of Pharmacy, Vol-I & II, Lippincott Williams & Wilkins, New York.
4. Pharmaceutical Dosage Forms: Disperse systems: Vol.1, Vol. 2 and Vol.3, Ed. By Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
5. Pharmaceutical Dosage Forms: Parenteral Medication: Vol.1, Vol. 2 and Vol.3, Ed. by Lieberman, Leon Lachman and Joseph B. Schwartz, Marcel Dekker Inc., New York.
6. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes, Marcel Dekker, Inc., New York.
7. Cosmetics by Poucher

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH612 Pharmaceutical Biotechnology

Theory

2 hours/Week

No.	Chapter	Hours
01	Introduction to biotechnology	01
02	Microbial genetics and variation	04
03	Genetic recombination: transformation conjugation Protoplast fusion, gene cloning and their applications, monoclonal antibodies b. Study of drug produced by biotechnology, viz. activase, humulin, Hb tec.	06
04	Immunology and Immunological Preparation: a. Immunity, primary and secondary defense mechanism, interferon b. Principles of immunology, antigen antibody reactions and application, preparations of vaccines, toxoids. Standardization and storage	08
05	Fermentation Techniques: a. Screening of organism, preparation and preservation of master culture, design of fermentor, various parameters and media used for fermentation b. Recovery of fermentation products Flowsheets penicillin, streptomycin, Vit. B2, Vit. B12	08
06	Immobilization of Enzymes: a. Techniques of immobilization b. Factors affecting enzyme kinetics c. Applications	03

Books Recommended

1. Textbook of Microbiology by Tortora.
2. Pharmaceutical Microbiology, sixth edn, edited by W. B. Hugo and A. D. Rusell Blackwell science.
3. Principles of Microbiology, Ronald M. Atlas. Second edn. W. C. Brown Publishers.
4. Bergeys manual of Systematic Bacteriology, Williams and Wilkins- A Waverly company.
5. Disinfection, Sterilization and Preservation. Fourth edn, Symour S. Black. Lea and Febiger Philadelphia, London.
6. Industrial Microbiology. Fourth edn, Prescott and Dunn. CBS Publishers and Distributors.
7. Principles of Fermentation Tehchnology. Second edn. P. F. Stanbury, A. Whiteshaker and S. J. Hall Aditya Books Pvt Ltd. New Delhi.
8. Microbiology, Pelczar/Chan Kreig Tata McGraw Hill edn.
9. Industrial Microbiology L.E. Casida, Jr. New age International Publishers.
10. Fundamental Principles of Bacteriology. A. J. Sale, Tata McGraw Hill Publishing Company Ltd.
11. Fundamentals of Microbiology by Forbischer.

12. Bentley's Text book of Pharmaceutics.
13. Dispensing Pharmacy by Cooper and Gunn, Twelfth edn.
14. Remington Pharmaceutical Science, Latest edn.
15. Microbiology by Ronald Atlas.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH613 Medicinal Chemistry – II

Theory

3 hours/Week

No.	Chapter	Hours
01	Drugs acting on Autonomic Nervous System: Cholinergics, Anti-cholinergics and Anti-cholinesterases, Adrenergics, Sympatholytics, Neuro-muscular junction blocking agents	10
02	Drugs acting on Central Nervous System: General Anesthetics, Local Anesthetics, Hypnotics & Sedatives, Opioid analgesics, anti-convulsants, Antiparkinsonism drugs, CNS stimulants Psycho-pharmacological agents (neuroleptics, anti-depressants, anxiolytics).	22
03	Drugs acting on Autocoids: Eicosanoids and their Synthesis, inhibitors, NSAID'S., Anti-Allergic drugs (H1-receptor antagonists)	06
04	Diagnostic agents.	03
05	Pharmaceutical aids	04

Practical

3 hours/Week

Qualitative analysis of Binary Organic mixture and Synthesis of Compounds

Books Recommended

1. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry. Edited by J.N. Delgado and William A. Remers, J.B. Lippincott Company Philadelphia.
2. Principles of Medicinal Chemistry by W.C. Foye, Lea and Febiger Philadelphia.
3. Bergers Medicinal Chemistry – H.E. Wolf, John Wiley and Sons New York Oxford University Press, Oxford.
4. The Organic Chemistry of Drug Synthesis Volume 1-6 by Daniel Lednicher, John Wiley and Sons, Inc. New York.
5. Pharmaceutical Substances Synthesis (two parts), patents, applications by A. Kleemann, J. Engel by Thieme Stuttgart New York.
6. Organic Chemistry volume 1 & 2 by I.L. Finar publishers ELBS/Longman London.
7. Principles of Medicinal Chemistry by Dr. S. S. Kadam, K.G. Bothara, Nirali Prakashan Pune.
8. Medicinal and Pharmaceutical Chemistry by Harkishan Singh, V.K. Kapoor, Vallabh Prakashan New Delhi.
9. Fundamentals of Drug Metabolism and Disposition by H.N. Ladu, H. G. Mandal and E.L. Way Williams and Wilkins Co. Baltimore.
10. Vogale's Text Book of Practical Organic Chemistry, ELBS / Longman, London.
11. Practical Organic Chemistry BY Mann and Saunders. Orient Longman, UK.
12. The Systematic Identification of Organic Compounds by Shriner, Hermann, Morrill, Curtin & Fuson, John Wiley and Sons, USA.
13. An Introduction to the Chemistry of heterocyclic Compounds by R.M. Acheson Wiley Eastern Ltd. New Delhi.
14. Spectrometric identification Of Organic Compounds by R. M. Silverstein, G. Clayton Bassel's. T.C. Mivvill. John Wiley & Sons, USA.
15. Organic spectroscopy by William Kemp. ELBS, London.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH614 Pharmaceutical Analysis – II

Theory

3 hours/Week

No.	Chapter	Hours
01	Extraction procedure including separation of drugs from excipients by single extraction, multiple extraction, counter current distribution, batch extraction, continuous extraction, solid-liquid and liquid-liquid extraction	05
02	Classification, principle, theories and parameters of chromatography.	06
03	Chromatographic techniques: TLC, HPTLC, Paper chromatography and column Chromatography	06
04	Principle, Instrumentation, calibration and applications of following electro analytical techniques: pHmetry [2], Potentiometry [3], Conductometry [3], Calorimetry [3], Polarography [4], Amperometry and Biamperometry [2] Polarimetry [3].	20
05	Radiochemical techniques: Radiochemical Laboratories, Instrumentation. Radiochemical methods of analysis	08

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Practicals involving electro analytical methods like pHmetry, Potentiometry, Conductometry.
2. Practicals involving chromatographic techniques like TLC and paper chromatography.
3. Extraction techniques.

Books Recommended

- 1.Principles of Instrumental Analysis - Skoog, Holler, Nieman, Saunders College Publishing.
- 2.Textbook of Pharmaceutical Analysis - Kenneth A. Connors,, John Wiley & Sons.
- 3.Instrumental Methods of Chemical Analysis - Galin W. Ewing, McGraw Hill International Editions.
- 4.Principles of Instrumental Analysis - Skoog, Leary, 4th Ed., Saunders college Publishing.
- 5.Instrumental Methods of Analysis - Willard, Merritt, Dean, Settle, CBS Publishers.
- 6.Textbook of quantitative chemical analysis, 6th edition, Pearson publication.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH615 Pharmacognosy – IV

Theory

3 hours/Week

No.	Chapter	Hours
01	Pharmacognostical study of following alkaloid containing crude drugs: (a) Pyridine piperidine: Tobacco, Areca and Lobelia. (b) Tropane: Belladonna, Hyoscyamus, Datura, Duboisia, Coca. (c) Isoquinoline: Ipecac, Opium. (d) Quinoline: Cinchona, Camptotheca. (e) Indol: Ergot, Rauwolfia, Catharanthus, Nux-vomica and Physostigma. (f) Imidazole: Pilocarpus. (g) Steroidal: Kurchi, Veratrum and Ashwagandha. (h) Alkaloidal amine: Ephedra, Colchicum. (i) Glycoalkaloid: Solanum. (j) Purines: Coffee, Tea and Cola. (k) Quinazoline: Vasaka.	27
02	Alkaloidal Phyto-constituents: Chemistry, biosynthetic pathways, Isolation, Estimation and pharmacological action of Atropine, Scopolamine, Morphine, Papaverine, Ephedrine, Reserpine, Caffeine, Ergotamine and Quinine.	10
03	Chemotaxonomy of medicinal plants.	05
04	Herbs as health food.	03

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- Identification of crude drugs mentioned in theory.
- Microscopical study of characters of selected drugs given in the theory in entire and powdered form.
- Chemical evaluation of powdered drugs.
- Laboratory experiments on extraction, isolation, separation, purification of various groups of chemical constituents of pharmaceutical significance.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.
2. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahmedabad, 8th edition, 1990
3. Trease and Evan's Pharmacognosy: W. C. Evans, W.B.Saunders Co., Singapore, 15th Edition, 2008.
4. Text Book Pharmacognosy: T.E. Wallis, CBS Publishers and Distributors Delhi- 5th Edition, Reprint, 1997.

5. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,
6. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbers, Lea and Febgir Philadelphia, 8th Edition, 1981.
7. Cultivation and Utilization of Aromatic Plants, Handa S.S. and Kaul M.K., Regional Research Laboraotry, Jammu, 1st Edition, 1997.
8. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
9. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhanand Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
10. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar.
11. Textbook of Industrial Pharmacognosy, By A.N. Kalia, CBS Publishers & Distributors.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH616 Pharmacology and Pathophysiology – I

Theory

3 hours/Week

No.	Chapter	Hours
01	Pathophysiology: <ul style="list-style-type: none">– Cell injury and repair mechanism– Inflammation– Healing– Apoptosis & Necrosis.	20
02	Pathophysiology of various diseases including: <ul style="list-style-type: none">– Respiratory disease: Asthma, COPD.– Gastrointestinal disorders: Peptic Ulcer, Ulcerative Colitis, Hepatitis, Cirrhosis	13
03	Drug acting on respiratory system: <ul style="list-style-type: none">– Antiasthmatic drugs including bronchodilators– Antitussive and expectorants– Respiratory stimulants	06
04	Drug acting on gastrointestinal tract: <ul style="list-style-type: none">– Antacid anti-secretory and anti-ulcer drugs– Laxatives and anti-diarrheal drug– Appetite stimulant and suppressant– Emetics and anti-emetics– Miscellaneous agents	06

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

- To study the anti-secretory and anti-ulcer activity using pylorus ligated rats.
- To estimate the strength of test sample of agonist/drug (e.g. Acetylcholine, Histamine, 5-HT & Oxytocin etc.) using a suitable muscle preparation of employing Matching bioassay, End Point bioassay, Graphical bio-assay, three point & Four point methods of Bioassay

Books Recommended

- Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
- Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
- Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn. Vallabh Prakashan, New Delhi.
- Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
- Rang h.P., dale M.M., et al-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
- Satoskar R.S., et al-Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.

7. Harvel, R.A., Champe P.C. etal –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
 8. Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.
 9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn. Pergamon Press, Singapore.
- Seth,S.D. text Book of pharmacology,B.I.Churchill,1997.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH617 Pharmaceutical Jurisprudence – II

Theory

2 hours/Week

No.	Chapter	Hours
01	An elaborate (practical oriented) study of the following: a. Drugs and Cosmetics Act-1940 and Rules –1945 b. Narcotic Drugs and Psychotropic Substances Act-1985 and rules c. Drug Price Control Order.	18
02	A brief study of the following with special references to the main provisions: a. Factories Act-1948 b. Minimum Wages Act-1948 c. Patents Act d. Trade and Merchandise Act e. Industrial Regulation Act (Pollution) f. I. Poisons Act-1919	12

Books Recommended

1. A Text Book of Forensic Pharmacy by B. M. Mithal, 8th edition.
2. A Text Book of Forensic Pharmacy by N. K. Jain, Vallabh Prakashan
3. The Patent Act-1970 with Patens Rules –1972
4. The Narcotic and Psychotropic Substances Act-1985 with the prevention of illicit traffic in narcotic drugs and psychotropic substances act-1988 along with allied rules and orders-1993.
5. The Medical Termination of Pregnancy Act-1971, along with the medical termination of pregnancy rules-1975
6. Insecticides Act-1963 to gather with insecticide rule 1971 and insecticide (Price, Stock, Display and Submission of reports) order-1986 along with selected notifications (5th edition, 1998)
7. The Drugs (Price Control) Order-1987 along with new drug policy-1994 and drugs (Price Control) order-1995
8. The Opium Act-1857 with opium act-1878 and opium and revenue laws act-1950
9. The Standards of Weight and Measures Act-1976
10. The Pharmacy Act-1998

Bachelor of Pharmacy Program

Semester VII

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH711	Dosage Form Design	100	100	3	3
PH712	Medicinal Chemistry – III	100	100	3	3
PH713	Pharmaceutical Analysis – III	100	100	3	3
PH714	Pharmacognosy-V	100	100	3	3
PH715	Pharmacology & Pathophysiology-II	100	100	3	3
PH716	Pharmaceutical Management	100	-	2	-
	Total	600	500	17	15

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH711 Dosage Form Design

Theory

3 hours/Week

No.	Chapter	Hours
01	Preformulation studies: a) Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability. b) Study of chemical properties of drugs like hydrolysis, oxidation, reduction, polymorphisms, racemization, polymerization etc., and their influence on formulation and stability of products. c) Study of prodrugs in solving problems related to stability, bioavailability and elegance of formulations.	11
02	Pharmaceutical necessities: Effect of following adjuvants on formulation of different pharmaceutical products: Antioxidants, preservatives, colours, flavours, diluents, binders, disintegrants, antifirctional agents, emulsifiers, suspending agents, ointment bases, solvents etc. and other formulation additives.	6
03	Stability of pharmaceuticals: a) Kinetic principles and stability testing: Reaction rate and order, acid base catalysis, decomposition reactions and stabilization of pharmaceuticals. b) Stability of formulation, factors affecting formulation stability, MKT, climatic zones, matrixing and bracketing instability study, accelerated stability testing, real time stability. Current WHO, USFDA and stability testing as per ICH guidelines for pharmaceutical drug substances and drug products. c) Product stability: Requirements, shelf-life, overages, containers, closures. d) Overage calculations	8
04	Controlled and sustained release dosage forms Design of oral sustained release systems: Biological factors, Physicochemical factors Diffusional systems: - Reservoir system, Lag time, Burst effect, Matrix system, Effect of porosity and tortuosity Dissolution controlled system, Cube root dissolution equation, Diffusion layer controlled dissolution. Bioerodible and Combination of diffusion and dissolution systems. Design, development and evaluation of oral and parenteral controlled release formulations.	8
05	Novel drug delivery system (a) Modified drug delivery systems: Fundamentals, rationale of modified release drug delivery, factors influencing the design and performance, pharmacokinetic and pharmacodynamic basis for modified drug delivery systems, estimation of loading and maintenance dose. (b) Design and development of oral modified release dosage forms:	22

	<p>Matrix tablets, microspheres, hydrogels, osmotic pressure controlled systems, gastro retentive systems, colon targeting.</p> <p>(c) Fabrication of parenteral drug delivery systems: Parenteral emulsions & parenteral suspensions, microspheres, liposomes, niosomes, nanoparticles.</p> <p>(d) Formulation and evaluation of Transdermal drug delivery systems.</p> <p>(e) A brief study of site specific and targeted drug delivery systems, transmucosal and ocular drug delivery systems.</p>	
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Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

Books Recommended

1. The Theory & Practice of industrial pharmacy by Leon Lachmen et al., Lea & Febiger, Philadelphia.
2. Remington's Pharmaceutical Sciences, ed. A.R. Gennaro, Mack Publishing Co.
3. Modern Pharmaceutics ed. G.S. Banker & C.T. Rhodes, Marcel Dekker Inc. N.Y.
4. Pharmaceutical dosage forms: Tablets, Parenterals, Disperse systems. Vol.: 1,2,3 Leon, Lachman. Et.al.
5. Pharmaceutics: The science of dosage form design. M.E. Aulton. ELBS/Churchill Livingstone.
6. Drug Stability, T. Carstensen, Marcel Dekker Inc. N.Y.
7. Physical Pharmacy, A.N. Martin et al, K.M. Verghese & Co.
8. Pharmacokinetics, Gibaldi & D. Perrier Marcel Dekker Inc., N.Y.
9. Pharmaceutical calculation, N.J. Stoklosa, Lea & Febiger, Philadelphia.
10. Pharmaceutical Statistics, Sanford Bolton. Marcel Dekker Inc.
11. Novel drug delivery systems: Fundamentals & Developmental concepts. Y.W. Chien, Marcel Dekker Inc.
12. Biopharmaceutics & Pharmacokinetics - an introduction. R.E. Notary, Marcel Dekker Inc., N.Y.
13. Controlled drug Delivery, Fundamentals and applications, J.R. Robinson & Lee, Marcel Dekker Inc.
14. Handbook of Pharmaceutical Excipients" By James C. Boylan, Pub., American Pharmaceutical Association & The Pharmaceutical Society of Great Britain.
15. Pharmaceutical Dissolution testing, Umesh V. Bankar, Marcel Dekker Inc.

DHARMSINH DESAI UNIVERSITY

BACHELOR OF PHARMACY

PH712 Medicinal Chemistry – III

Theory

3 hours/Week

No.	Chapter	Hours
01	Drug Metabolism - Various processes of drug metabolism and its importance in drug design with specific examples and concepts in prodrugs	07
02	Drug design - Introduction various approaches for lead optimization, physicochemical parameters used in QSAR and different methods of QSAR. Introduction to Molecular modeling	06
03	Synthetic procedures of official drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs: A. Anti-hypertensives (03) B. Anti-arrythmic agents (03) C. Anti-anginal agents (02) D. Anti-hyperlipaemic agents (02) E. Cardiotonics (02) F. Anti-coagulants, Anti-Platelets and Anti-thrombolytic agents (03) G. Diuretics (03)	18
04	Thyroid and Antithyroid drugs	04
05	Insulin and hypoglycemic agents.	05
06	Steroid hormones: Detailed study of sex hormones and adrenal cortex hormones including synthetic substitutes, SAR in synthetic substitutes.	05

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Selected drug synthesis from the course content.
2. Special analysis of the drug synthesized.
3. Organic spotting of binary mixtures with derivative preparation and TLC.
4. Establishing the Pharmacopoeial standards of the drugs synthesized.

Books Recommended

1. J.N.Delagado and W.A.R. Remers, Eds, Wilson and Giswild's Text book of Organic, Medicinal and Pharmaceutical Chemistry, J.Lipincott., Philadelphia.
2. H.E.Wolf,Ed., Burger's Medicinal Chemistry, John Wiley & Sons, New York.
4. B.N.Ladu, H.G.Mandel & E.L.Way, Fundamentals of Drug Metabolism & Disposition, William & Wilkins Co., Baltimore.
5. Popst and Perrum, "Computer Aided Drug Design", Acedemic Press, New York.
6. C.Hanch, Compresive Medicinal, Vol:IV, Quantitive Drug Design, Pregamon Peress, Oxford.
7. Y.C.Martin, Quatitative Drug Design - A Critical Introduction (Medicinal Research Monograph, Vol:8). Marcel Dekker.Inc., New York.

8. Exploring QSAR: Vol:I, Fundamentals and Applications in Chemistry and Biology by C.Hansch and A.Leo. and Vol:II, Hydrophobic, Electronic and Steric constants by C.Hansch, A.Leo. and D.Hockman.
9. P.C.Jurs, Computer Software Application in Chemistry, John Wiley & Sons, New York.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH713 Pharmaceutical Analysis – III

Theory

3 hours/Week

No.	Chapter	Hours
01	Ultraviolet and Visible Spectrophotometry: Electromagnetic Radiation (EMR), properties of EMR, Mechanism of Absorption of EMR by molecules, Factors affecting absorption position and absorption intensity, Laws of photochemistry, Deviations from Beer's Law, Instrumentation (components and their general working principles), single beam and double beam instruments, sample handling, selection of wavelength and band width, Applications (direct methods, indirect methods, analysis of mixtures)	13
02	Fluorimetry: Origin of fluorescence and phosphorescence, Factors affecting fluorescence intensity, Relationship of fluorescence and phosphorescence to molecular structure, Instrumentation (components and their general working principles), Applications	06
03	Infrared Spectrophotometry Origin of an I.R. spectrum, Instrumentation (components and their general working principles), Sample handling, A brief introduction to Fourier transform infrared spectroscopy (FTIR), Applications, Analytical shortcomings	10
04	Nuclear Magnetic Resonance Spectroscopy: Magnetic properties of the nucleus, Origin of NMR spectrum, Chemical shift, Coupling, Factors affecting chemical shift and coupling, Instrumentation (CW and FTNMR), Brief introduction to ¹³ CNMR	08
05	Mass Spectrometry Origin of mass spectra, Fragmentation rules, Recognition of molecular ion peak, Instrumentation, Applications	08

Practical

3 hours/Week

To illustrate the topics included under theory

Quantitative estimation and general tests of formulations containing single drug, using instrumental techniques based on theory.

Books Recommended

1. Principles of Instrumental Analysis - Skoog, Holler, Nieman, 5th Ed. Saunders College Publishing.
2. A Textbook of Pharmaceutical Analysis - Kenneth A. Connors, 3rd Ed., John Wiley & Sons.
3. Instrumental Methods of Chemical Analysis - Galin W. Ewing, 5th Ed., McGraw Hill International Editions.
4. Principles of Instrumental Analysis - Skoog, Leary, 4th Ed., Saunders college Publishing
5. Instrumental Methods of Analysis - Willard, Merritt, Dean, Settle, CBS Publishers 7th Ed.
6. Spectrometric Identification of Organic compounds-Silverstein, Morrill, 5th Ed., John Wiley & Sons, Inc.

7. Pharmaceutical Analysis: Modern Methods, James W. Munson, Marcel Dekker, Inc.
8. Practical Pharmaceutical Chemistry-I & II, A.H. Beckett and J.B. Stenlake, 4th Ed. CBS Publishers.
9. Indian Pharmacopoeia.
10. British Pharmacopoeia.
11. United States Pharmacopoeia.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH714 Pharmacognosy-V

Theory

3 hours/Week

No.	Chapter	Hours
01	Plant Tissue Culture Techniques & its Application in Pharmacy : Introduction and types of PTC. Equipment and facilities require for PTC. Media composition. Immobilized cell techniques, Micropropagation, protoplast, static, suspension, hairy root cultures and some other new techniques in PTC. Biotransformation studies including recent developments in production of biological active constituents in PTC.	09
02	Marine Pharmacognosy, novel medicinal agents from marine sources.	05
03	Role of medicinal plant and aromatic plants in national economy.	01
04	Chemical and spectral approaches to simple molecules of natural origin.	03
05	Concept of stereoisomerism taking examples of Natural Products such as Sennoside, hyoscyamine, citral, menthol, quinine, ephedrine & papaverine.	03
06	Terpenoids: Chemistry, Biogenesis and Pharmacological activity of Geraniol, Menthone, Carvone, Pinene, Abietic acid, β -amyrin, Oleanolic acid, Vitamin – A.	08
07	Traditional drugs: Common vernacular names, botanical sources, morphology, microscopy, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs: Entire herb: Punarnava, Apamarg, Brahmi, Shankhapusphi, Kantakari. Root & Rhizomes: Satavari, Majith, Chitrak, Vaj, Rasna, Nagarmotha Bark: Arjuna , Ashoka. Flower: Palash. Unorganised drugs: Guggal, Shilajit.	16

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Identification of crude drugs mentioned in theory.
2. Microscopical study of characters of selected drugs given in the theory in entire and powdered form.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.

2. Pharmacognosy and pharmacobiotechnology, Ashutosh Kar, New Age International (P) Ltd, Publishers, 2nd edition 2007.
3. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahmedabad, 8th edition, 1990
4. Trease and Evan's Pharmacognosy: W. C. Evans, W.B.Saunders Co., Singapore, 15th Edition, 2008.
5. Text Book Pharmacognosy: T.E. Wallis, CBS Publishers and Distributors Delhi- 5th Edition, Reprint, 1997.
6. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,.
7. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbars, Lea and Febgir Philadelphia, 8th Edition, 1981.
8. Cultivation and Utilization of Aromatic Plants, Handa S.S. and Kaul M.K., Regional Research Laboraotry, Jammu, 1st Edition, 1997.
9. Pharmacognosy of powdered crude drugs: M. A. Iyenger, Manipal Power Press, 1st Edition, 1974.
10. Mukherji P. K., Quality Control of Herbal Drugs, Business Horizon Pharma. Publishers, 1st Edition, 2002.
11. Herbal drug technology, S. S. Agrawal and M. Paridhavi, Univeristies Press, 1st Edition, 2007.
12. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
13. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
14. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH715 Pharmacology & Pathophysiology-II

Theory

3 hours/Week

No.	Chapter	Hours
01	Pathophysiology of various diseases including: <ul style="list-style-type: none"> • CNS disorders: Epilepsy, Parkinsonism, Schizophrenia, Depression • Joint and connective tissue disorders: Rheumatoid arthritis, Gout and Hyperuricemia • Renal disorders: Acute Renal Failure & Chronic Renal Failure • Haematopoietic disorders: Anemia • Endocrine: Diabetes mellitus and thyroid disorders 	15
02	Central Nervous system: <ul style="list-style-type: none"> • Neurohumoral transmission in the C.N.S • General anesthetics • Alcohols and disulfiram • Sedatives, hypnotics & anxiolytics agents • Antiepileptic drugs • Anti-parkinsonian drugs • Psychopharmacological agents (Antipsychotic, antidepressants, antimaniacs and hallucinogens) • Opioid analgesics • Non- opioid analgesics • C.N.S stimulants • Drug addiction and drug abuse • Drug used in Alzheimer's disease • Drug used in migraine 	26
03	Immunopharmacology	04

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Experiments on CNS:

- a) Spontaneous motor activity
- b) Analgesic activity
- c) Anti-convulsant activity
- d) Anti-parkinsonism activity
- e) CNS stimulant and CNS depressant activity
- f) Sedative and hypnotics activity
- g) Anti-inflammatory activity
- h) Muscle relaxant activity of drugs using simple experiments.

2. Experiments on clinical pharmacy:

- a) To audit given prescription for format of prescription, essentiality and rationality and suggest carry home message (three experiments containing three prescriptions each, in totality nine prescriptions, covering various diseases or organ-systems).

- b) To evaluate formulations on anemia, diarrhoea and cough for their essentiality and rationality and also provide carry home message.
- c) To suggest appropriate parenteral nutrition for hospitalized patients after proper nutritional assessments in different conditions, and enlist importance of medications necessary in a pharmacy for Intensive Care Unit management.
- d) To evaluate drug-drug interactions for the type of drug interaction, the mechanism responsible for drug interactions, possible outcomes or clinical manifestations of interaction and suggestion corrective measure to overcome or prevent the drug interaction.
- e) To evaluate case for Interpretation of laboratory data.
- f) To evaluate case involving skills of pharmacist for patient counseling.
- g) To evaluate case for dose adjustment in geriatrics, pediatrics and pregnant women.
- h) To evaluate case for Therapeutic Drug Monitoring (TDM).

Books Recommended

1. Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
2. Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
3. Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn. Vallabh Prakashan, New Delhi.
4. Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
5. Rang h.P., dale M.M., et al-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
6. Satoskar R.S., et al-Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.
7. Harvel, R.A., Champe P.C. et al –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
8. Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.
9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn. Pergamon Press, Singapore.
10. Seth, S.D. text Book of pharmacology, B.I. Churchill, 1997.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH716 Pharmaceutical Management

Theory

2 hours/Week

No.	Chapter	Hours
01	Concept of Management: Administrative Management (Planning, Organizing, Staffing, Directing and Controlling), entrepreneurship development, Principles of Management (Co-ordination, Communication, Motivation, Decision-making, leadership, Innovation, Creativity, Delegation of Authority/Responsibility, Record Keeping). Identification of key points to give maximum thrust for development and perfection, total quality management (TQM).	05
02	Accountancy : Principles of Accountancy, Brief introduction to Ledger, book entries, Trial balance, Cash book, Bank reconciliation statement, Profits and loss account, Balance sheet.	03
03	Economics: Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves.	02
04	Pharmaceutical Marketing: Functions buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.	04
05	Salesmanship: Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing.	02
06	Market Research: Recruitment, training, evaluation, compensation to the pharmacist , Pre-requisition: Basic information services.	02
07	Materials Management: A brief exposure of the basic principles of Materials. Management Purchase, stores and inventory control (Eligibility, Efficiency Evaluation, Recruitment Methodology, Service Conditions, Termination Performance Evaluation, etc.).	06
08	Production Management: A brief exposure of the different aspects of Production Management Visible and Invisible inputs, Methodology of Activities, Performance Evaluation Technique, Process-Flow, Process Know-how, Maintenance Management.	06

Books Recommended

1. J.A. Stoner, R.E. Freeman & D.R. Gilbert "Management" Prentice Hall, New Delhi.
2. P. Kotler, "Marketing Management analysis, planning, implementation & control, Prentice hall. New Delhi,

3. H.A. Smith, "Principles and Method of Pharmacy Management", Lea & Febiger, Philadelphia,
4. P. Gopalkrishnan and M. Sundaresan, "Material management: An integrated approach", Prentice hall, New Delhi.
5. C.B. Mannoria, "Personal management", Himalaya publishing house, Bombay, Latest edition.
6. L. Lachman, H.A. Liberman and J.L. Kanic, "Theory & practice of Industrial Pharmacy", Lea & Febiger, U.S.A.
7. P. Kotler, "Principles of marketing" Prentice Hall, New Delhi.

Bachelor of Pharmacy Program

Semester VIII

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH811	Biopharmaceutics & Pharmacokinetics	100	100	3	3
PH812	Medicinal Chemistry – IV	100	100	3	3
PH813	Pharmaceutical Analysis – IV	100	100	3	3
PH814	Pharmacognosy-VI	100	100	3	3
PH815	Clinical Pharmacy	100	-	3	-
PH816	Elective	-	100	-	3
	Total	500	500	15	15

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH811 Biopharmaceutics & Pharmacokinetics

Theory

3 hours/Week

No.	Chapter	Hours
01	Introduction to Biopharmaceutics and pharmacokinetics and their role in formulation development and clinical setting	02
02	Biopharmaceutics: a) Introduction to biopharmaceutics and its role in formulation development. b) Passage of drugs across biological barriers (passive diffusion, active transport, facilitated diffusion and pinocytosis). c) Factors influencing absorption- physiochemical, physiological and pharmaceutical. d) Drug distribution in the body, plasma protein binding and drug excretion.	15
03	Pharmacokinetics (a) Definition and scope, significance of plasma drug concentration measurement. (b) Compartment model: Pharmacokinetics of drug absorption Zero order and first order absorption rate constant using Wagner- Nelson and Loo-Riegelman method. (c) Volume of distribution and distribution coefficient. (d) Compartment kinetics- one compartment and two compartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intra vascular and oral route. (e) Curve fitting (Method of Residuals), regression procedures. (f) Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance. (g) Hepatic elimination of drugs, first pass effect, extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation. (h) Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaelis Menten Equation, detection of nonlinearity (Saturation mechanism). (i) Numericals related to pharmacokinetic parameters using one compartmental model.	20
03	Bioavailability and Bioequivalence: a) Measures of bioavailability, C _{max} , t _{max} and area under the curve (AUC). b) Design of single dose bio-equivalence study and relevant statistics. c) Review of regulatory requirements for conduction of bio-equivalent studies.	8

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

Books Recommended

1. The Theory & Practice of industrial pharmacy by Leon Lachmen et al., Lea & Febiger, Philadelphia.
2. Remington's Pharmaceutical Sciences, ed. A.R. Gennaro, Mack Publishing Co.
3. Modern Pharmaceutics ed. G.S. Banker & C.T. Rhodes, Marcel Dekker Inc. N.Y.
4. Pharmaceutical dosage forms: Tablets, Parenterals, Disperse systems. Vol.: 1,2,3 Leon, Lachman. Et.al.
5. Pharmaceutics: The science of dosage form design. M.E. Aulton. ELBS/Churchill Livingstone.
6. Drug Stability, T. Carstensen, Marcel Dekker Inc. N.Y.
7. Physical Pharmacy, A.N. Martin et al, K.M. Verghese & Co.
8. Pharmacokinetics, Gibaldi & D. Perrier Marcel Dekker Inc., N.Y.
9. Pharmaceutical calculation, N.J. Stoklosa, Lea & Febiger, Philadelphia.
10. Pharmaceutical Statistics, Sanford Bolton. Marcel Dekker Inc.
11. Novel drug delivery systems: Fundamentals & Developmental concepts. Y.W. Chien, Marcel Dekker Inc.
12. Biopharmaceutics & Pharmacokinetics - an introduction. R.E. Notary, Marcel Dekker Inc., N.Y.
13. Controlled drug Delivery, Fundamentals and applications, J.R. Robinson & Lee, Marcel Dekker Inc.
14. Handbook of Pharmaceutical Excipients" By James C. Boylan, Pub., American Pharmaceutical Association & The Pharmaceutical Society of Great Britain.
15. Pharmaceutical Dissolution testing, Umesh V. Bankar, Marcel Dekker Inc.

DHARMSINH DESAI UNIVERSITY

BACHELOR OF PHARMACY

PH812 Medicinal Chemistry – IV

Theory

3 hours/Week

No.	Chapter	Hours
01	Synthetic procedures of official drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs A. Sulphonamides and Fluoroquinolones (03) B. Anti-malarial drugs (03) C. Anti-Leprotic drugs (02) D. Anti-tubercular drugs (02) E. Anti-septics and Disinfectants (03) F. Anti-fungal agents (02) G. Anti-amoebic agents (02) H. Anti-viral Drugs including anti-HIV agents (08) I. Anti-Neoplastic agents (08) J. Immunosuppressive agents (02)	35
02	Antibiotics: General Chemistry of (β -lactum antibiotics, Aminoglycoside antibiotics Tetracyclines, Chloramphenicol, Macrolide antibiotics, Polyene and Polypeptide antibiotics	10

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Selected drug synthesis from the course content.
2. Special analysis of the drug synthesized.
3. Organic spotting of binary mixtures with derivative preparation and TLC.
4. Establishing the Pharmacopoeial standards of the drugs synthesized.

Books Recommended

1. J.N.Delagado and W.A.R. Remers, Eds, Wilson and Giswild's Text book of Organic, Medicinal and Pharmaceutical Chemistry, J.Lipincott., Philadelphia.
2. H.E.Wolf,Ed., Burger's Medicinal Chemistry, John Wiley & Sons, New York.
3. T.Nogradydey, Medicinal Chemistry - A Biochemical approach, Oxford University Press, New York
4. B.N.Ladu, H.G.Mandel and E.L.Way. Fundamentals of Drug Metabolism & Disposition, William & Welkins Co. 428E, Prestone street, Baltimore.
5. Vogel's Textbook of Practical Organic Chemistry, ELBS, Longman, London.
6. Mann & Saunder, Practical Organic Chemistry, Orient Longman, UK.
7. Shriner, Heremann, Morrill, Curtin & Fusion, The Systemic identification of Organic Compounds, John Wiley & Sons, New York.
8. W.C.Foye, Principles of Medicinal Chemistry, Lea and Feiber, Philadelphia.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH813 Pharmaceutical Analysis – IV

Theory

3 hours/Week

No.	Chapter	Hours
01	Atomic Absorption and Atomic Emission Spectroscopy: Origin of atomic absorption and atomic emission spectra, Instrumentation, Qualitative and quantitative application of flame photometry	06
02	Quality Assurance: Introduction to Basic principles and applications of QA and GLP: Importance and applications of ISO 9000 & 14000. Quality review and documentation in QC laboratory and analytical method validation	04
03	Harmonization of Pharmaceutical Standards, Outsourcing of pharmaceuticals, SUPAC guidelines, etc.	04
04	Validation	04
05	High Performance Liquid Chromatography Introduction, theory – migration equation, theoretical plate, measurement of column performance and its optimization, instruments for liquid chromatography including column packing for various types of chromatography, mobile phase characteristics for normal and reversed phases, polarity and selectivity of the solvents, scope and applications. Super critical fluid chromatography, exclusion chromatography	10
06	Gas Chromatography: Introduction, principles of Gas – Liquid Chromatography, instruments for Gas –Liquid Chromatography, columns and stationary phases, qualitative and quantitative applications to pharmaceuticals, brief introduction to hyphenated techniques like GC-MS, LC-MS, etc.	08
07	X – Ray Crystallography: Introduction, X-ray absorption and X-ray diffraction methods, Instrumentation for relevant instruments	04
08	Principle, instrumentation, types and applications of electrophoresis.	03

Practical

3 hours/Week

1. Quantitative estimation and general tests of formulations containing single drug, using instrumental techniques based on theory.

Books Recommended

- 1.Principles of Instrumental Analysis - Skoog, Holler, Nieman, 5th Ed. Saunders College Publishing.
- 2.A Textbook of Pharmaceutical Analysis - Kenneth A. Connors, 3rd Ed., John Wiley & Sons.
- 3.Instrumental Methods of Chemical Analysis - Galin W. Ewing, 5th Ed., McGraw Hill International Editions.
- 4.Principles of Instrumental Analysis - Skoog, Leary, 4th Ed., Saunders college Publishing
- 5.Instrumental Methods of Analysis - Willard, Merritt, Dean, Settle, CBS Publishers 7th Ed.

6. Understanding ISO 9000 and implementing the basics to Quality-D.H. Stamatis, Marcel Dekker, Inc.
7. Guidelines for Laboratory Quality Auditing - Donald C. Singer, Ronald P. Upton, Marcel Dekker, Inc.
8. Good Manufacturing Practices for Pharmaceuticals: A plan for total quality control - Sidney H Willing, James R. Stoker, Marcel Dekker, Inc.
10. O.P.P.I. Manual.
11. Good Laboratory Practice Regulations - Ed. by Sandy Weinberg, Marcel Dekker, Inc.
12. Pharmaceutical Analysis: Modern Methods, James W. Munson, Marcel Dekker, Inc.
13. Practical Pharmaceutical Chemistry-I & II, A.H. Beckett and J.B. Stenlake, 4th Ed. CBS Publishers.
14. Indian Pharmacopoeia.
15. British Pharmacopoeia.
16. United States Pharmacopoeia.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH814 Pharmacognosy-VI

Theory

3 hours/Week

No.	Chapter	Hours
01	Herbal Cosmetics: Introduction, classification, importance, preparation and evaluation of herbal cosmetics.	04
02	Standardisation of Herbal Drugs: <ul style="list-style-type: none"> Importance of Standardisation and problem involved in the standardisation of herbs. Standardisation of single drugs and compound formulations. WHO Guidelines for quality standardized herbal formulation. Estimation of the parameter limits used for standardisation. Preparation and evaluation of Herbal Extract. 	06
03	Herbal formulations: The holistic concept of drug administration in traditional system & modern system of medicine. <ul style="list-style-type: none"> General introduction, their importance, Classification. Principles of Siddha, Ayurveda, Homeopathy, Unani & Naturopathy systems of medicine. Introduction for different Ayurvedic dosage forms. Toxicity studies of different complimentary medicine. Rules and regulatory requirements for the production of the Ayurvedic medicines as per FDA. General introduction and different stages required for herbal formulation. Dosage forms and its Evaluation parameters. 	12
04	Traditional drugs : Common vernacular names, botanical sources, morphology, microscopy, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs: Stem: Galo Underground stem: Garlic Leaf: Tylophora, Nagod, Adusa, Karen, Gymnema, Neem. Fruit: Amla, Gokhru, Pepper, Bhilama, Kalijiri. Seed: Methi, Chakramadu, Malkangni, Karanj.	17
05	World - wide trade in medicinal plants and derived products with special reference to diosgenin (Dioscorea), taxol (Taxus spp.), digitalis, tropane alkaloid containing plants, papain, cinchona, Ipecac, Liquorice, ginseng, aloe, valerian, rauwolfia and plants containing laxatives, artemisia, camptotheca.	04
06	A brief account of plant based industries and institution involved in work on medicinal and aromatic plants in India.	02

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Demonstration of various traditional dosage forms.
2. Microscopical study of characters of selected drugs given in the theory in entire and powdered form.
3. Preparation and evaluation herbal cosmetics.
4. Preparation and evaluation of Ayurvedic formulation.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.
2. Pharmacognosy and pharmacobiotechnology, Ashutosh Kar, New Age International (P) Ltd, Publishers, 2nd edition 2007.
3. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahemedabad, 8th edition, 1990.
4. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,.
5. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbars, Lea and Febgir Philadelphia, 8th Edition, 1981.
6. Pharmacognosy of powdered crude drugs: M. A. Iyenger, Manipal Power Press, 1st Edition, 1974.
7. Mukherji P. K., Quality Control of Herbal Drugs, Business Horizon Pharma. Publishers, 1st Edition, 2002.
8. Herbal drug technology, S. S. Agrawal and M. Paridhavi, Univeristies Press, 1st Edition, 2007.
9. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
10. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
11. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar.
12. Herbal cosmetics, hand book By H. Panda
13. Cosmetics formulation, manufacturing and their quality control by P.P. Sharma
14. Textbook of Pharmacognosy and Phytochemistry by Edwin Jarald and Sheeja Jarald
15. Modern Methods of Plant Analysis by Peach & Tracey
16. Biotechnology by S.S. Purohit

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH815 Clinical Pharmacy

Theory

3 hours/Week

No.	Chapter	Hours
01	Endocrine system: <ul style="list-style-type: none"> Hypothalamic and pituitary hormones Thyroid hormones and anti-thyroid drugs Insulin and oral hypoglycemic agents and glucagon. ACTH and corticosteroids Androgen and anabolic steroids Estrogen, progesterone and oral contraceptives Drug acting on uterus 	15
02	Introduction to clinical pharmacy: <ul style="list-style-type: none"> Development and scope of clinical pharmacy Concept of health care team Role of clinical pharmacist as a member of health care team and important function. 	05
03	Basic concept of pharmacotherapy: <ul style="list-style-type: none"> Therapeutic Drug Monitoring. Critical care Unit: Blood and Plasma Volume expanders Drug used during infancy and in the elderly (Pediatrics and Geriatrics) Drug used during pregnancy Drug induced diseases The basics of drug interactions General principle of toxicology: Heavy Metals and Antagonists. Interpretation of clinical Laboratory test 	22
04	Clinical Trials & GCP guidelines.	03

Books Recommended

- Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
- Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
- Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn. Vallabh Prakashan, New Delhi.
- Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
- Rang h.P., dale M.M., et al-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
- Satoskar R.S., et al-Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.
- Harvel, R.A., Champe P.C. et al –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
- Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.

9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn.
Pergamon Press, Singapore.
10. Seth, S.D. text Book of pharmacology, B.I. Churchill, 1997.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH816 Elective

3 hours/Week

- ❖ Topics for preparation of project report will be given on the basis of result of B. Pharm Semester - VI (merit list is to be prepared)
- ❖ Topics will be given from all the area of pharmaceutical sciences viz. pharmaceutical technology, pharmacology, pharmaceutical analysis, medicinal chemistry, Pharmacognosy, etc
- ❖ Preparation and submission of project report should be mandatory for all the students of B. Pharm semester-VIII.
- ❖ Evaluation of students will be done at the end of the year by preparing a power point presentation by students
- ❖ Presentations will be evaluated by external referee.

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Bachelor of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table-I: Course of study for semester I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP105T	Communication skills – Theory *	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP107P	Human Anatomy and Physiology – Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical*	2	-	1
BP112RBP	Remedial Biology – Practical*	2	-	1
Total		32/34^S/36[#]	4	27/29^S/30[#]

[#]Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course.

^SApplicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course.

* Non University Examination (NUE)

Table-II: Course of study for semester II

Course Code	Name of the course	No. of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP203T	Biochemistry – Theory	3	1	4
BP204T	Pathophysiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	3	-	3
BP206T	Environmental sciences – Theory *	3	-	3
BP207P	Human Anatomy and Physiology II –Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry – Practical	4	-	2
BP210P	Computer Applications in Pharmacy – Practical*	2	-	1
Total		32	4	29

*Non University Examination (NUE)

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Table-III: Course of study for semester III

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP302T	Physical Pharmaceutics I – Theory	3	1	4
BP303T	Pharmaceutical Microbiology – Theory	3	1	4
BP304T	Pharmaceutical Engineering – Theory	3	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP306P	Physical Pharmaceutics I – Practical	4	-	2
BP307P	Pharmaceutical Microbiology – Practical	4	-	2
BP 308P	Pharmaceutical Engineering –Practical	4	-	2
Total		28	4	24

Table-IV: Course of study for semester IV

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	4
BP402T	Medicinal Chemistry I – Theory	3	1	4
BP403T	Physical Pharmaceutics II – Theory	3	1	4
BP404T	Pharmacology I – Theory	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	4
BP406P	Medicinal Chemistry I – Practical	4	-	2
BP407P	Physical Pharmaceutics II – Practical	4		2
BP408P	Pharmacology I – Practical	4	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	4	-	2
Total		31	5	28

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Table-V: Course of study for semester V

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Industrial PharmacyI– Theory	3	1	4
BP503T	Pharmacology II – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Industrial PharmacyI – Practical	4	-	2
BP507P	Pharmacology II – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
Total		27	5	26

Table-VI: Course of study for semester VI

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP601T	Medicinal Chemistry III – Theory	3	1	4
BP602T	Pharmacology III – Theory	3	1	4
BP603T	Herbal Drug Technology – Theory	3	1	4
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	1	4
BP605T	Pharmaceutical Biotechnology – Theory	3	1	4
BP606T	Quality Assurance –Theory	3	1	4
BP607P	Medicinal chemistry III – Practical	4	-	2
BP608P	Pharmacology III – Practical	4	-	2
BP609P	Herbal Drug Technology – Practical	4	-	2
Total		30	6	30

B. PHARM. SEMESTER – I (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY I -THEORY (BP101T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the various experiments related to special senses and nervous system.
- Appreciate coordinated working pattern of different organs of each system

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to human body Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology. Cellular level of organization Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine Tissue level of organization Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.	10	CO1
[2]	Integumentary system Structure and functions of skin Skeletal system Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction Joints Structural and functional classification, types of joints movements and its articulation	10	CO1 CO2 CO3

[3]	Body fluids and blood Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system. □ Lymphatic system Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system	10	CO2 CO3 CO4 CO5
[4]	Peripheral nervous system: Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. Special senses Structure and functions of eye, ear, nose and tongue and their disorders.	08	C01 CO2 CO3 C04 C05
[5]	Cardiovascular system Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart	08	C01 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.

D. REFERENCE BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.
4. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic anatomy and function of the body and remember the position of the various parts of our body
CO2	Remember, Understand and Apply	To know about the working mechanism of the body part and measure the activity of certain body parts by various techniques.
CO3	Understand Apply and Evaluate	To understand about the mechanism behind the action produced by various body part
CO4	Understand	To know about how disease occurs, and for that which organ system is required to defence those disease condition
CO5	Remember, Understand, Apply and evaluate	To get knowledge about functioning and dysfunctioning of various parts of the body/system and disease occur due to these imbalances.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	1	3	1	3	3	1	3	3	3	3	1	1
CO2	3	2	2	3	2	2	2	2	3	1	3	3	3	3	2	2
CO3	3	3	3	3	2	2	2	2	3	2	2	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.6	3	2.4	1.8	2.4	2.2	2.2	2.8	1.6	2.4	2.8	3	3	2.2	1.8

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL ANALYSIS I-THEORY (BP102T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	04	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs

Objectives: Upon completion of the course student shall be able to

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- Develop analytical skills

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	(a) Pharmaceutical analysis Definition and scope i) Different techniques of analysis ii) Methods of expressing concentration iii) Primary and secondary standards. iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate (b)Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures	10	CO1 CO5
[2]	Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl	10	CO2 CO3 CO4 CO5
[3]	Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride. Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.	10	CO2 CO3 CO4 CO5
[4]	Redox titrations (a) Concepts of oxidation and reduction (b) Types of redox titrations (Principles and applications)	08	CO2 CO3 CO4 CO5

	Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate		
[5]	Electrochemical methods of analysis Conductometry - Introduction, Conductivity cell, Conductometric titrations, applications. Potentiometry - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications. Polarography - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications	07	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. G. H. Jeffery J. Bassett J. Mendham R C. Denney, *Vogel's textbook of quantitative chemical analysis*, 5th ed.; Bath press, Avon : Great Britain, 1989.
2. Sharma B. K., *Analytical Chemistry*, 2nd ed.; Krishna Prakashan media (p) Ltd: Delhi, India, 2006.

D. REFERENCE BOOKS

1. P. Gundu Rao, *Inorganic Pharmaceutical Chemistry (Pharma Chemistry-I)*, 2010
2. Arthur Owen Bentley; John Edmund Driver; Lewis Malcolm Atherden. *Bentley and Driver's Textbook of Pharmaceutical Chemistry.*; Oxford University Press: Oxford, 1977.
3. Kennedy, J. H. *Analytical Chemistry : Principles*; Saunders College Pub: New York, 1990.
4. Health, O. Indian Pharmacopoeia 2010. Vol. 1; Ghaziabad Indian Pharmacopoeia Commission, 2010.
5. Skoog, Douglas A, F J. Holler, and Timothy A. Nieman, *Principles of Instrumental Analysis*, 7th ed.; Saunders College Pub: United states of America, 2016.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the importance, scope and fundamentals of analytical chemistry.
CO2	Remember, Understand and learn	Understand and learn different analytical and electroanalytical methods
CO3	Understand, remember Apply	Remember and apply various analytical and electroanalytical methods in pharmaceutical drug analysis
CO4	Understand, analyse and evaluate	Analyse and evaluate various volumetric and electrochemical titrations results
CO5	Development and evaluation	Evaluation of sources of errors, promoting ethical practises and development of analytical skills

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	1	3	1	1	1	-	3	3	3	2	2	-
CO2	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO3	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO4	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO5	3	1	3	1	1	3	1	1	1	-	3	3	3	2	2	-
Avg.	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICS I -THEORY (BP103T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Prepare various conventional dosage forms

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia. • Dosage forms: Introduction to dosage forms, classification and definitions • Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription. • Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.	10	CO1 CO3 CO4
[2]	Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight. • Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions. • Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques	10	CO2 CO5
[3]	Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions. • Biphasic liquids: • Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome. • Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.	10	CO2 CO5

[4]	Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. · Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.	8	CO1 CO2 CO5
[5]	Semisolid dosage forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms	7	CO2 CO5

C. TEXT BOOKS

1. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

D. REFERENCE BOOKS

2. Ansel, H. C.; Allen, L. V.; Popovich, N. G. Pharmaceutical Dosage Forms and Drug Delivery Systems; Philadelphia, Pa Lippincott-Williams & Wilkins, 1999.
3. Arthur Owen Bentley; Ernest Alexander Rawlins. Bentley's Textbook of Pharmaceutics.; All India Traveller Book Seller: New Delhi, 2002.
4. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
5. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.
6. Françoise Nielloud; Marti-Mestres, G. Pharmaceutical Emulsions and Suspensions; Informa Healthcare, Cop: New York, 2010.
7. Ghebre-Sellassie, I. Pharmaceutical Pelletization Technology; Dekker: New York U.A., 1989.
8. Parikh, D. M. Handbook of Pharmaceutical Granulation Technology; Informa Healthcare: New York, N.Y., 2007.
9. Remington, J. P.; Gennaro, A. R. Remington : Volume 1 : The Science and Practice of Pharmacy; Mack Pub. Co: Easton, Pa., 1995.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand and remember the professional way of handling the prescription
CO2	Understand and Remember	To understand the basics of different dosage forms and pharmaceutical incompatibilities
CO3	Understand	To understand the history of profession of pharmacy
CO4	Perform	To perform the pharmaceutical calculations
CO5	Prepare and evaluate	To prepare and evaluate various conventional dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	3	3	2	3	3	3	3	3	3
CO2	3	2	3	3	1	2	1	2	2	1	2	3	3	3	2	2
CO3	3	2	2	1	1	3	-	2	2	-	3	2	2	3	3	3
CO4	3	1	3	3	-	1	1	1	1	1	2	3	2	3	2	1
CO5	3	1	3	3	-	1	1	1	1	1	2	3	3	3	1	1
Avg	3	1.8	2.8	2.6	0.6	2	1.2	1.8	1.8	1	2.6	2.8	2.6	3	2.2	2

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL INORGANIC CHEMISTRY -THEORY (BP104T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of the course the student shall be able to

- Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- Understand the medicinal and pharmaceutical importance of inorganic compounds

B. COURSE CONTENT

General methods of preparation, assay for the compounds superscripted with **asterisk (*)**, properties and medicinal uses of inorganic compounds belonging to the following classes

NO	TOPIC	L (Hrs)	COs
[1]	Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate	10	CO1 CO2
[2]	Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity. Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance. Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.	10	CO2 CO3 CO4 CO5
[3]	Gastrointestinal agents Acidifiers: Ammonium chloride* and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations	10	CO2 CO3 CO4 CO5
[4]	Miscellaneous compounds Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate Haematinics: Ferrous sulphate*, Ferrous gluconate Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite Astringents: Zinc Sulphate, Potash Alum	8	CO2 CO3 CO4 CO5

[5]	Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α , β , γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I_{131} , Storage conditions, precautions & pharmaceutical application of radioactive substances.	7	CO2 CO3 CO4 CO5
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C. TEXT BOOKS (LATEST EDITION)

1. Anand & G.R. Chatwal, Inorganic Pharmaceutical Chemistry, India, 2010
2. Suhagia B. N., Inorganic Pharmaceutical Chemistry, Nirav Prakashan, India, 2013

D. REFERENCE BOOKS (LATEST EDITION)

1. Schroff, M. L. Pharmaceutical Chemistry; National Book Centre: Calcutta, 1968.
2. Arthur Owen Bentley; John Edmund Driver; Lewis Malcolm Atherden. Bentley and Driver's Textbook of Pharmaceutical Chemistry.; Oxford University Press: Oxford, 1977.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
CO2	Understand and Remember	To understand the medicinal and pharmaceutical importance of inorganic compounds
CO3	Understand	To understand and learn about various types of inorganic compounds
CO4	Understand and Remember	To study preparation and assay of selected inorganic compounds
CO5	Understand and Remember	To understand and remember synonyms and chemical formula of various inorganic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	1	-	-	1	-	2	1	3	2	3	1	1	1
CO2	3	-	-	1	-	1	-	-	2	1	3	2	3	1	1	1
CO3	3	-	-	1	-	-	-	-	1	1	3	2	2	1	1	1
CO4	3	-	-	1	-	-	-	-	1	-	3	2	2	1	-	-
CO5	3	-	-	1	-	-	-	-	-	-	3	2	-	-	-	-
Avg	3	-	-	1	-	0.2	0.2	-	1.2	0.6	3	2	2	0.8	0.6	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: COMMUNICATION SKILLS -THEORY (BP105T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac.	Total
2	-	-	2	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

Objectives: Upon completion of the course the student shall be able to

- Understand the behavioural needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
- Communicate effectively (Verbal and Non-Verbal)
- Effectively manage the team as a team player
- Develop interview skills
- Develop Leadership qualities and essentials

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment	07	CO1 CO2
[2]	Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style	07	CO1 CO2
[3]	Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message	07	CO1 CO2 CO3
[4]	Interview Skills: Purpose of an interview, Do's and Dont's of an interview	05	CO4

	Giving Presentations: Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery		CO5
[5]	Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion	04	CO3 CO5

C. TEXT BOOKS

1. Mosam Sinha. *Effective Communication Skills*; Aavishkar Publishers, Distributors: Jaipur, 2017.
2. Lisel Erasmus-Kritzinger. *Introductory Communication : The Ultimate Guide to Effective Communication Skills, Study Skills, Life Skills*; Nasou Via Afrika: Cape Town, 2007.

D. REFERENCE BOOKS

1. Rutherford, A. J. *Basic Communication Skills for Technology*; Englewood Cliffs, Nj Prentice Hall, 1991.
2. Worth, R. *Communication Skills.*; Ferguson: New York, 2019.
3. Nira Konar. *Communication Skills for Professionals*; Phi Learning Private Limited: New Delhi, 2011.
4. Mitra, B. K. *Personality Development and Soft Skills*; Oxford University Press: New Delhi, 2011.
5. Wentz, F. H. *Soft Skills Training : A Workbook to Develop Skills for Employment*; Createspace: Charleston, Sc, 2012.
6. Peter, F. S. J. *Soft Skills and Professional Communication*; Tata Mcgraw-Hill: New Delhi, 2012.
7. Araya, M. MTD Training Effective Communication Skills. www.academia.edu.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the behavioural needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
CO2	Learn	Learn to communicate effectively (Verbal and Non Verbal) and apply appropriate communication style in professional context
CO3	Understand	Understand the effective team management as a team player
CO4	Understand and Remember	Understand and remember the requisites for development of an effective interview skills
CO5	Understand and learn	Develop Leadership qualities and essentials

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	1	3	-	3	-	-	3	1	1	-	3	-
CO2	-	-	-	-	3	3	-	3	-	-	3	1	1	-	3	-
CO3	-	-	-	-	3	1	-	1	-	-	3	1	1	-	3	-
CO4	-	-	-	-	-	1	-	1	-	-	3	1	1	-	3	-
CO5	-	-	-	-	3	3	-	3	-	-	3	1	1	-	3	-
Avg.	-	-	-	-	2	2.2	-	2.2	-	-	3	1	1	-0	3	-

B. PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL BIOLOGY -THEORY (BP106RBT)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	--	---	2	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Objectives: Upon completion of the course the student shall be able to

- know the classification and salient features of five kingdoms of life
- Understand the basic components of anatomy & physiology of plant
- Know understand the basic components of anatomy & physiology animal with special reference to human

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Living world: Definition and characters of living organisms <ul style="list-style-type: none"> • Diversity in the living world • Binomial nomenclature • Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus, Morphology of Flowering plants <ul style="list-style-type: none"> • Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed. • General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledones 	7	CO1 CO4 CO5
[2]	Body fluids and circulation <ul style="list-style-type: none"> • Composition of blood, blood groups, coagulation of blood • Composition and functions of lymph • Human circulatory system • Structure of human heart and blood vessels • Cardiac cycle, cardiac output and ECG Digestion and Absorption <ul style="list-style-type: none"> • Human alimentary canal and digestive glands • Role of digestive enzymes • Digestion, absorption and assimilation of digested food Breathing and respiration <ul style="list-style-type: none"> • Human respiratory system • Mechanism of breathing and its regulation • Exchange of gases, transport of gases and regulation of respiration • □ Respiratory 	7	CO2 CO3

[3]	Excretory products and their elimination <ul style="list-style-type: none"> • Modes of excretion • Human excretory system- structure and function • Urine formation • Rennin angiotensin system Neural control and coordination <ul style="list-style-type: none"> • Definition and classification of nervous system • Structure of a neuron • Generation and conduction of nerve impulse • Structure of brain and spinal cord • Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata Chemical coordination and regulation <ul style="list-style-type: none"> • Endocrine glands and their secretions • Functions of hormones secreted by endocrine glands Human reproduction <ul style="list-style-type: none"> • Parts of female reproductive system • Parts of male reproductive system • Spermatogenesis and Oogenesis • □ Menstrual cycle 	07	CO2 CO3
[4]	Plants and mineral nutrition: <ul style="list-style-type: none"> • Essential mineral, macro and micronutrients • Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation Photosynthesis <ul style="list-style-type: none"> • Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis. 	05	CO2 CO3
[5]	Plant respiration: Respiration, glycolysis, fermentation (anaerobic). Plant growth and development <ul style="list-style-type: none"> • Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators Cell - The unit of life <ul style="list-style-type: none"> • Structure and functions of cell and cell organelles. Cell division Tissues <ul style="list-style-type: none"> • Definition, types of tissues, location and functions 	04	CO1 CO4 CO5

C. TEXT BOOKS

1. A Gokhale, S. B.; Kokate, C. K.; Gokhale, A. S.; Kalaskar, M. G. Pharmacognosy of Traditional Drugs - I; Nirali Prakashan, August: Pune, 2014.
2. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.

D. REFERENCE BOOKS

1. Gokhale, S. B.; Kokate, C. K.; Gokhale, A. S.; Kalaskar, M. G. Pharmacognosy of Traditional Drugs - I; Nirali Prakashan, August: Pune, 2014.
2. Dutta, A. C. Botany for Degree Students.; Oxford University Press: Kolkata, 1996.
3. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To get knowledge about the basic part of the living world i.e plants, the parts of plant, its morphology and physiology, classification of kingdom. diversity in the world.
CO2	Remember and understand	To know about the anatomy and function of the various parts of the body
CO3	Understand Remember and Evaluate	To understand about the mechanism behind the action produced by various body part, evaluation of functions of the body part. To know about how disease occurs, and for that which organ system is required to defence those disease condition
CO4	Understand and evaluate	To know about plant photosynthesis, minerals, and factor affecting photosynthesis
CO5	Remember, Understand, Apply and evaluate	To get knowledge about plant respiration, plant growth and detail about the cell and tissue structure and function.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	2	3	3	3	2	3	3	3	2	2	3	2	1
CO2	3	1	2	3	2	2	2	2	3	2	3	3	3	3	2	2
CO3	3	2	3	3	2	2	2	2	3	2	2	3	3	3	2	3
CO4	3	2	3	3	2	3	3	2	3	2	2	3	3	3	3	3
CO5	3	2	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	1.6	2.4	2.6	2.5	2.4	2.6	2	2.8	2.2	2.4	2.6	2.8	3	2.2	2.2

B.PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL MATHEMATICS-THEORY (BP106RMT)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	-	-	2	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and La Place transform.

Objectives: Upon completion of this course the student should be able to

- Know the theory and their application in Pharmacy.
- Solve the different types of problems by applying theory.
- Appreciate the important application of mathematics in Pharmacy.
- Apply mathematics in solving statistical problems in pharmacy.
- Know the basics of mathematical problem-solving skills in Pharmacy.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Partial fraction Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics Logarithms Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems. Function: Real Valued function, Classification of real valued functions. Limits and continuity: Introduction, Limit of a function, Definition of limit of a function. (ϵ - δ definition) $\lim_{x \rightarrow a} \frac{x^2 - a^2}{x - a} = 2a$, $\lim_{x \rightarrow 0} \frac{e^{2x} - 1}{x} = 2$	06	CO1, CO2, CO4.
[2]	Matrices and Determinant: Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoin or adjutant of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear equations using matrix method, Cramer's rule, Characteristics equation and roots of a square matrix, Cayley-Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.	06	CO1, CO2, CO4.
[3]	Calculus Differentiation: Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula)–Without Proof, Derivative of x^n w.r.t. x, where n is any rational number, Derivative of e^x Derivative of log	06	CO1, CO3, CO5.

	e^x , Derivative of a^x , Derivative of trigonometric functions from first principles (without Proof), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application		
[4]	Analytical Geometry Introduction: Signs of the Coordinates, Distance formula, Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope– intercept form of a straight line Integration: Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application	06	CO1, CO3, CO4.
[5]	Differential Equations: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, Application in solving Pharmacokinetic equations Laplace Transform: Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations	06	CO3, CO4, CO5.

C. TEXT BOOKS

1. Hari Kishan. *Differential Calculus*; Atlantic Publishers & Distributors: New Delhi, 2007.
2. Ranganath, G. K. *Remedial Mathematics*. 2017.

D. REFERENCE BOOKS

1. Hari Kishan. *Differential Calculus*; Atlantic Publishers & Distributors: New Delhi, 2007.
2. Ranganath, G. K. *Remedial Mathematics*. 2017.
3. Hyma, P. *Pharmaceutical Mathematics with Application to Pharmacy*; Anmol Publications Pvt. Ltd: New Delhi, India, 2017.
4. H S Govinda Rao. *Higher Engineering Mathematics*; Viva Books: New Delhi, 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Know the theory and their application in Pharmacy.
CO2	Understand and apply	Solve the different types of problems by applying theory.
CO3	Evaluate	Appreciate the important application of mathematics in Pharmacy.
CO4	Apply and Remember	Apply mathematics in solving statistical problems in pharmacy.
CO5	Analyse and Evaluate	Know the basics of mathematical problem solving skills in Pharmacy.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	0	3	1	1	3	3	3	3	1
CO2	3	1	3	3	1	3	3	0	1	1	0	3	3	3	3	1
CO3	3	1	3	3	1	3	3	0	2	1	1	3	3	3	3	1
CO4	3	1	3	3	2	3	3	1	1	1	0	2	3	3	3	1
CO5	3	1	3	3	1	3	3	1	1	1	1	2	3	3	3	1
Avg	3	1.4	3	3	1.2	3	3	0.4	1.6	1	0.6	2.6	3	3	3	1

B. PHARM. SEMESTER – I (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY I-PRACTICAL (BP107 P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
---	--	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives:

- Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Study of compound microscope. 2. Microscopic study of epithelial and connective tissue 3. Microscopic study of muscular and nervous tissue 4. Identification of axial bones 5. Identification of appendicular bones 6. Introduction to hemocytometry. 7. Enumeration of white blood cell (WBC) count 8. Enumeration of total red blood corpuscles (RBC) 9. Determination of bleeding time 10. Determination of clotting time 11. Estimation of haemoglobin count 12. Determination of blood group 13. Determination of erythrocyte sedimentation rate (ESR) 14. Determination of heart rate and pulse rate 15. Recording of blood pressure.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
2. Sri Nageswari K; Sharma, R. Practical Workbook of Human Physiology; Jaypee Brothers Medical Publishers (P) Ltd, 2006.

D. REFERENCE BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.

3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic instruments used in this subject and how to operate it
CO2	Remember, Understand and evaluate	To know about the working mechanism of the instruments, understanding of models and result evaluation.
CO3	Understand Apply and Evaluate remember	To understand about procedure for measurement of various biochemical parameter, evaluation of result and after interpretation of result
CO4	Understand Apply and Evaluate	To know the value, obtain from the test and apply it in healthy or disease condition and give interpretation
CO5	Remember, Apply and evaluate	To get knowledge about parts of the instrument used in lab, its working principle, measurement and interpretation of result

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	2	3	3	3	2	3	3	3	1
CO2	3	2	2	3	1	3	2	2	3	1	3	3	3	3	2	1
CO3	3	3	3	3	2	2	2	3	3	1	2	3	3	3	2	2
CO4	3	2	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	3	3	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.4	2.8	3	1.6	2.6	2.6	2.2	2.8	1.8	2.4	2.6	3	3	2.4	1.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL ANALYSIS I-PRACTICAL (BP108P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.

Objectives: Upon completion of the course student shall be able to

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- Develop analytical skills

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Preparation and standardization of (1) Sodium hydroxide (2) Sulphuric acid (3) Sodium thiosulfate (4) Potassium permanganate (5) Ceric ammonium sulphate Assay of the following compounds along with Standardization of Titrant (1) Ammonium chloride by acid base titration (2) Ferrous sulphate by Cerimetry (3) Copper sulphate by Iodometry (4) Calcium gluconate by complexometry (5) Hydrogen peroxide by Permanganometry (6) Sodium benzoate by non-aqueous titration (7) Sodium Chloride by precipitation titration Determination of Normality by electro-analytical methods (1) Conductometric titration of strong acid against strong base (2) Conductometric titration of strong acid and weak acid against strong base (3) Potentiometric titration of strong acid against strong base	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Ministry, India.; Indian Pharmacopoeia Commission. *Indian Pharmacopoeia, 2010*; Indian Pharmacopoeia Commission: Ghaziabad, 2010.
2. Jain, D. S. M.; Patel, D. V. B. *Pharmaceutical Analysis*; Nirali Prakashan, 2018.

D. REFERENCE BOOKS

1. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988
2. Muhammad Sajid Hamid Akash; Kanwal Rehman. *Essentials of Pharmaceutical Analysis*; Singapore Springer, 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, learn and remember	Understand, learn and remember various calculations for quantification of drugs by analytical and electroanalytical methods.
CO2	Learn and remember	Learn and remember the concept of calibration of apparatus and instruments
CO3	Understand and apply	Understand and apply the analytical and electroanalytical methods for assay and quantification of drugs in an unknown samples.
CO4	Understand	Understand the importance of data integrity and ethical practices in every steps of drugs quantification
CO5	Develop	Develop skills in performing the volumetric titration and handling electroanalytical instruments

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	1	1	1	1	2	-	3	3	3	2	2	-
CO2	3	3	2	1	1	2	1	1	2	-	3	3	3	2	2	-
CO3	3	3	3	3	2	2	1	1	2	1	3	3	3	2	2	1
CO4	3	1	3	1	2	2	1	1	2	-	3	3	3	2	2	1
CO5	3	3	1	1	1	2	1	1	2	1	3	3	3	2	2	-
Avg	3	2.6	2.2	1.8	1.4	1.8	1	1	2	0.4	3	3	3	2	2	0.4

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICS I-PRACTICAL (BP109P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	-	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Course enables the student to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Prepare various conventional dosage forms

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Syrups a) Syrup IP'66 b) Compound syrup of Ferrous Phosphate BPC'68 2. Elixirs a) Piperazine citrate elixir b) Paracetamol pediatric elixir 3. Linctus a) Terpin Hydrate Linctus IP'66 4. Solutions b) Iodine Throat Paint (Mandles Paint) a) Strong solution of ammonium acetate b) Cresol with soap solution c) Lugol's solution 5. Suspensions a) Calamine lotion b) Magnesium Hydroxide mixture c) Aluminium Hydroxide gel 6. Emulsions a) Turpentine Liniment b) Liquid paraffin emulsion 7. Powders and Granules a) ORS powder (WHO) b) Effervescent granules c) Dusting powder d) Divided powders 8. Suppositories a) Glycero gelatin suppository b) Cocoa butter suppository c) Zinc Oxide suppository 8. Semisolids a) Sulphur ointment b) Non staining-iodine ointment with methyl salicylate c) Carbopol gel	60	CO1 CO2 CO3 CO4 CO5

	9. Gargles and Mouthwashes a) Iodine gargle b) Chlorhexidine mouthwash		
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C. TEXT BOOKS

1. Sanmathi. Dispensing Pharmacy : A Practical Manual.; Pharma Book Syndicate, 2010.
2. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

D. REFERENCE BOOKS

1. Ansel, H. C.; Allen, L. V.; Popovich, N. G. Pharmaceutical Dosage Forms and Drug Delivery Systems; Philadelphia, Pa Lippincott-Williams & Wilkins, 1999.
2. Arthur Owen Bentley; Ernest Alexander Rawlins. Bentley's Textbook of Pharmaceutics.; All India Traveller Book Seller: New Delhi, 2002.
3. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
4. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To convert the values of different parameters in different unit system for the calculation of ingredients in the formulation.
CO2	Apply	To perform the calculation for preparation of different dosage forms.
CO3	Create and prepare	To prepare the conventional dosage forms.
CO4	Evaluate	To evaluate the conventional dosage forms.
CO5	Apply and evaluate	To learn the packaging conditions, labeling and storage conditions for different dosage forms.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	3	3	2	2	-	2	2	-	3	3	3	3	3	1
CO2	3	1	3	3	1	2	1	3	2	2	3	3	3	3	3	2
CO3	3	1	3	3	1	1	-	1	1	1	3	3	3	3	3	1
CO4	3	1	3	3	1	1	-	1	1	1	3	3	3	3	3	1
CO5	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
Avg	3	1.6	3	3	1.6	1.8	0.6	1.8	1.8	1.4	3	3	3	3	3	1.6

B. PHARM. SEMESTER – I (BPH)**SUBJECT: PHARMACEUTICAL INORGANIC CHEMISTRY -PRACTICAL (BP110P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of the course the student shall be able to

- know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- understand the medicinal and pharmaceutical importance of inorganic compounds

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	Limit tests for following ions Limit test for Chlorides and Sulphates Modified limit test for Chlorides and Sulphates Limit test for Iron Limit test for Heavy metals Limit test for Lead Limit test for Arsenic Identification test Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate Test for purity Swelling power of Bentonite Neutralizing capacity of aluminum hydroxide gel Determination of potassium iodate and iodine in potassium Iodide Preparation of inorganic pharmaceuticals Boric acid Potash alum Ferrous sulphate	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Dhake A S, Inorganic pharmaceutical chemistry, First edition, Career publications, India, 2004

D. REFERENCE BOOKS (LATEST EDITION)

1. Ministry, India.; Indian Pharmacopoeia Commission. Indian Pharmacopoeia, 2010. Addendum 2012; Indian Pharmacopoeia Commission: Ghaziabad, 2012.
2. Anand & G.R. Chatwal, Inorganic Pharmaceutical Chemistry, India, 2010

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To study limit tests of various inorganic compounds
CO2	Understand and Remember	To perform identification tests of various inorganic compounds
CO3	Understand and Remember	To understand and remember the preparations of various inorganic pharmaceuticals
CO4	Understand and Remember	To understand and remember the reactions involved in preparation of various inorganic pharmaceuticals
CO5	Understand and Evaluate	To understand and evaluate tests for purity of various inorganic pharmaceuticals

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	-	1	-	1	1	-	2	3	3	3	2	1	1
CO2	3	1	1	-	1	-	-	1	-	-	3	3	2	2	-	-
CO3	2	1	1	-	1	-	-	1	-	-	3	3	2	-	-	1
CO4	2	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-
CO5	3	1	1	-	1	-	1	1	1	-	3	3	3	2	1	1
Avg	2.6	0.8	0.8	-	0.8	-	0.4	0.8	0.2	0.4	3	2.6	2	1.2	0.4	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: COMMUNICATION SKILLS -PRACTICAL (BP111P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac.	Total
-	-	2	2	1	15	5	5	-	25

A. COURSE OVERVIEW

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

Objectives: Upon completion of the course the student shall be able to

- Communicate effectively (Verbal and Non-Verbal)
- Effectively manage the team as a team player
- Develop interview skills, writing skills, Leadership qualities and essentials

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Basic communication covering the following topics Meeting People Asking Questions Making Friends What did you do?</p> <p>Pronunciations covering the following topics Pronunciation (Consonant Sounds) Pronunciation and Nouns Pronunciation (Vowel Sounds)</p> <p>Advanced Learning Listening Comprehension / Direct and Indirect Speech Figures of Speech Effective Communication Writing Skills Effective Writing Interview Handling Skills E-Mail etiquette Presentation Skills</p>	30	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Fujishin, R. *The Art of Communication : Improving Your Fundamental Communication Skills*; Rowman & Littlefield: Lanham, 2016.
2. Pandey, M.; Phil, M.; Lit, E.; Lib, M. *FIRST YEAR B. PHARM. Semester I*

D. REFERENCE BOOKS

1. Burton, L.; Dalley, D.; University Of Learning Ltd. *Developing Your Influencing Skills : A Guide to Developing the 7 Traits of Influential People*; Universe Of Learning: Great Britain, 2010.
2. Shikha Kapoor. *Personality Development and Soft Skills : Preparing for Tomorrow*; I.K. International Publishing House Pvt. Ltd: New Delhi, 2018.
3. Thomson, A. J.; Martinet, A. V. *A Practical English Grammar*; Oxford Univ. Press, 2012.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and learn	Understand and learn the basics of communication and apply it appropriately in professional and social context
CO2	Learn, remember and apply	Learn, remember and apply the key concepts of pronunciations in speaking
CO3	Display/ Demonstrate	Display competence in oral, written, and visual communication
CO4	Learn	Learn to prepare an audience – centric presentation
CO5	Understand, learn and apply	Understand, Learn and apply the requisites for an effective writing skills and listening skills

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	-	3	-	3	1	-	3	1	-	-	3	-
CO2	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO3	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO4	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO5	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
Avg.	-	-	-	-	-	3	-	3	2.6	-	3	1	-	-	3	-

B. PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL BIOLOGY – PRACTICAL (BP112RBP)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
--	--	1	2	1	15	10	5	-	25

A. COURSE OVERVIEW

1. Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Objectives: Upon completion of the course the student shall be able to

- know the classification and salient features of five kingdoms of life
- Understand the basic components of anatomy & physiology of plant
- Know understand the basic components of anatomy & physiology animal with special reference to human

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. Introduction to Experiments in Biology <ol style="list-style-type: none"> A) Study of Microscope B) Section Cutting Techniques C) Mounting and Staining D) Permanent Slide Preparation 2. Study of Cell and Its Inclusions 3. Study of Stem, Root, Leaf, Seed, Fruit, Flower and Their Modifications 4. Detailed Study of Frog by Using Computer Models 5. Microscopic Study and Identification of Tissues Pertinent To Stem, Root 6. Leaf, Seed, Fruit and Flower 7. Identification of Bones 8. Determination of Blood Group 9. Determination of Blood Pressure 10. Determination of Tidal Volume 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.
2. Kale, S. R.; Kale, R. R. Practical Human Anatomy and Physiology for First Year Diploma Course in Pharmacy; Nirali Prakashan: Pune, India, 2007.

D. REFERENCE BOOKS

1. Kale, S. R.; Kale, R. R. Practical Human Anatomy and Physiology for First Year Diploma Course in Pharmacy; Nirali Prakashan: Pune, India, 2007.
2. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.
3. Shafi, M.J.H. Biology practical manual according to National core curriculum .Biology forum of Karnataka.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic instruments used in this subject and how to operate and what is the procedure behind it.
CO2	Remember, Understand and evaluate	To know about the working mechanism of the instruments, understanding of models and result evaluation.
CO3	Understand Apply and Evaluate remember	To understand about parts of the plant and animals, evaluation of study in both animals and plants
CO4	Understand Apply and Evaluate	To know the about the parts and function of the parts of body
CO5	Remember, Apply and evaluate	To get knowledge about parts of the instrument used in lab, its working principle, measurement and interpretation of result

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	2	3	3	3	2	3	3	3	3
CO2	3	2	2	3	2	2	2	2	3	2	3	3	3	3	2	2
CO3	3	3	3	3	2	2	2	2	3	2	2	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.8	2.6	2.8	2	2.4	2.6	2	2.8	2.2	2.4	2.6	3	3	2.4	2.2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY II -THEORY (BP201T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the haematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time, etc. and also record blood pressure, heart rate, pulse and respiratory volume.
- Appreciate coordinated working pattern of different organs of each system.
- Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Nervous system Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)	10	CO1
[2]	Digestive system Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT. Energetics Formation and role of ATP, Creatinine Phosphate and BMR.	06	CO2 CO4

[3]	Respiratory system Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration. Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods. Urinary system Anatomy of urinary tract with special reference to anatomy of kidney and Nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.	10	CO3 CO4
[4]	Endocrine system Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, Adrenal gland, pancreas, pineal gland, thymus and their disorders.	10	C04
[5]	Reproductive system Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition Introduction to genetics Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance	09	CO4 CO5

C. TEXT BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.

D. REFERENCE BOOKS

1. Sembulingam, K. Essentials of Medical Physiology: With Free Review of Medical Physiology. Jaypee Brothers: S.L., 2019.
2. Waugh, A.; Ross, J. S.; Grant, A.; Wilson, K. J. W. Ross and Wilson Anatomy and Physiology in Health and Illness : Anne Waugh, Allison Grant ; Illustrations by Graeme Chambers.; Churchill Livingstone: Edinburgh, 2001.
3. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
4. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
5. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.
6. Singh, I. Textbook of Human Histology: (with Colour Atlas & Practical Guide); Jaypee Brothers Medical Publishers: New Delhi, 2011.
7. Ghai, C. L. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
8. Srinageswari, K.; Sharma, R. Practical workbook of Human Physiology; Jaypee brother's medical publishers, New Delhi
9. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
10. Chatterjee, C. C. Human Physiology: For Preclinical Medical and Degree Courses in Physiology; CBS Publishers & Distributors: New Delhi, 2016.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember, Understand and Apply	To know the basic fundamental structural features of neurons, mechanism of neurotransmitters along with processes of neuroconduction and neurotransmission.
CO2	Remember, Understand and Apply	To understand the basic biochemical processes occurs in the body related to digestion and energy production
CO3	Understand and remember	To understand the structure and basic functioning of the respiratory tract and urinary tract.
CO4	Understand and remember	To know about various hormones in the body and its related disorders
CO5	Understand and remember	To get knowledge about human reproductive system and its importance and know the basic genetics processes

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO2	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO3	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO4	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO5	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
Avg	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY I-THEORY (BP202T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

B. COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

NO	TOPIC	L (Hrs)	COs
[1]	Classification, nomenclature and isomerism Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds	07	CO1 CO2
[2]	Alkanes*, Alkenes* and Conjugated dienes SP ³ hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP ² hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E 1 verses E 2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement	10	CO1 CO3 CO4 CO5
[3]	Alkyl halides SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol	10	CO1 CO3 CO4 CO5
[4]	Carbonyl compounds	10	CO1

	Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.		CO3 CO4 CO5
[5]	Carboxylic acids Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid Aliphatic amines - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine	8	CO1 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

D. REFERENCE BOOKS (LATEST EDITION)

1. Robert Thornton Morrison; Robert Neilson Boyd. Organic Chemistry. 2 : Study Guide; Allyn And Bacon: Boston, Mass., 1987.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Education: India, 2003.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To learn about name, structure, isomerism and uses of organic compound
CO2	Understand and Remember	To understand about various factors which affect the reactions of organic compounds
CO3	Understand and Apply	To know the reaction, name of the reaction and orientation of reactions
CO4	Understand	To understand the reactivity/stability of organic compounds
CO5	Understand and Remember	To understand and remember the preparation of organic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO2	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO3	3	1	1	2	-	-	-	1	1	-	3	3	2	2	1	-
CO4	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO5	3	-	-	2	-	-	-	1	1	3	3	3	2	3	1	-
Avg	3	0.2	0.2	2	-	-	-	1	1	0.6	3	3	2	2.2	1	-

B. PHARM. SEMESTER – II (BPH)
SUBJECT: BIOCHEMISTRY (BP203T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
3	1	-	04	04	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Objectives: Upon completion of course student shall be able to

- Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
- Understand the metabolism of nutrient molecules in physiological and pathological conditions.
- Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Carbohydrate metabolism</p> <p>Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance Hormonal regulation of blood glucose level and Diabetes mellitus</p> <p>Biological oxidation</p> <p>Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate level phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers</p>	10	CO2 CO4
[2]	<p>Lipid metabolism</p> <p>β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.</p> <p>Amino acid metabolism</p> <p>General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders</p>	10	CO2 CO4

	Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alcaptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline Catabolism of heme; hyperbilirubinemia and jaundice		
[3]	Nucleic acid metabolism and genetic information transfer Biosynthesis of purine and pyrimidine nucleotides Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis Genetic code, Translation or Protein synthesis and inhibitors	10	CO3 CO4
[4]	Biomolecules Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. Bioenergetics Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP	08	CO2 CO4 CO5
[5]	Enzymes Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions	07	CO1

C. TEXT BOOKS

1. Murray, R.; Bender, D.; Botham, K.; Kennelly, P.; Rodwell, V.; Weil, P.; York, N.; San, C.; Lisbon, F.; Madrid, L.; City, M.; Delhi, M.; Juan, S. *Twenty-Eighth Edition*..
2. U Satyanarayana. *Biochemistry*; Elsevier India: New Delhi, 2021.

D. REFERENCE BOOKS

1. Cox, D. L. *Lehninger principles of biochemistry: International Edition*.; W H Freeman & Co Ltd: S.L., 2021..
2. Berg, J. M.; Tymoczko, J. L.; J, G.; Lubert Stryer. *Biochemistry*; W.H. Freeman/Mcmillan Learning: New York, 2019..

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and learn	Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
CO2	Understand and learn	Understand the metabolism of nutrient molecules in physiological and pathological conditions.
CO3	Understand and learn	Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.
CO4	Learn and remember	Learn and remember the basic chemical structure of nutrient molecules and biological importance of biological macromolecules
CO5	Understand	Explain biological mechanisms, such as the processes and control of bioenergetics and metabolism, as chemical reactions

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
CO2	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
CO3	3	-	3	1	-	2	1	1	2	-	3	3	3	3	1	1
CO4	3	-	3	1	-	2	1	1	2	-	3	3	3	3	1	1
CO5	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
Avg.	3	-	3	1	-	2	1	1	2.6	-	3	3	3	3	1	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: PATHOPHYSIOLOGY-THEORY (BP 204T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	---	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

Objectives: Upon completion of the course the student shall be able to

- Describe the etiology and pathogenesis of the selected disease states;
- Name the signs and symptoms of the diseases; and
- Mention the complications of the diseases.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Basic principles of Cell injury and Adaptation: Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance Basic mechanism involved in the process of inflammation and repair: Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis	10	CO1
[2]	Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis) • Respiratory system: Asthma, Chronic obstructive airways diseases. • Renal system : Acute and chronic renal failure .	10	CO2 CO3 CO4 CO5

[3]	Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia <ul style="list-style-type: none"> ● Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones ● Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease. ● Gastrointestinal system: Peptic Ulcer 	10	CO2 CO3 CO4 CO5
[4]	Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease. <ul style="list-style-type: none"> ● Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout ● Principles of cancer: classification, etiology and pathogenesis of cancer 	08	CO2 CO3 CO4 CO5
[5]	Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections <ul style="list-style-type: none"> ● Sexually transmitted diseases: AIDS, Syphilis, Gonorrhea 	07	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Harsh Mohan; Damjanov, I. Textbook of Pathology; Jaypee Brothers Medical Publishers: New Delhi, 2019.
2. Walker, R.; Cate Whittlesea. Clinical Pharmacy and Therapeutics; Churchill Livingstone: Edinburgh ; New York, 2007.

D. REFERENCE BOOKS

1. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020
2. Walker, R.; Cate Whittlesea. Clinical Pharmacy and Therapeutics; Churchill Livingstone: Edinburgh ; New York, 2007.
3. Blumenthal, D. K.; Rollins, D. E. Workbook and Casebook for "Goodman and Gilman's the Pharmacological Basis of Therapeutics"; Mcgraw Hill: New York ; Madrid Etc, 2016.
4. Davidson's Principles and Practice of Medicine.; Elsevier Health Sciences: S.L., 2022.

RECOMMENDED JOURNALS

1. Toner, P. G. The Journal of Pathology 1999, 187 (1), 187. [https://doi.org/3.0.co;2-n">10.1002/\(sici\)1096-9896\(199901\)187:1<187::aid-path269>3.0.co;2-n](https://doi.org/3.0.co;2-n).
2. Robbins, J. KCNQ Potassium Channels: Physiology, Pathophysiology, and Pharmacology. Pharmacology & Therapeutics 2001, 90 (1), 1–19. [https://doi.org/10.1016/s0163-7258\(01\)00116-4](https://doi.org/10.1016/s0163-7258(01)00116-4).
3. Quiz Page. Indian Journal of Pathology and Microbiology 2015, 58 (4), 568. <https://doi.org/10.4103/0377-4929.168897>.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the mechanism behind cell death, inflammatory process and repair mechanism in human body
CO2	Remember, Understand and Apply	To know about the system and function of the body and disease associated with dysfunctioning of the system
CO3	Understand Apply and Evaluate	To understand about the mechanism behind generation of the disease and/or cause of diseases
CO4	Understand	To know about cause, and treatment of the communicable and non-communicable diseases.
CO5	Remember, Understand, Apply and evaluate	To get knowledge about medication used to treat the disease according to the pathway of disease production.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2	1	1	3	3	2	2	3	3	3	2	1
CO2	3	2	2	3	1	1	1	3	3	2	2	3	3	3	2	1
CO3	3	2	3	3	2	3	2	3	3	1	2	3	3	3	2	1
CO4	3	1	3	3	1	3	3	3	3	2	2	3	3	3	3	2
CO5	3	3	2	3	2	2	3	3	2	3	2	2	3	3	2	2
Avg	3	2	2.4	2.8	1.6	2	2	3	2.8	2	2	2.8	3	3	2.2	1.4

B. PHARM. SEMESTER – II (BPH)
SUBJECT: COMPUTER APPLICATIONS IN PHARMACY-THEORY (BP205T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	-	-	3	3	50	15	10	-	75

A. COURSE OVERVIEW

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

Objectives: Upon completion of the course the student shall be able to

- Know the various types of application of computers in pharmacy
- Know the various types of databases
- Know the various applications of databases in pharmacy

B. COURSE CONTENT

NO	TOPIC	L(Hrs)	COs
[1]	Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division Concept of Information Systems and Software : Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	06	CO2
[2]	Web technologies: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database	06	CO3 CO4
[3]	Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System	06	CO1
[4]	Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	06	CO5
[5]	Computers as data analysis in Preclinical development: Chromatographic data analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)	06	CO1

C. TEXT BOOKS

1. V. Bhagat, S. Narkhede, D. Kardile, S. Shankar. *Computer Application in Pharmacy*. NiraliPrakashan, Pune. 1st Edition 2018.

D. REFERENCE BOOKS

1. William E Fassett; Dale B Christensen. *Computer Application in Pharmacy*. Lea and Febiger, USA, 1986.
2. Sean Ekins. *Computer Application in Pharmaceutical Research and Development*. Wiley-Interscience, USA, 2006.
3. S.C. Rastogi. *Bioinformatics: Concept, Skills and Applications*. CBS Publishers and Distributors, New Delhi, 2nd Edition 2019.
4. Cary N. Prague. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath*. Wiley Dreamtech India (P) Ltd., New Delhi,

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand various applications of computers in pharmacy
CO2	Understand and apply	Understand and apply concept of Information Systems and Software
CO3	Remember and Evaluate	Remember and evaluate various types of databases
CO4	Understand and Remember	Understand and remember about Web technologies
CO5	Understand and analyse	Understand and analyse concept of Bioinformatics

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	3	-	2	-	-	1	-	3	2	2	1	-	-
CO2	2	1	1	2	-	1	-	-	1	-	2	1	2	1	-	-
CO3	1	-	2	2	-	-	-	-	-	-	1	1	1	-	-	-
CO4	-	-	1	1	-	-	-	1	-	-	2	2	1	-	-	-
CO5	2	1	-	3	-	-	1	-	1	-	-	2	3	1	-	-
Avg	1.4	0.8	1.2	2.2	-	0.6	0.2	0.2	0.6	-	1.6	1.6	1.8	0.6	-	-

B. PHARM. SEMESTER – II (BPH)**SUBJECT: ENVIRONMENTAL SCIENCES- THEORY (BP206T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	-	-	2	3	50	15	10	-	75

A. COURSE OVERVIEW

Scope: Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

Objectives: Upon completion of the course the student shall be able to:

- Create the awareness about environmental problems among learners.
- Impart basic knowledge about the environment and its allied problems.
- Develop an attitude of concern for the environment.
- Motivate learner to participate in environment protection and environment improvement.
- Acquire skills to help the concerned individuals in identifying and solving environmental problems.
- Strive to attain harmony with Nature.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	The Multidisciplinary nature of environmental studies Natural Resources Renewable and non-renewable resources: Natural resources and associated problems a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.	10	CO1 CO3 CO4
[2]	Ecosystems <ul style="list-style-type: none">▪ Concept of an ecosystem.▪ Structure and function of an ecosystem.▪ Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	10	CO1 CO2 CO3
[3]	Environmental Pollution: Air pollution; Water pollution; Soil pollution	10	CO1 CO3 CO5

C. TEXT BOOKS

1. S.S. Randhava, Environmental Sciences, Vikas and Company Medical Publishers, Peevee publication, Jalandhar, 2019.
2. Prof. M. K. Gupta, Prof. Manish Jaimini, Environmental sciences, Vikas Pandey, published by Nirali Prakashan, Pune, 2018

D. REFERENCE BOOKS

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. Environmental Biology, Nidi Publ. Ltd. Bikaner, 2001
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2001, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and create	Discuss environmental problems among learners and create the awareness and strive to attain harmony with Nature.
CO2	Understand and remember	Describe concept of Ecosystems and remember structure and function of it.
CO3	Create	To create an attitude of concern for the environment protection and environment improvement.
CO4	Understand and remember	Explain Natural Resources of Environment
CO5	Understand and analyse	Describe and analyse the environmental pollution.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	3	2	1	2	2	3	3	3	2	2	2	2
CO2	2	3	3	1	2	2	1	2	2	3	3	3	2	2	2	2
CO3	2	3	3	2	2	2	1	2	2	3	3	3	3	2	2	2
CO4	2	3	2	2	2	2	2	2	2	3	3	3	3	2	2	2
CO5	2	3	3	2	3	2	2	2	2	3	3	3	3	2	2	2
Avg	2.2	3	2.8	1.6	2.4	2	1.4	2	2	3	3	3	2.6	2	2	2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY II - PRACTICAL (BP207P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Practical physiology is complimentary to the theoretical discussions in physiology.

Objectives: Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	1. To study the integumentary and special senses using specimen, models, etc., 2. To study the nervous system using specimen, models, etc., 3. To study the endocrine system using specimen, models, etc 4. To demonstrate the general neurological examination 5. To demonstrate the function of olfactory nerve 6. To examine the different types of taste. 7. To demonstrate the visual acuity 8. To demonstrate the reflex activity 9. Recording of body temperature 10. To demonstrate positive and negative feedback mechanism. 11. Determination of tidal volume and vital capacity. 12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens. 13. Recording of basal mass index 14. Study of family planning devices and pregnancy diagnosis test. 15. Demonstration of total blood count by cell analyser 16. Permanent slides of vital organs and gonads.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

- Ghai, C. L. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
- Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991

D. REFERENCE BOOKS

- Waugh, A.; Ross, J. S.; Grant, A.; Wilson, K. J. W. Ross and Wilson Anatomy and Physiology in Health and Illness : Anne Waugh, Allison Grant ; Illustrations by Graeme Chambers.; Churchill Livingstone: Edinburgh, 2001.
- Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about basic anatomy and physiology of the human organ systems
CO2	Remember, Understand and evaluate	To know about performance of experiments like neurological reflex, body temperature measurement, body mass index, olfaction, gestation reflex and eye sight, etc.
CO3	Understand Apply and Evaluate remember	To understand about procedure for measurement of various haematological parameter, evaluation and interpretation of result
CO4	Understand Apply and Evaluate	To know about family planning
CO5	Remember, Apply and evaluate	To know the histological structures of the body organs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	3	3	3	1	3	3	1	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	1	1	3	3	3	1	3	3	3	3	3	3	3	3	3
Avg	3	2.2	2.2	3	3	3	2.2	3	3	2.6	2.8	3	3	3	3	3

B. PHARM. SEMESTER – II (BPH)**SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY I-PRACTICAL (BP208P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Systematic qualitative analysis of unknown organic compounds like Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc. 2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test 3. Solubility test 4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides. 5. Melting point/Boiling point of organic compounds 6. Identification of the unknown compound from the literature using melting point/ boiling point. 7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point. 8. Minimum 5 unknown organic compounds to be analysed systematically. 2. Preparation of suitable solid derivatives from organic compounds 3. Construction of molecular models	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav & Roopal Prakashan, India, 2008

D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.

3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand the various preliminary test for organic compounds
CO2	Understand and apply	To perform nature identification test for various organic compounds
CO3	Understand and evaluate	Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
CO4	Understand and evaluate	To study about various functional groups identification for organic compounds
CO5	Understand & Apply	Identification of unknown organic compound from the literature using melting point/boiling point

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO2	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO3	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO4	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO5	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
Avg	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: BIOCHEMISTRY PRACTICAL (BP209P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4		35	10	5	-	50

A. COURSE OVERVIEW

Scope: The scope of the subject deals with complete understanding of different qualitative test to be performed for identification of carbohydrates, lipids and proteins. It is also emphasizing on quantitative estimation of sugars and proteins, preparation of buffers and studying the activity of enzyme.

Objectives: Upon completion of course, student shell able to

- Perform various qualitative tests for identification of carbohydrates, proteins and abnormal constituents.
- Understand the Principles for quantitative estimation of glucose and cholesterol.
- Understand and evaluate activity of salivary amylase enzyme

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch) Identification tests for Proteins (albumin and Casein) Qualitative analysis of urine for abnormal constituents Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method) Determination of blood creatinine Determination of blood sugar Determination of serum total cholesterol Preparation of buffer solution and measurement of pH Study of enzymatic hydrolysis of starch. Determination of Salivary amylase activity Study the effect of Temperature on Salivary amylase activity. Study the effect of substrate concentration on salivary amylase activity.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. G. Raval, H. Practicals in biochemistry
2. Gupta, R. C. *Practical Biochemistry*; Cbs Publishers And Distributors: New Delhi, 2006.

D. REFERENCE BOOKS

1. Plummer David T. *An Introduction to Practical Biochemistry*; Tata Mcgraw Hill: New Delhi, 1990.
2. G Rajagopal; Es Rāmakiruşṇan. *Practical Biochemistry for Medical Students*; Orient Longman ; New York, Ny: Hyderabad, 1983.
3. Varley, H. *Practical Clinical Biochemistry*; Cbs Publishers & Distributors: Delhi, 1988.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, remember and learn	Understand, remember, learn principles and perform various test ethically for qualitative analysis of carbohydrates, proteins and abnormal constituent in urine.
CO2	Understand, learn and apply and evaluate	Understand, learn and perform the quantitative test for analysis of reducing sugars and protein.
CO3	Understand Apply and Evaluate	Analyse and evaluate the factors affecting enzyme activity
CO4	Understand Apply and Evaluate	Understand and learn the concept of buffers
CO5	Understand Apply and Evaluate	Evaluation and interpretation of data emanating from a pathological lab for various carbohydrates, lipids and protein.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO2	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO3	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO4	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO5	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
Avg.	3	3	3	1	2	2	1	1	3	-	3	3		-	2	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: COMPUTER APPLICATIONS IN PHARMACY-PRACTICAL(BP210P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	2	2	1	15	5	5	-	25

A. COURSE OVERVIEW

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

Objectives: Upon completion of the course the student shall be able to

- Know the various types of office tools and their applications
- Create the various databases
- Know the various applications of databases in pharmacy

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	CO
[1]	1. Design a questionnaire using a word processing package to gather information about a particular disease. 2. Create a HTML web page to show personal information 3. Retrieve the information of a drug and its adverse effects using online tools 4. Creating mailing labels Using Label Wizard , generating label in MS WORD 5. Create a database in MS Access to store the patient information with the required fields Using access 6. Design a form in MS Access to view, add, delete and modify the patient record in the database 7. Generating report and printing the report from patient database 8. Creating invoice table using – MS Access 9. Drug information storage and retrieval using MS Access 10. Creating and working with queries in MS Access 11. Exporting Tables, Queries, Forms and Reports to web pages 12. Exporting Tables, Queries, Forms and Reports to XML pages	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. V. Bhagat, S. Narkhede, D. Kardile, S. Shankar. *Computer Application in Pharmacy*. NiraliPrakashan, Pune. 1st Edition 2018.

D. REFERENCE BOOKS

1. William E Fassett; Dale B Christensen. *Computer Application in Pharmacy*. Lea and Febiger, USA, 1986.

2. Sean Ekins. *Computer Application in Pharmaceutical Research and Development*. Wiley-Interscience, USA, 2006.
3. S.C. Rastogi. *Bioinformatics: Concept, Skills and Applications*. CBS Publishers and Distributors, New Delhi, 2nd Edition 2019.
4. Cary N. Prague. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath*. Wiley Dreamtech India (P) Ltd., New Delhi,

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	Understand basic tools of MS Word, MS Excel and MS Power point and apply them to create documents.
CO2	Remember, Understand and Create	Remember and Understand HTML tags and create HTML web page.
CO3	Create	Create mailing labels Using Label Wizard, generating label in MS WORD
CO4	Design	Design questionnaire/reports using a word processing package to gather information about a particular disease.
CO5	Understand and Apply	Understand tools of MS Access and apply in creating database, queries, relationship and reports from patient database

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	-	1	2	-	-	-	2	-	-	1	1	2	-	-	-
CO2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	1	-	-	-	1	-	-	1	1	-	-	1	-
CO4	1	-	1	2	-	-	-	1	1	-	-	1	1	-	-	-
CO5	1	-	1	2	-	-	-	-	-	-	-	1	-	-	-	-
Avg	0.6	-	0.6	1.6	-	-	-	0.8	0.2	-	0.4	0.8	0.6	-	0.2	-

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY II -THEORY (BP301T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- prepare organic compounds

B. COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

NO	TOPIC	L (Hrs)	COs
[1]	Benzene and its derivatives A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel crafts alkylation- reactivity, limitations, Friedelcrafts acylation. C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction D. Structure and uses of DDT, Saccharin, BHC and Chloramine	10	CO1 CO3 CO4 CO5
[2]	Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols Aromatic Amines* - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts Aromatic Acids* – Acidity, effect of substituents on acidity and important reactions of benzoic acid.	10	CO1 CO3 CO4 CO5
[3]	Fats and Oils a. Fatty acids – reactions. b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.	10	CO1 CO3 CO5
[4]	Polynuclear hydrocarbons: a. Synthesis, reactions b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives	8	CO1 CO3 CO5

[5]	Cyclo alkanes* Stabilities – Baeyer’s strain theory, limitation of Baeyer’s strain theory, Coulson and Moffitt’s modification, Sachse Mohr’s theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only	7	CO1 CO3 CO4 CO5
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C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

D. REFERENCE BOOKS (LATEST EDITION)

1. Robert Thornton Morrison; Robert Neilson Boyd. Organic Chemistry. 2 : Study Guide; Allyn And Bacon: Boston, Mass., 1987.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Education: India, 2003.

E. COURSE OUTCOMES

CO Number	Skill		Statement
CO1	Understand and Apply		To write the structure, name of organic compound
CO2	Understand and Remember		To understand the type of isomerism of the compound
CO3	Understand and Remember		To know the reaction, name of the reaction and orientation of reactions
CO4	Understand and Remember		To understand the reactivity/stability of organic compounds
CO5	Understand and Remember		To understand and remember the preparation of organic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	1	1	-	1	2	3	3	3	3	1	1	1
CO2	3	1	1	1	1	1	-	1	3	2	3	3	3	1	1	1
CO3	3	1	1	1	1	1	-	1	3	2	3	3	3	3	1	1
CO4	3	1	1	1	1	1	-	1	3	1	3	3	3	3	1	1
CO5	3	1	1	1	1	1	-	1	2	2	3	3	3	2	1	1
Avg	2.8	1	1	1.2	1	1	-	1	2.6	2	3	3	3	2	1	1

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS I-THEORY (BP302T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Understand various physicochemical properties of drug molecules in the designing the dosage forms
- Know the principles of solubility, pH & buffers to use them for designing of formulations

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications	10	CO1
[2]	States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid crystalline, amorphous & polymorphism. Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications	10	CO2 CO3
[3]	Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.	10	CO4
[4]	Complexation and protein binding: Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants	08	CO3
[5]	pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.	07	CO5

C. TEXT BOOKS

1. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	Understand and analyse the principles of solubility and partition coefficient
CO2	Remember, Evaluate and apply	Remember and evaluate various physicochemical properties of drug molecules and apply in the designing the dosage form
CO3	Understand and Apply	Understand and apply physical principles of states of matter and complexation
CO4	Remember and evalaute	Remember and evaluate the role of surfactants, interfacial phenomenon and adsorption
CO5	Understand	Understand the importance of pH and buffers in pharmaceutical dosage forms and maintaining stability

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	1	-	-	-	-	1	-	-	3	1	3	-	1
CO2	3	-	-	1	-	-	-	-	1	-	-	3	1	2	-	-
CO3	3	-	-	-	-	-	-	-	1	-	-	3	1	2	-	1
CO4	3	-	-	-	-	-	-	-	1	-	-	3	1	1	-	-
CO5	3	-	-	-	-	-	-	-	1	-	-	3	1	1	-	-
Avg	3	-	-	0.4	-	-	-	-	1	-	-	3	1	1.8	-	0.4

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL MICROBIOLOGY-THEORY (BP303T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to learn all categories of microorganisms especially for the production of alcohol, antibiotics, vaccines, vitamins, enzymes etc.

Objectives: Upon completion of the course the student shall be able to understand the concepts related to various microorganisms, sterility testing and its application in pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes Study of ultrastructure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.	10	CO1
[2]	Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipment employed in large scale sterilization. Sterility indicators.	10	CO2 CO3
[3]	Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.	10	CO5
[4]	Designing of aseptic area, laminar flow equipment; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.	08	CO2 CO5
[5]	Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.	07	CO4

	Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.		
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C. TEXT BOOKS

1. Pelczar, M. J.; Chan, E. C. S.; Krieg, N. R. *Microbiology*; Tata Mcgraw-Hill: New Delhi, 2010.

D. REFERENCE BOOKS

1. Denyer, S. P.; Hodges, N. A.; Gorman, S. P.; Hugo, W. B.; Russell, A. D. *Pharmaceutical Microbiology*; Blackwell Science: Malden, 2004.
2. Prescott; Dunn. *Industrial Microbiology*, 4th edition.; CBS Publishers & Distributors, Delhi.
3. Denyer, S. P.; Hugo, W. B. *Hugo and Russell's Pharmaceutical Microbiology*; Wiley-Blackwell: Chichester, West Sussex, Uk ; Hoboken, Nj, 2011.
4. Rose, A. H. *Industrial Microbiology*; Butterworths: London, 1961.
5. Probiher; Hinsdill. *Fundamentals of Microbiology*, 9th ed.; Japan.
6. Cooper, J. W.; Gunn, C.; Sidney James Carter. *Cooper and Gunn's Tutorial Pharmacy*; Cbs Publishers: Editorial: New Delhi, 2005.
7. Peppler, H. J.; Perlman, D. *Microbial Technology*.; New York, Etc., Academic P, 1979.
8. I.P., B.P., U.S.P.- latest editions.
9. Edward Alcamo. *Fundamentals of Microbiology*; Jones And Bartlett: Sudbury, Mass., 2001.
10. Jain, N. K. *Pharmaceutical Microbiology*.; Vallabh Prakashan: Delhi, 2001.
11. Brenner, D. J.; Krieg, N. R.; Staley, J. T.; Garrity, G. M. *Bergey's Manual of Systematic Bacteriology. Volume Two, the Proteobacteria. Part A, Introductory Essays. Part B, the Gammaproteobacteria. Part C, the Alpha-, Beta-, Delta-, and Epsilonproteobacteria*; Springer: New York, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand Apply and Evaluate	To Understand methods of identification, cultivation and preservation of various microorganisms
CO2	Remember, and Understand Evaluate	To understand the importance and implementation of sterilization in pharmaceutical processing and industry
CO3	Understand Apply and Evaluate	To Understand the cell culture technology and its applications in pharmaceutical industries
CO4	Understand and Remember	To understand structure and growth of bacteria, virus and fungi
CO5	Understand Apply and Evaluate	To perform and evaluate microbial assay of various antibiotics and vitamin

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	2	3	3	0	2	0	3	2	3	3	3	1	3	2	3
C02	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
C03	3	-	2	3	2	2	0	2	1	2	2	3	3	3	2	3
C04	3	2	2	2	2	2	2	2	1	3	3	3	1	3	2	3
C05	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
Avg	3	2	2.6	2.8	1.6	2.4	1.6	2.6	2	2.8	2.8	3	2.2	3	2.4	3

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL ENGINEERING - THEORY (BP304T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Objectives: Upon completion of the course student shall be able:

- To know various unit operations used in Pharmaceutical industries.
- To understand the material handling techniques.
- To perform various processes involved in pharmaceutical manufacturing process.
- To carry out various test to prevent environmental pollution.
- To appreciate and comprehend significance of plant lay out design for optimum use of resources.
- To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.</p> <p>Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.</p> <p>Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.</p>	10	CO2 CO3 CO1
[2]	<p>Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.</p> <p>Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator & Economy of multiple effect evaporator.</p> <p>Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation</p>	10	CO2 CO3
[3]	<p>Drying: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits</p>	10	CO2 CO3

	of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer. Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier		
[4]	Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter. Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.	8	CO2 CO3
[5]	Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.	7	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. C V S Subrahmanyam; J Thimma Setty; Suresh, S.; V Kusum Devi. Pharmaceutical Engineering : Principles and Practices.; Vallabh Prakashan: Delhi, 2002.
2. C V S Shubramanyam. Pharmaceutical Engineering : Unit Operations - II; Vallabh Prakashan: Delhi, 2014.

D. REFERENCE BOOKS

1. Badger, W. L. Introduction to Chemical Engineering; Mc Graw Hill: Auckland, 1987.
2. Cooper, J. W.; Gunn, C.; Sidney James Carter. Cooper and Gunn's Tutorial Pharmacy; Cbs Publishers: Editorial: New Delhi, 2005.
3. Joseph Price Remington; Eric Wentworth Martin. Remington's Practice of Pharmacy Easton, Pa. Mack, 1961.
4. Khar, R. K.; Vyas, S. P.; Ahmad, F. J.; Jain, G. K. Lachman/Lieberman's the Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributor, Repr: New Delhi, 2015.
5. McCabe, W. L.; Smith, J. C.; Harriott, P. Unit Operations of Chemical Engineering; Chennai McGraw-Hill Education (India) Private Limited, 2014.
6. Simpson, N. J. K. Solid-Phase Extraction Principles, Techniques, and Applications; New York, N.Y. Dekker, 2000.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember and Understand	To understand and remember the various unit operations used in Pharmaceutical industries.
CO2	Understand	To understand the material handling techniques.
CO3	Apply and Evaluate	To perform various processes involved in pharmaceutical manufacturing process.
CO4	Understand and apply	To appreciate and comprehend significance of plant lay out design for optimum use of resources and to carry out various test to prevent environmental pollution.
CO5	Apply and evaluate	To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	2	-	2	2	2	3	3	3	3	3	3
CO2	3	1	3	3	2	2	-	2	2	2	2	3	3	3	2	2
CO3	3	2	2	3	2	1	2	2	1	2	3	3	3	2	3	2
CO4	3	1	2	3	-	1	1	-	-	3	3	3	2	2	2	3
CO5	3	1	2	3	-	1	1	2	2	3	2	3	3	3	1	3
Avg	3	1.4	2.4	3	1.2	1.4	0.8	1.6	1.4	2.4	2.6	3	2.8	2.6	2.2	2.6

B. PHARM. SEMESTER – III (BPH)**SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY II -PRACTICAL (BP305P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- prepare organic compounds

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Experiments involving laboratory techniques <ul style="list-style-type: none"> • Recrystallization • Steam distillation Determination of following oil values (including standardization of reagents) <ul style="list-style-type: none"> • Acid value • Saponification value • Iodine value Preparation of compounds <ul style="list-style-type: none"> • Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction. • 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/ Acetanilide by halogenation (Bromination) reaction. 1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction. • Benzoic acid from Benzyl chloride by oxidation reaction. • Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction. Benzil from Benzoin by oxidation reaction. • Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction • Cinnamic acid from Benzaldehyde by Perkin reaction, <i>P</i>-Iodo benzoic acid from <i>P</i>-amino benzoic acid 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav & Roopal Prakashan, India, 2008

D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.
3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To understand the experimental laboratory techniques
CO2	Understand and Remember	Determination of oils values for fats and oils
CO3	Understand and Apply	To study the name of the reaction involved in the organic compound
CO4	Understand and Remember	To understand the preparation of organic compound
CO5	Understand & Evaluate	To perform the purification of compound

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	1	1	-	1	1	2	1	1	2	3	3	1	1
CO2	3	1	2	1	1	-	1	1	3	1	2	2	3	3	1	1
CO3	3	1	2	1	1	-	-	1	3	2	1	2	3	2	1	1
CO4	3	1	2	1	1	-	1	1	3	1	2	2	3	2	1	1
CO5	3	1	2	1	1	-	1	1	3	2	1	2	3	3	1	1
Avg	3	1	2	1	1	-	0.8	1	2.8	1.4	1.4	2	3	2.6	1	1

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS I-PRACTICAL (BP306P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principals involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know and determine physical properties such as solubility, surface tension, partition coefficient and pKa and apply in the design of dosage forms.
- Know the principles of solubility, pH & buffers to use them for designing of formulations

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Determination the solubility of drug at room temperature 2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation 3. Determination of Partition co- efficient of benzoic acid in benzene and water 4. Determination of Partition co- efficient of Iodine in CCl ₄ and water 5. Determination of % composition of NaCl in a solution using phenol-water system by CST method 6. Determination of surface tension of given liquids by drop count and drop weight method 7. Determination of HLB number of a surfactant by saponification method 8. Determination of Freundlich and Langmuir constants using activated char coal 9. Determination of critical micellar concentration of surfactants 10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method 11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Sen, K. K., Dutta, S. K. A Laboratory Manual of Physical Pharmaceutics. India: PharmaMed Press. 2019.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.
8. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, Evaluate and Apply	Understand and evaluate physical properties such as solubility, surface tension, partition coefficient and pKa and apply in the design of dosage forms.
CO2	Understand and apply	Understand and apply Henderson – Hasselbalch equation for determination of pKa value of drugs.
CO3	Understand and Evaluate	Understand and evaluate the HLB value and critical micellar concentration of a surfactant.
CO4	Understand and Evaluate	Understand adsorption isotherms and determine Freundlich-Langmuir adsorption isotherm.
CO5	Evaluate	Evaluate the stability constants of complexes by various methods.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO2	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO3	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO4	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO5	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
Avg	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL MICROBIOLOGY-PRACTICAL (BP307P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Course enables the student to learn all categories of microorganisms especially for the production of alcohol, antibiotics, vaccines, vitamins enzymes etc..

Objectives: Upon completion of the course the student shall be able to

- Understand methods of identification, cultivation and preservation of various microorganisms.
- To understand the importance and implementation of sterilization in pharmaceutical processing and industry
- Learn sterility testing of pharmaceutical products.
- Carried out microbiological standardization of Pharmaceuticals.
- Understand the cell culture technology and its applications in pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology. 2. Sterilization of glassware, preparation and sterilization of media. 3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations. 4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical). 5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques 6. Microbiological assay of antibiotics by cup plate method and other methods 7. Motility determination by Hanging drop method. 8. Sterility testing of pharmaceuticals. 9. Bacteriological analysis of water 10. Biochemical test. 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

(1) Arora, B.; Arora, D. R. *Practical Microbiology*; Cbs Publishers & Distributors, Pvt Ptd: New Delhi, 2020.

D. REFERENCE BOOKS

- (1) G Sirockin; Cullimore, S. *Practical Microbiology*; London Mcgraw-Hill C, 1969.
- (2) Pelczar, M. J.; Chan, E. C. S.; Krieg, N. R. *Microbiology*; Tata Mcgraw-Hill: New Delhi, 2010.

E. COURSE OUTCOMES

CO Number	Skill		Statement
CO1	Understand and Evaluate	Apply	To perform and Evaluate sterility testing of pharmaceutical products.
CO2	Understand and Evaluate	Apply	To perform microbiological standardization of Pharmaceuticals.
CO3	Understand and Evaluate	Apply	To perform staining techniques for different microbes
CO4	Understand and Evaluate	Apply	To evaluate motility of microorganism
CO5	Understand and Evaluate	Apply	To perform microbial assay of antibiotics

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	1	3	3	3	3	2	3	3	3	2	2
CO3	3	3	3	2	1	1	1	2	1	2	1	2	2	3	2	1
CO4	3	3	3	2	1	1	1	1	1	1	1	1	1	3	1	1
CO5	3	3	3	2	1	1	2	3	3	3	2	3	2	3	2	3
Avg	3	3	3	2.4	1	1	2	2.4	2.2	2.4	1.8	2.4	2.2	3	2	2

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL ENGINEERING-PRACTICAL (BP308P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	-	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Objectives: Upon completion of the course student shall be able:

- To know various unit operations used in Pharmaceutical industries.
- To understand the material handling techniques.
- To perform various processes involved in pharmaceutical manufacturing process.
- To carry out various test to prevent environmental pollution.
- To appreciate and comprehend significance of plant lay out design for optimum use of resources.
- To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Determination of radiation constant of brass, iron, unpainted and painted glass. 2. Steam distillation – To calculate the efficiency of steam distillation. 3. To determine the overall heat transfer coefficient by heat exchanger. 4. Construction of drying curves (for calcium carbonate and starch). 5. Determination of moisture content and loss on drying. 6. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method. 7. Description of Construction working and application of Pharmaceutical 8. Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier. 9. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots. 10. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill. 11. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment. 12. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity) 13. To study the effect of time on the Rate of Crystallization. 14. To calculate the uniformity Index for given sample by using Double Cone Blender.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Momin M, Mehta T, Practical Manual of Pharmaceutical Engineering, B.S. Shah Prakashan, Ahmedabad, Gujarat, 2002.

D. REFERENCE BOOKS

1. C V S Shubramanyam. Pharmaceutical Engineering : Unit Operations - II; Vallabh Prakashan: Delhi, 2014.
2. C V S Subrahmanyam; J Thimma Setty; Suresh, S.; V Kusum Devi. Pharmaceutical Engineering : Principles and Practices.; Vallabh Prakashan: Delhi, 2002.
3. Badger, W. L. Introduction to Chemical Engineering; Mc Graw Hill: Auckland, 1987.
4. Cooper, J. W.; Gunn, C.; Sidney James Carter. Cooper and Gunn's Tutorial Pharmacy; Cbs Publishers: Editorial: New Delhi, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand and convert the values of factors in different units to perform various unit operations in Pharmaceutical industries.
CO2	Apply	To perform basic unit operations such as filtration, centrifugation, drying etc.
CO3	Evaluate	To check the effect of various processing parameters on different unit operations.
CO4	Apply	To create plant lay out design for optimum use of resources and to carry out various tests to prevent environmental pollution.
CO5	Apply and evaluate	To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	-	1	1	2	1	3	3	3	2	2	2
CO2	3	2	3	3	2	2	-	2	2	2	3	3	3	3	1	2
CO3	3	2	3	3	-	2	-	2	2	2	3	3	3	3	2	2
CO4	3	2	3	3	2	-	-	2	1	1	3	3	3	2	3	2
CO5	3	3	3	3	2	3	2	3	3	3	3	3	3	2	3	3
Avg	3	2.2	3	3	1.6	1.4	0.6	2	2	1.8	3	3	3	2.4	2.2	2.2

B. PHARM. SEMESTER – VII (BPH)
SUBJECT: INTRODUCTION TO YOGA (BP309P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	2	2	-	-	-	-	-	-

* Non-University Examination with grading satisfactory/ unsatisfactory

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge and practical skill of Yoga

Objectives: Upon completion of the course student shall be able

- To introduce the student to the fundamentals of a Yoga practice in a safe, supportive and academic environment.
- To learn proper body alignment & the basics of breathing techniques (pranayama)
- To understand various forms of yoga mediation & yogic asanas.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)
[1]	<p>TRAINING IN YOGIC ASANAS, PRANAYAMS AND MUDRAS</p> <ul style="list-style-type: none"> - Kapalbhati, Anulom-vilom, Pranayam, Omkar Pranayam, Bharmari, Pranayam, Body Rotation, Shavasana, Suryanamaskar, - Asanas for Meditation: Padmasana, Swastikasan, Siddhasana, Bhadrasana, Vajrasana, Makarasana, Savasana. - Asanas to be performed in Standing Position: Trikonasana, Purvashanasana, Utkatasana, Hastapadasana - Asanas to be performed while lying in Supine position: Sarvangasana, Halasana, Savasana, Kostonavishrasana, Matsyendrasana, Suptavajrasana - Asanas to be performed while lying in Prone position: Uttanpadasana, Uttanadhasana, Serpashana, Bhujasana, Salabhasana, Dhanurasana, Makarasana - Asanas to be performed in sitting position: Pawanmuktasana, Hastapadasana, Vajrasana, Ardhamatsyendrasana, Shishuvasana, Saptamudrasana, Gomukhasana. - Yoga Mudras (Seven Types) 	30

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY III -THEORY (BP401T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Objectives: At the end of the course, the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

B. COURSE CONTENT

To emphasize on definition, types, mechanisms, examples, uses/applications

NO	TOPIC	L (Hrs)	COs
[1]	Stereo isomerism Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers Reactions of chiral molecules Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute	10	CO3
[2]	Geometrical isomerism Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions	10	CO3
[3]	Heterocyclic compounds: Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene	10	CO1 CO2 CO4
[4]	Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis & medicinal uses of Pyrimidine, Purine, azepines and their dvts	8	CO2 CO3 CO4
[5]	Reactions of synthetic importance	7	CO5

	Metal hydride reduction (NaBH ₄ and LiAlH ₄), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation		
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C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

D. REFERENCE BOOKS (LATEST EDITION)

1. Bansal R, Heterocyclic Chemistry; New Age International (P) Limited, Publishers: New Delhi, 2014.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Education: India, 2003.

E. COURSE OUTCOMES

CO Number	Skill		Statement
CO1	Understand and Remember		To understand the methods of preparation for various organic compounds
CO2	Understand and Remember		To understand chemical properties for various organic compounds
CO3	Understand and Apply		To know the stereo chemical aspects of organic compounds and stereochemical reactions
CO4	Understand and Apply		To know medicinal uses and Other application of organic compounds
CO5	Understand and Remember		To understand and remember the reaction of synthetic importance

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	3	-	-	-	-	1	1	3	3	2	3	1	1
CO2	3	-	-	3	-	-	-	-	1	-	3	3	2	3	1	1
CO3	3	-	-	3	-	-	-	-	1	-	3	3	2	3	1	1
CO4	3	-	-	2	-	-	-	-	1	-	3	3	3	3	1	1
CO5	3	-	-	2	-	-	-	-	1	-	3	3	3	3	2	1
Avg	3	-	-	2.6	-	-	-	-	1	0.2	3	3	2.4	3	1.2	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: MEDICINAL CHEMISTRY I-THEORY (BP402T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

B. COURSE CONTENT

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Medicinal Chemistry History and development of medicinal chemistry Physicochemical properties in relation to biological action Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism. Drug metabolism Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.	10	CO1 CO2
[2]	Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. Sympathomimetic agents: SAR of Sympathomimetic agents Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. <ul style="list-style-type: none"> • Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. • Agents with mixed mechanism: Ephedrine, Metaraminol. Adrenergic Antagonists: Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.	10	CO2 CO3 CO4 CO5
[3]	Cholinergic neurotransmitters:	10	CO2

	<p>Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.</p> <p>Parasympathomimetic agents: SAR of Parasympathomimetic agents</p> <p>Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.</p> <p>Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorophate, Echothiophate iodide, Parathion, Malathion.</p> <p>Cholinesterase reactivator: Pralidoxime chloride.</p> <p>Cholinergic Blocking agents: SAR of cholinolytic agents</p> <p>Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.</p> <p>Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.</p>		CO3 CO4 CO5
[4]	<p>Drugs acting on Central Nervous System</p> <p>A. Sedatives and Hypnotics:</p> <p>Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem</p> <p>Barbiturates: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital</p> <p>Miscellaneous: Amides & imides: Glutethimide. Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.</p> <p>B. Antipsychotics</p> <p>Phenothiazines: SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.</p> <p>Ring Analogues of Phenothiazines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.</p> <p>Fluoro buterophenones: Haloperidol, Droperidol, Risperidone.</p> <p>Beta amino ketones: Molindone hydrochloride.</p> <p>Benzamides: Sulpieride.</p> <p>C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action</p> <p>Barbiturates: Phenobarbitone, Methobarbital. Hydantoins: Phenytoin*, Mephenytoin, Ethotoin Oxazolidine diones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Phenacemide, Carbamazepine* Benzodiazepines: Clonazepam Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate</p>	8	CO2 CO3 CO4 CO5
[5]	<p>Drugs acting on Central Nervous System</p> <p>General anesthetics:</p> <p>Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.</p>	7	CO2 CO3 CO4 CO5

	<p>Ultra short acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.</p> <p>Dissociative anesthetics: Ketamine hydrochloride.*</p> <p>Narcotic and non-narcotic analgesics</p> <p>Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anileridine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.</p> <p>Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.</p> <p>Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.</p>		
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C. TEXT BOOKS (LATEST EDITION)

1. Kadam S S, Bothara, K G Principles of Medicinal Chemistry, Volume I & II, 17th edition, Nirali Prakashan, India, 2008
2. Alagaraswamy, V Textbook of Medicinal Chemistry, Volume I & II, Elsevier, India 2012

D. REFERENCE BOOKS (LATEST EDITION)

1. Delgado, J. N.; Remers, W. A. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry; Lippincott-Raven: Philadelphia, 1998.
2. Foye, W. O.; Lemke, T. L.; Williams, D. A. Principles of Medicinal Chemistry; Williams & Wilkins, Cop: Baltimore Etc., 1995.
3. Remington, J. P.; Gennaro, A. R. Remington's Pharmaceutical Sciences; Mack Pub. Co: Easton, Pa., 1990.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand the chemistry of drugs with respect to their pharmacological activity
CO2	Understand and Remember	To understand the classification of drugs with their structures
CO3	Understand	To understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
CO4	Understand and Remember	To know the Structural Activity Relationship (SAR) of different class of drugs
CO5	Understand and Apply	To learn about the chemical synthesis of some drugs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	1	1	1	-	-	2	-	3	3	3	2	1	1
CO2	3	-	-	1	1	1	-	-	2	-	3	3	1	2	1	1
CO3	3	-	-	1	1	1	-	-	2	-	3	3	3	2	1	1
CO4	3	-	-	1	1	1	-	-	1	-	3	3	2	2	1	1
CO5	3	-	-	1	1	1	-	-	2	-	3	3	1	2	1	1
Avg	3	-	-	1	1	1	-	-	1.8	-	3	3	2	2	1	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS-II-THEORY (BP403T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Know basics of the dispersed systems and colloidal dispersions.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.	07	CO1
[2]	Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus	08	CO2
[3]	Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.	10	CO1 CO3
[4]	Micromeretics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.	10	CO4
[5]	Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention	10	CO3 CO4

C. TEXT BOOKS

1. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Understand basics of the dispersed systems and apply principles of colloidal dispersions.
CO2	Interpret and Evaluate	Interpret the rheological behaviour of fluids and evaluate the physics of tablet compression.
CO3	Evaluate and apply	Formulate and evaluate coarse dispersions making use of rheological and electrical properties.
CO4	Understand, Evaluate and apply	Understand and evaluate the properties of powders and apply them in formulation development.
CO5	Understand and Analyse	Understand principles of kinetics in the stabilization of dosage forms. Analyze the chemical stability of various drug products

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO2	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO3	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO4	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO5	3	-	2	-	-	-	-	-	3	-	-	3	2	3	-	-
Avg	3	-	1.2	-	-	-	-	-	2.2	-	-	3	2	3	-	-

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACOLOGY I -THEORY (BP401T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	---	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

Objectives: Upon completion of the course the student shall be able to

- Understand the pharmacological actions of different categories of drugs
- Explain the mechanism of drug action at organ system/sub cellular/macromolecular levels.
- Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
- Observe the effect of drugs on animals by simulated experiments
- Appreciate correlation of pharmacology with other bio medical sciences

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	1. General Pharmacology a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination	08	CO1 CO4 CO5
[2]	General Pharmacology a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action. b. Adverse drug reactions. c. Drug interactions (pharmacokinetic and pharmacodynamic) d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance	12	CO1 CO2 CO3 CO4 CO5

[3]	Pharmacology of drugs acting on peripheral nervous system a. Organization and function of ANS. b. Neurohumoral transmission-transmission and classification of neurotransmitters. c. Parasympathomimetic, Parasympatholytic, Sympathomimetics, sympatholytic. d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). e. Local anaesthetic agents. f. Drugs used in myasthenia gravis and glaucoma	10	CO1 CO2 CO3 CO4 CO5
[4]	Pharmacology of drugs acting on central nervous system a. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. b. General anaesthetics and pre-anaesthetics. c. Sedatives, hypnotics and centrally acting muscle relaxants. d. Anti-epileptics e. Alcohols and disulfiram.	08	CO1 CO2 CO3 CO4 CO5
[5]	Pharmacology of drugs acting on central nervous system a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manic and hallucinogens. b. Drugs used in Parkinson's disease and Alzheimer's disease. c. CNS stimulants and nootropics. d. Opioid analgesics and antagonists e. Drug addiction, drug abuse, tolerance and dependence.	07	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.3.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.
4. Bickley, L. S.; Bates, B. Bates' Guide to Physical Examination and History Taking.; Lippincott Williams & Wilkins: Philadelphia, 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To know about general idea of pharmacology subject, the contents of the subject, the basic about the drug and its action inside the body
CO2	Remember, Understand and Apply	To get knowledge about how to body react towards the drug and basic action and adverse effects produced by the drugs
CO3	Understand Apply and Evaluate	To understand about the system, disease and drug used in treatment of that type of disease
CO4	Understand and remember	To know about how disease occurs and drugs used in those diseases and drug interaction with others.
CO5	Remember, Understand, Apply and evaluate	To get knowledge about various agonist and antagonist and drugs dependence abuse and tolerance about certain drugs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3	1
CO2	3	2	3	3	3	3	2	3	3	2	3	3	3	3	3	1
CO3	3	2	3	3	3	3	2	3	3	2	2	3	3	3	3	1
CO4	3	2	3	3	3	3	2	3	3	2	2	3	3	3	3	1
CO5	3	2	3	3	3	3	3	3	3	2	2	2	3	3	3	1
Avg	3	2	3	3	3	3	2.4	3	3	1.8	2.2	2.8	3	3	3	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACOGNOSY AND PHYTOCHEMISTRY -THEORY (BP405T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Objectives: Upon completion of the course, the student shall be able

- To know the techniques in the cultivation and production of crude drugs.
- To know the crude drugs, their uses and chemical nature.
- Know the evaluation techniques for the herbal drugs.
- To carry out the microscopic and morphological evaluation of crude drugs.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Pharmacognosy: (a) Definition, history, scope and development of Pharmacognosy (b) Sources of Drugs – Plants, Animals, Marine & Tissue culture (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins). Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero-taxonomical classification of drugs Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.	10	CO2 CO5
[2]	Cultivation, Collection, Processing and storage of drugs of natural origin: Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants Conservation of medicinal plants	10	CO1
[3]	Plant tissue culture: Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines	07	CO4
[4]	Pharmacognosy in various systems of medicine: Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine. Introduction to secondary metabolites:	10	CO2 CO3 CO5

	Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins		
[5]	<p>Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs</p> <p>Plant Products: Fibers - Cotton, Jute, Hemp Hallucinogens, Teratogens, Natural allergens</p> <p>Primary metabolites: General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic uses and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:</p> <p>Carbohydrates: Acacia, Agar, Tragacanth, Honey</p> <p>Proteins and Enzymes : Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).</p> <p>Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax .</p> <p>Marine Drugs: Novel medicinal agents from marine sources.</p>	08	CO2 CO5

C. TEXT BOOKS

1. Dr. Shukla P., Dr. Shashi, A. & Dr. Shukla P., A textbook of "Pharmacognosy & Phytochemistry-I" 1st Edition, Nirali Prakashan, 2019.
2. Kabra, A., Dr. Ashok PK. & Setia, S., A textbook of "Pharmacognosy & Phytochemistry-I", Pee Vee Book, S. Vikas & Company (Medical Publishers) ,2019.

D. REFERENCE BOOKS

1. Deore SL., "Pharmacognosy & Phytochemistry-I-A Comprehensive Approach" 2nd edition, Pharma Med. Press, 2019.
2. Ali, M., "Pharmacognosy- Pharmacognosy & Phytochemistry-I", Volume-I CBS Publishers & Distributors PVT. Ltd., 2018
3. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry" , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
4. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
5. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
6. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
7. Jarald EE. & Jarald SE., "Textbook of Pharmacognosy & Phytochemistry" 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.
8. Neha Tyagi & Dr. Verma Santosh Kumar "A textbook of Pharmacognosy & Phytochemistry-I", 1st Edition, BFC Publication, 2020.
9. Gokhale, SB., Dr. Kokate CK., Dr. Tatiya AV., Dr. Kalaskar MG., "Pharmacognosy & Phytochemistry-I" 1st Edition, Nirali Prakashan, 2019.
10. Ashutosh Kar, "Pharmacognosy & Phytochemistry-I", 1st Edition, New Age International Private LTD. Publishers. 2020.
11. Dr. Das K., "Pharmacognosy & Phytochemistry-I" 1st Edition, Nirali Prakashan, 2019.
12. Kalia AN., Textbook of "Pharmacognosy & Phytochemistry-I" CBS Publishers & Distributors PVT. Ltd., 2021.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	Identify and analyse the techniques in the cultivation and production of crude drugs.
CO2	Remember and Understand Evaluate	Describe Pharmacognostic parameters & Pharmacognostic study of crude drug with their evaluation.
CO3	Understand and Apply	Explain & apply the basic principle of Indian systems of medicines.
CO4	Understand and apply	Discuss and apply the basic principle and techniques of Plant tissue culture.
CO5	Understand and apply	Discuss primary and secondary metabolites systematically from the source of their pharmaceutical and industrial application.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	-	2	-	2	2	3	2	3	2	2	2	1
CO2	3	2	2	2	-	2	2	1	2	1	2	3	2	3	2	1
CO3	3	2	2	1	-	2	3	2	2	1	2	3	2	3	3	1
CO4	3	2	2	2	-	2	2	1	2	1	2	3	2	2	3	1
CO5	3	2	2	2	-	2	-	2	2	1	2	3	2	2	2	1
Avg	3	2	2	1.8	-	2	1.4	1.6	2	1.4	2	3	2	2.4	2.4	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: MEDICINAL CHEMISTRY I-PRACTICAL (BP406P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Preparation of drugs/ intermediates 1,3-pyrazole 1,3-oxazole Benzimidazole Benztriazole 2,3- diphenyl quinoxaline Benzocaine Phenytoin Phenothiazine Barbiturate Assay of drugs Chlorpromazine Phenobarbitone Atropine Ibuprofen Aspirin Furosemide Determination of Partition coefficient for any two drugs	60	CO1 CO2 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav & Roopal Prakashan, India, 2008

D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.
3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To determine the partition coefficient of some drugs
CO2	Understand and Apply	To carry out the synthesis of drugs
CO3	Understand and Evaluate	To perform the assay of drugs using various analytical methods
CO4	Understand and Apply	To synthesize intermediates using different chemical reaction
CO5	Understand and Apply	To purify synthesized compounds and determine their physical constants

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	1	1	-	1	1	-	3	3	1	2	1	0
CO2	3	1	1	1	1	1	1	1	1	1	3	3	2	3	1	1
CO3	3	1	1	1	1	1	-	1	1	-	3	3	1	1	1	1
CO4	3	1	1	1	1	1	-	1	1	1	3	3	2	2	1	1
CO5	3	1	1	1	1	1	1	1	1	1	3	3	1	2	1	2
Avg	3	1	1	1	1	1	0.4	1	1	0.6	3	3	1.4	2	1	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS-II-PRACTICAL(BP407P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Know basics of the micromeritics, dispersed systems and colloidal dispersions

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Determination of particle size, particle size distribution using sieving method 2. Determination of particle size, particle size distribution using Microscopic method 3. Determination of bulk density, true density and porosity 4. Determine the angle of repose and influence of lubricant on angle of repose 5. Determination of viscosity of liquid using Ostwald's viscometer 6. Determination sedimentation volume with effect of different suspending agent 7. Determination sedimentation volume with effect of different concentration of 8. single suspending agent 9. Determination of viscosity of semisolid by using Brookfield viscometer 10. Determination of reaction rate constant first order. 11. Determination of reaction rate constant second order 12. Accelerated stability studies	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Sen, K. K., Dutta, S. K. A Laboratory Manual of Physical Pharmaceutics. India: PharmaMed Press. 2019.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.
8. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Evaluate	Understand and evaluate basic, derived and flow properties of powders and apply to prepare a stable formulation.
CO2	Understand and Evaluate	Understand and evaluate viscosity of fluids and formulations.
CO3	Remember and Analyse	Remember various type of suspending agent and analyse them to formulate a stable suspension.
CO4	Apply and Analyse	Apply principles of chemical kinetics in determination of rate constants as per the chemical reaction.
CO5	Understand and Analyse	Understand and analyse the shelf life of a formulation by accelerated stability studies.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO2	3	-	1	-	-	-	-	-	1	-	-	3	1	3	-	-
CO3	3	-	1	-	-	-	-	-	1	-	-	3	1	3	-	-
CO4	3	-	2	-	-	-	-	-	1	-	-	3	2	3	-	-
CO5	3	-	2	-	-	-	-	-	1	-	-	3	2	3	-	-
Avg	3	-	1.4	-	-	-	-	-	1.2	-	-	3	1.6	3	-	-

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACOLOGY I-PRACTICAL (B408 P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
--	--	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the various experiments related to special senses and nervous system.
- Appreciate coordinated working pattern of different organs of each system

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. Introduction to experimental pharmacology. 2. Commonly used instruments in experimental pharmacology. 3. Study of common laboratory animals. 4. Maintenance of laboratory animals as per CPCSEA guidelines. 5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anaesthetics and euthanasia used for animal studies. 6. Study of different routes of drugs administration in mice/rats. 7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice. 8. Effect of drugs on ciliary motility of frog oesophagus 9. Effect of drugs on rabbit eye. 10. Effects of skeletal muscle relaxants using rota-rod apparatus. 11. Effect of drugs on locomotor activity using actophotometer. 12. Anticonvulsant effect of drugs by MES and PTZ method. 13. Study of stereotype and anti-catatonic activity of drugs on rats/mice. 14. Study of anxiolytic activity of drugs using rats/mice. 15. Study of local anaesthetics by different methods Microscopic study of epithelial and connective tissue 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.

D. REFERENCE BOOKS

1. Kulkarni, R. S. Index Theorems of Atiyah, Bott, Patodi and Curvature Invariants; Presses De L'université De Montreal: Montreal, 1975.
2. F Hoffmeister; G Stille. Handbook of Experimental Pharmacology. Vol. 55/2, Psychotropic Agents, Part 2, Anxiolytics, Gerontopsychopharmacological Agents, and Psychomotor Stimulants; Springer: Berlin, 1981.
3. Kapadia, S. R.; Chew, D.; Cura, F.; L'allier, P. L.; Roffi, M.; E Murat Tuzcu. Textbook of Interventional Cardiology: A Global Perspective; Jaypee: The Health Sciences Publisher: New Delhi, 2017.
4. Fundamentals of Experimental Pharmacology; Hilton & Company: Kolkata, 2015.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To know about general idea of pharmacology subject, the contents of the subject, the basic instrument used in pharmacology
CO2	Remember, Understand and Apply	To get knowledge about animals used in experimental pharmacology its detail, housing, feeding, dissection etc
CO3	Understand Apply and Evaluate	To understand about the drugs acting on the animals body part and instruments used to check the activity of the animal
CO4	Understand and remember	To know about how diseases are produced in the animals and drug used for those diseases.
CO5	Remember, Understand, Apply and evaluate	To get knowledge about which animals, which instrument and which kind of drug we can used to induce the disease and for treatment of those disease,

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	2	3	2	3	3	3	3	3	3	3	3	3
CO3	3	2	3	3	2	3	2	3	3	1	2	3	3	3	3	3
CO4	3	2	3	3	2	3	2	3	3	1	2	3	3	3	3	3
CO5	3	3	3	3	2	3	3	3	3	2	2	2	3	3	3	2
Avg	3	2.6	3	3	2	3	2.4	3	3	2	2.2	2.8	3	3	3	2.8

B. PHARM. SEMESTER – IV (BPH)**SUBJECT: PHARMACOGNOSY AND PHYTOCHEMISTRY I-PRACTICAL (BP409P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Objectives: Upon completion of the course, the student shall be able

- To know the techniques in the cultivation and production of crude drugs.
- To know the crude drugs, their uses and chemical nature.
- Know the evaluation techniques for the herbal drugs.
- To carry out the microscopic and morphological evaluation of crude drugs.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar 1. (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil. 2. Determination of stomatal number and stomatal index. 3. Determination of vein islet number, vein islet termination and palisade ratio. 4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer. 5. Determination of Fiber length and width 6. Determination of number of starch grains by Lycopodium spore method 7. Determination of Ash value. 8. Determination of Extractive values of crude drugs. 9. Determination of moisture content of crude drugs. 10. Determination of swelling index and foaming index.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Rana, M. & Kabra A., "Practical Manual - Pharmacognosy & Phytochemistry-I" Pee Vee Book, S. Vikas & Company (Medical Publishers), 2019.
2. Dr. Khandelwal, K.R., "Practical Pharmacognosy" 19th edition, Nirali Prakashan, 2008.

D. REFERENCE BOOKS

1. Kabra, A., Dr. Ashok P.K. & Setia, S., A textbook of "Pharmacognosy & Phytochemistry-I", Pee Vee Book, S. Vikas & Company (Medical Publishers), 2019.
2. Deore, S.L., "Pharmacognosy & Phytochemistry-I-A Comprehensive Approach" 2nd edition, Pharma Med. Press, 2019.
3. Ali, M., "Pharmacognosy- Pharmacognosy & Phytochemistry-I", Volume-I CBS Publishers & Distributors PVT. Ltd., 2018.

4. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry", 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
5. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
6. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
7. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
8. Jarald EE. & Jarald SE., "Textbook of Pharmacognosy & Phytochemistry" 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Identify and Analyse	Identify and Analyse unorganised and organized crude drugs by chemical tests.
CO2	Remember, Understand and Evaluate	Evaluation of Crude drug by qualitative and quantitative microscopic method.
CO3	Understand, Evaluate and Analyse	Discuss the evaluation and analyse Physicochemical parameters for crude drugs.
CO4	Understand, Remember and Apply	Describe the principle of different microscopic measurement techniques.
CO5	Apply and Analyse	Explain evaluation of crude drugs.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
CO2	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
CO3	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
CO4	3	3	2	3	-	1	-	1	1	1	3	2	2	3	2	1
CO5	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
Avg	3	3	2	3	-	1.8	-	1	1.8	1	3	2	2	3	2	1

B.PHARM. SEMESTER – V (BPH)
SUBJECT: MEDICINAL CHEMISTRY II -THEORY (BP501T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

- Understand the chemistry of drugs with respect to their pharmacological activity
- Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
- Know the Structural Activity Relationship of different class of drugs
- Study the chemical synthesis of selected drugs

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Classification, mechanism of action, uses, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted(*) of following class of drugs in all units.</p> <p>Antihistaminic agents: Histamine, receptors and their distribution in the human body</p> <p>H1-antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium</p> <p>H2-antagonists: Cimetidine*, Famotidine, Ranitidin</p> <p>Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole</p> <p>Anti-neoplastic agents:</p> <p>Alkylating agents: Meclorothamine*, Cyclophosphamide, Melphalan</p> <p>Chlorambucil, Busulfan, Thiotepa</p> <p>Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine</p> <p>Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin</p> <p>Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate</p> <p>Miscellaneous: Cisplatin, Mitotane.</p>	10	CO1 CO2 CO3 CO4 CO5
[2]	<p>Anti-anginal:</p> <p>Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole</p> <p>Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem</p>	10	CO1 CO2 CO3 CO4

	hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine Diuretics: Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride. Osmotic Diuretics: Mannitol Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.		CO5
[3]	Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcaïnide hydrochloride, Amiodarone, Sotalol Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan	10	CO1 CO2 CO3 CO4 CO5
[4]	Drugs acting on Endocrine system Nomenclature, Stereochemistry and metabolism of steroids Sex hormones: Testosterone, Nandrolone, Progestrones, Oestriol, Oestradiol, Oestrone, Diethyl stilbestrol Drugs for erectile dysfunction: Sildenafil, Tadalafil Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrel Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole	08	CO1 CO2 CO3 CO4 CO5
[5]	Antidiabetic agents: Insulin and its preparations Sulfonylureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acarbose, Voglibose. Local Anesthetics: SAR of Local anesthetics Benzoic Acid derivatives; Cocaine, Hexylcaine, Mepylcaine, Cyclomethycaine, Piperocaine Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine. Miscellaneous: Phenacaine, Dipreron, Dibucaine.*	07	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Alagarsamy, V. Textbook of Medicinal Chemistry, Volume I and Volume II, 3rd ed.; CBS Publishers, India, 2016
2. Kadam, S.S., Mahadik, K.R., Bothara, K.G. Principles of Medicinal Chemistry, Volume I and II, 20th ed.; Nirali Prakashan, India, 2010

D. REFERENCE BOOKS

1. Hansch, C., Semmes, P.G., Taylor, J.B. Comprehensive Medicinal Chemistry, Volume I to VI, 1st ed.; Elsevier, India, 2005
2. Abraham, D.J. Burger's Medicinal Chemistry and Drug Discovery, Volume I to VI, 6th ed.; Wiley-Interscience, New Jersey, 2003
3. Lemke, T.L., Williams, D.A. FOYE'S Principles of Medicinal Chemistry, 7th ed.; Lippincott Williams & Wilkins, Baltimore, 2013
4. Baele, J.M., Block J. H. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th ed.; Lippincott Williams & Wilkins; Baltimore, 2011
5. Lendnicher, D., Mitscher, L.A. The Organic Chemistry of Drug Synthesis, Volume I to VI, Wiley-Interscience, New Jersey, 2008
6. Johnson, D.S., Li, J.J. Art of Drug Synthesis, 1st ed.; Wiley-Interscience, New Jersey, 2007
7. Smith, J.H., Williams, H. Smith and Williamson's Introduction to the Principles of Drug Design and Action, 3rd ed; CRC Press, The Netherlands, 2005
8. Vardanyan, R., Hruby, V. Synthesis of Essential Drugs, Volume I & II, 1st ed.; Elsevier, The Netherlands, 2006

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To describe classification and chemistry of drugs
CO2	Understand and remember	To discuss mechanism of action of various drugs
CO3	Understand and remember	To explain drug metabolic pathways and adverse effects of drugs
CO4	Analysis	To explain Structural Activity Relationship of different class of drugs
CO5	Apply	To describe synthesis of selected drugs.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	1	-	-	-	-	-	-	3	2	3	1	1	-
CO2	3	-	2	2	-	-	-	-	-	-	3	2	3	1	2	-
CO3	3	-	1	1	-	-	-	-	-	-	3	2	3	1	2	-
CO4	3	-	2	1	-	-	-	-	-	-	3	2	3	1	1	-
CO5	3	3	3	2	3	-	-	-	-	3	3	2	3	3	2	3
Avg	3	0.6	1.8	1.4	0.6	-	-	-	-	0.6	3	2	3	1.4	1.6	0.6

B. PHARM. SEMESTER – V (BPH)
SUBJECT: INDUSTRIAL PHARMACY I-THEORY (BP502T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

Objectives: Upon completion of the course the student shall be able to

- Know the various pharmaceutical dosage forms and their manufacturing techniques.
- Know various considerations in development of pharmaceutical dosage forms
- Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Pre-formulation Studies: Introduction to pre-formulation, goals and objectives, study of physicochemical characteristics of drug substances. a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significant Application of pre-formulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.	07	CO1
[2]	Tablets: a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems, equipments and tablet tooling. b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. c. Quality control tests: In process and finished product tests Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia	10	CO2 CO3
[3]	Capsules: a. Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules. b. soft gelatin capsules: Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications. Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets	08	CO2 CO3

[4]	Parenteral Products: a. Definition, types, advantages and limitations. Pre-formulation factors and essential requirements, vehicles, additives, importance of isotonicity b. Production procedure, production facilities and controls, aseptic processing c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products. d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products. Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labelling, containers; evaluation of ophthalmic preparations	10	CO2 CO3
[5]	Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens. Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies. Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.	10	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.

D. REFERENCE BOOKS

1. Lieberman, H. A. Pharmaceutical Dosage Forms. Tablets, Vol. 1; New York, Ny Dekker, 1989.
2. Lieberman, H. A.; Lachmann, L.; Kenneth Edwards Avis. Pharmaceutical Dosage Forms : Parenteral Medications; Vol-1-3; M. Dekker: New York, 1984.
3. Lieberman, H. A.; Rieger, M. M.; Banker, G. S. Pharmaceutical Dosage Forms-- Disperse Systems. Volume 1- 3; Dekker: New York, 1998.
4. Banker, G. S.; Rhodes, C. T. Modern Pharmaceutics; Marcel Dekker: New York, 2002.
5. Beringer, P. Remington : The Science and Practice of Pharmacy.; Lippincott Williams & Wilkins: Philadelphia ; London, 2011.
6. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
7. Ansel, H. C. Introduction to Pharmaceutical Dosage Forms; Lea & Febiger: Philadelphia, 1985.
8. Rhodes, C. T.; Jens Thurø Carstensen. Drug Stability : Principles and Practices; Marcel Dekker: New York, 2000.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	To understand pre-formulation considerations in development of pharmaceutical dosage forms.
CO2	Remember, Understand and Evaluate	To get knowledge of various pharmaceutical dosage forms and their manufacturing techniques.
CO3	Understand Apply and Evaluate	To understand various quality control test for pharmaceutical dosage forms and apply it to maintain quality drug product.
CO4	Understand and Remember	To know packaging requirements and evaluate various packaging materials for pharmaceutical dosage forms.
CO5	Understand	To understand formulation and preparation of cosmetic products.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	1	-	1	1	-	2	3	3	3	2	1	1
CO2	3	3	3	3	1	2	1	1	3	1	3	3	3	1	1	1
CO3	3	1	3	3	1	3	1	1	1	-	3	3	3	2	2	2
CO4	3	1	3	3	1	3	1	1	3	-	3	3	3	1	2	2
CO5	3	3	2	3	1	2	1	1	3	2	3	3	3	1	1	1
Avg	3	2.2	3	3	1	2	1	1	2	1	3	3	3	1.4	1.4	1.4

B. PHARM. SEMESTER – V (BPH)
SUBJECT: PHARMACOLOGY-II–THEORY (BP503T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.

Objectives: Upon completion of this course the student should be able to

- Understand the mechanism of drug action and its relevance in the treatment of different diseases
- Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
- Demonstrate the various receptor actions using isolated tissue preparation
- Appreciate correlation of pharmacology with related medical sciences

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Pharmacology of drugs acting on cardio vascular system a. Introduction to hemodynamic and electrophysiology of heart. b. Drugs used in congestive heart failure c. Anti-hypertensive drugs. d. Anti-anginal drugs. e. Anti-arrhythmic drugs. f. Anti-hyperlipidaemia drugs.	10	CO1, CO2, CO4.
[2]	Pharmacology of drugs acting on cardio vascular system a. Drug used in the therapy of shock. b. Haematinics, coagulants and anticoagulants. c. Fibrinolytics and anti-platelet drugs d. Plasma volume expanders Pharmacology of drugs acting on urinary system a. Diuretics b. Anti-diuretics.	10	CO1, CO2, CO4.
[3]	Autacoids and related drugs a. Introduction to autacoids and classification b. Histamine, 5-HT and their antagonists. c. Prostaglandins, Thromboxane's and Leukotrienes. d. Angiotensin, Bradykinin and Substance P. e. Non-steroidal anti-inflammatory agents f. Anti-gout drugs g. Anti-rheumatic drugs	10	CO1, CO3, CO5.
[4]	Pharmacology of drugs acting on endocrine system a. Basic concepts in endocrine pharmacology. b. Anterior Pituitary hormones-analogues and their inhibitors. c. Thyroid hormones-analogues and their inhibitors.	08	CO1, CO3, CO4.

	d. Hormones regulating plasma calcium level-Parathormone, Calcitonin and Vitamin-D. e. Insulin, Oral Hypoglycaemic agents and glucagon. f. ACTH and corticosteroids.		
[5]	Pharmacology of drugs acting on endocrine system a. Androgens and Anabolic steroids. b. Estrogens, progesterone and oral contraceptives. c. Drugs acting on the uterus. Bioassay a. Principles and applications of bioassay. b. Types of bioassay c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT.	07	CO3, CO4, CO5.

C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; Mcgraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; Knollmann B. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; Mcgraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Understand the mechanism of drug action and its relevance in the treatment of different diseases.
CO2	Understand and apply	Correlate the pathophysiology and mechanism of drug action of drugs and its application in treatment of the disease.
CO3	Create, Remember and Evaluate	Create the choice of medicine based on various receptor actions using isolated tissue preparation.
CO4	Understand and Remember	Appreciate correlation of pharmacology with related medical sciences.
CO5	Understand, analyse and Evaluate	Apply clinical skills in ethical practice in pharmacy practice.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	3	3	-	3	3	2	3	-	3	3	3	3	2	3
CO2	3	-	3	3	-	3	3	1	3	-	3	3	3	3	2	3
CO3	3	-	3	3	-	3	3	2	3	-	3	3	3	3	2	3
CO4	3	-	3	3	-	3	3	1	3	-	3	3	3	3	2	3
CO5	3	-	3	3	-	3	3	-	3	-	3	2	3	3	2	3
Avg	3	-	3	3	-	3	3	1.2	3	-	3	2.8	3	3	2	3

B. PHARM. SEMESTER – V (BPH)
SUBJECT: PHARMACOGNOSY & PHYTOCHEMISTRY-II -THEORY (BP504T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and Phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine

Objectives: Upon completion of the course, the student shall be able

- To know the modern extraction techniques, characterization and identification of the herbal drugs and Phytoconstituents.
- To understand the preparation and development of herbal formulation.
- To understand the herbal drug interactions.
- To carryout isolation and identification of phytoconstituents.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Metabolic pathways in higher plants and their determination a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway. b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.	07	CO1
[2]	General introduction, composition, chemistry & chemical classes, biological source, therapeutic uses and commercial applications of following secondary metabolites: Alkaloids: Vinca, Rauwolfia, Belladonna, Opium, Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander, Tannins: Catechu, Pterocarpus Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony Glycosides: Senna, Aloes, Bitter Almond Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids.	14	CO5
[3]	Isolation, Identification and Analysis of Phytoconstituents a) Terpenoids: Menthol, Citral, Artemisin b) Glycosides: Glycyrrhetic acid & Rutin c) Alkaloids: Atropine, Quinine, Reserpine, Caffeine d) Resins: Podophyllotoxin, Curcumin.	06	CO2 CO3
[4]	Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine.	10	CO4

[5]	Basics of Phytochemistry Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.	08	CO2
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C. TEXT BOOKS

1. Dr. Shukla P., Dr. Shashi, A. & Dr. Shukla P., "Pharmacognosy & Phytochemistry-II" NiraliPrakashan, 1st Edition, 2019.
2. Kabra, A., Dr. Ashok PK. & Setia, S., A textbook of "Pharmacognosy & Phytochemistry-II", Pee Vee, S. Vikas & Company Medical Publishers, 2019.

D. REFERENCE BOOKS

1. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry", 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
2. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
3. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
4. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
5. Jarald EE. & Jarald SE., "Textbook of Pharmacognosy & Phytochemistry" 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.
6. Dr. Sudha T., Mrs. Rajeshwari, R., Dr. Ravikumar VR. & Dr. Nimbakar TP., Current trend in "Pharmacognosy & Phytochemistry-II" Part-2, PV Publication, 2019.
7. Dr. Das K., "Pharmacognosy & Phytochemistry-II" 1st Edition, NiraliPrakashan, 2019.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To describe various metabolic pathways and formation of different metabolites
CO2	Understand and apply	To explain conventional and modern extraction techniques for phytoconstituents and apply analytical techniques.
CO3	Apply and evaluate	To evaluate phytoconstituents by Isolation, identification and estimation.
CO4	Analyse	To analyse industrial production and estimate of important phytoconstituents.
CO5	Remember and understand	To discuss the chemistry and commercial applications of natural crude drugs.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	-	1	-	1	2	1	3	3	2	3	1	1
CO2	3	2	2	3	-	2	1	2	2	2	2	3	2	3	2	1
CO3	3	2	3	3	-	2	1	2	2	2	2	3	2	3	2	1
CO4	3	2	2	3	-	2	2	2	3	3	3	3	3	3	2	1
CO5	3	2	2	3	-	3	2	2	3	3	3	3	3	3	3	1
Avg	3	2	2	3	0	2	1.2	1.8	2.4	2.2	2.6	3	2.4	3	2	1

B.PHARM. SEMESTER – V (BPH)
SUBJECT: PHARMACEUTICAL JURISPRUDENCE–THEORY (BP505T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India.

Objectives: Upon completion of the course, the student shall be able to understand:

- The Pharmaceutical legislations and their implications in the development and marketing of Pharmaceuticals.
- Various Indian pharmaceutical Acts and Laws.
- The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
- The code of ethics during the pharmaceutical practice.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Drugs and Cosmetics Act, 1940 and its rules 1945: Objectives, Definitions, Legal definitions of schedules to the Act and Rules Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties. Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.	10	CO3 CO4
[2]	Drugs and Cosmetics Act, 1940 and its rules 1945. Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties. Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors.	10	CO3 CO4
[3]	Pharmacy Act –1948: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.	10	CO3 CO4 CO5

	Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties.		
[4]	Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties. Prevention of Cruelty to animals Act-1960: Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties. National Pharmaceutical Pricing Authority: Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM).	08	CO3 CO4
[5]	Pharmaceutical Legislations – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee. Code of Pharmaceutical ethics: Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath Medical Termination of Pregnancy Act : Right to Information Act: Introduction to Intellectual Property Rights (IPR):	07	CO1 CO2 CO3

C. TEXT BOOKS

1. Dua, J. and Sharma, S., "Pharmaceutical Jurisprudence", S Vikas and Company, Pee vee publishers, India, 2019.
2. Jani, GK., "Pharmaceutical Jurisprudence, Forensic Pharmacy", Atul Prakashan, India, 2019

D. REFERENCE BOOKS

1. Jain, NK., "A text book of Forensic Pharmacy" Second edition-Reprint, Vallabh Prakashan, 2007.
2. Mithal, BM., "Text book of Forensic Pharmacy" first edition, Vallabh Prakashan, 1988.
3. Suresh, B., A text book of "Forensic Pharmacy" 20th edition, Birla publication PVT. LTD., 2019.
4. Government of India, Ministry of Health and Family Welfare, "Drugs and Cosmetics Act and Rules" 2016.
5. Dr. Agrawal, SP. And Dr. Khanna, R., "Pharmaceutical Jurisprudence And Ethics" 5th edition, Birla publication PVT. LTD., 2008.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Describe and apply the Pharmaceutical legislations in the development and marketing of pharmaceuticals.
CO2	Understand, Remember and Apply	Discuss the code of ethics during the pharmaceutical practice.
CO3	Understand and remember	Explain basic principle of Indian pharmaceutical Acts and Laws.
CO4	Understand and remember	Describe the concept of the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
CO5	Understand, Remember and Apply	Explain and apply Pharmacy act.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	-	2	2	3	2	2	-	3	3	2	1	3	1
CO2	3	1	2	-	2	2	3	2	2	-	3	3	2	1	3	1
CO3	3	2	2	-	2	2	3	2	2	-	3	3	2	2	3	1
CO4	3	2	2	-	2	2	3	2	2	-	3	3	2	2	3	1
CO5	3	2	2	-	2	2	3	2	2	-	3	3	2	2	3	1
Avg	3	1.6	2	-	2	2	3	2	2	-	3	3	2	1.6	3	1

B. PHARM. SEMESTER – V (BPH)
SUBJECT: INDUSTRIAL PHARMACY I -PRACTICAL (BP506P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: Course enables the student to understand and apply various manufacturing techniques to formulate different pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- To design pre-formulation protocol and evaluation of various preformulation parameters for drugs.
- To prepare and evaluate different dosage forms like tablets, capsules, liquids, semisolids, sterile etc.
- To formulate cosmetic products.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Preformulation studies on paracetamol/aspirin/or any other drug 2. Preparation and evaluation of Paracetamol tablets 3. Preparation and evaluation of Aspirin tablets 4. Coating of tablets- film coating of tables/granules 5. Preparation and evaluation of Tetracycline capsules 6. Preparation of Calcium Gluconate injection 7. Preparation of Ascorbic Acid injection 8. Quality control test of (as per IP) marketed tablets and capsules 9. Preparation of Eye drops/ and Eye ointments 10. Preparation of Creams (cold / vanishing cream) 11. Evaluation of Glass containers (as per IP)	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Goudanavar, Prakash. Practical Manual for Industrial Pharmacy I: As per Syllabus Prescribed by PCI for B. Pharm v Sem; Orange Books Publication, 2020.
2. Patil, Ketan., Patil, Paresh., Patil, Narendra., Kshirsagar, Sandip. The Theory and Practical Book of Industrial Pharmacy-I; Ip Innovative Publication Pvt. Ltd: New Delhi, 2020.

D. REFERENCE BOOKS

1. Kohli, D. P. S.; Shah, D. H. Drug Formulations Manual; Business Horizons: New Delhi, 2012.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Apply and Create	To apply knowledge of preformulation in designing preformulation protocol and designing dosage forms.
CO2	Create and Evaluate	To prepare and evaluate tablet, capsules, of different APIs
CO3	Create and Evaluate	To prepare and evaluate sterile dosage form like injections and ophthalmic products.
CO4	Create	To prepare cosmetic products.
CO5	Evaluate	Evaluation of packaging materials for dosage forms as per pharmacopoeial standards.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	1	3	2	3	3	3	3	3	3	1
CO2	3	3	3	3	1	2	3	3	3	3	3	3	3	3	3	2
CO3	3	3	3	3	1	2	3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	1	3	1	3	3	3	3	3	3	3	3	2
CO5	3	3	3	3	1	2	3	3	3	3	3	3	3	3	3	3
Avg	3	3	3	3	1.2	2.6	2.2	3	3	3	3	3	3	3	3	3

B.PHARM. SEMESTER – V (BPH)
SUBJECT: PHARMACOLOGY-II-PRACTICAL (BP507P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.

Objectives: Upon completion of this course the student should be able to

- Perform different types of bioassay.
- Isolate different organs/tissues from the laboratory animals by simulated experiments.
- Analyse various receptor actions using isolated tissue preparation.
- Evaluate and analyse different types of analgesic and anti-inflammatory drugs
- To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1) Introduction to in-vitro pharmacology and physiological salt solutions. 2) Effect of drugs on isolated frog heart. 3) Effect of drugs on blood pressure and heart rate of dog. 4) Study of diuretic activity of drugs using rats/mice. 5) DRC of acetylcholine using frog rectus abdominis muscle. 6) Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis-muscle and rat ileum respectively. 7) Bioassay of histamine using guinea pig ileum by matching method 8) Bioassay of oxytocin using rat uterine horn by interpolation method. 9) Bioassay of serotonin using rat fundus strip by three point bioassay. 10) Bioassay of acetylcholine using rat ileum/colon by four point bioassay. 11) Determination of PA ₂ value of prazosin using rat anococcygeus muscle (by Schilds plot method). 12) Determination of PD ₂ value using guinea pig ileum. 13) Effect of spasmogens and spasmolytic using rabbit jejunum. 14) Anti-inflammatory activity of drugs using carrageenan induced paw-oedema model. 15) Analgesic activity of drug using central and peripheral methods.	60	CO1, CO2, CO3, CO4, CO5.

C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; McGraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; Knollmann B. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; McGraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Perform, Apply and Quantify.	Perform different types of bioassay.
CO2	Understand and Isolate	Isolate different organs/tissues from the laboratory animals by simulated experiments.
CO3	Analyse	Analyse various receptor actions using isolated tissue preparation.
CO4	Analyse and Evaluate.	Evaluate and analyse different types of analgesic and anti-inflammatory drugs
CO5	Evaluate and analyse	To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	2	3	3	3	3	2	3	3	3	3	3	2	2	3	3
CO3	3	2	3	3	3	3	2	3	3	2	2	3	3	3	3	3
CO4	3	2	3	3	3	3	2	3	3	2	2	3	1	3	2	3
CO5	3	2	3	3	3	3	3	3	3	2	2	3	2	3	2	3
Avg	3	2	3	3	3	3	2.4	3	3	2.4	2.8	3	2.4	2.8	2.6	3

B. PHARM. SEMESTER – V (BPH)
SUBJECT: PHARMACOLOGY-II-PRACTICAL (BP507P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.

Objectives: Upon completion of this course the student should be able to

- Understand the mechanism of drug action and its relevance in the treatment of different diseases
- Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
- Demonstrate the various receptor actions using isolated tissue preparation
- Appreciate correlation of pharmacology with related medical sciences

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	1) Introduction to in-vitro pharmacology and physiological salt solutions. 2) Effect of drugs on isolated frog heart. 3) Effect of drugs on blood pressure and heart rate of dog. 4) Study of diuretic activity of drugs using rats/mice. 5) DRC of acetylcholine using frog rectus abdominis muscle. 6) Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis-muscle and rat ileum respectively. 7) Bioassay of histamine using guinea pig ileum by matching method 8) Bioassay of oxytocin using rat uterine horn by interpolation method. 9) Bioassay of serotonin using rat fundus strip by three point bioassay. 10) Bioassay of acetylcholine using rat ileum/colon by four point bioassay. 11) Determination of PA ₂ value of prazosin using rat anococcygeus muscle (by Schilds plot method). 12) Determination of PD ₂ value using guinea pig ileum. 13) Effect of spasmogens and spasmolytic using rabbit jejunum. 14) Anti-inflammatory activity of drugs using carrageenan induced paw-oedema model. 15) Analgesic activity of drug using central and peripheral methods.	45	CO1, CO2, CO3, CO4, CO5.

C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; McGraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; Knollmann B. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; McGraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Perform, Apply and Quantify.	Perform different types of bioassay.
CO2	Understand and Isolate	Isolate different organs/tissues from the laboratory animals by simulated experiments.
CO3	Analyse	Analyse various receptor actions using isolated tissue preparation.
CO4	Analyse and Evaluate.	Evaluate and analyse different types of analgesic and anti-inflammatory drugs
CO5	Evaluate and analyse	To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	3	-	-	3	3	3	-	-	3	3	3	3	3
CO2	3	-	3	3	-	-	3	3	3	-	-	3	2	2	3	3
CO3	3	-	3	3	-	-	3	3	3	-	-	3	3	3	3	3
CO4	3	-	3	3	-	-	3	3	3	-	-	3	1	3	2	3
CO5	3	1	3	3	-	-	3	3	3	-	-	3	2	3	2	3
Avg	3	0.4	3	3	-	-	3	3	3	-	-	3	2.4	2.8	2.6	3

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: MEDICINAL CHEMISTRY III -THEORY (BP601T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

Objectives: Upon completion of the course student shall be able to

- Understand the importance of drug design and different techniques of drug design.
- Understand the chemistry of drugs with respect to their biological activity.
- Know the metabolism, adverse effects and therapeutic value of drugs.
- Know the importance of SAR of drugs.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Classification, mechanism of action, uses, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*) of following class of drugs in all units. Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. β-Lactam antibiotics: Penicillin, Cephalosporins, β- Lactamase inhibitors, Monobactams Aminoglycosides: Streptomycin, Neomycin, Kanamycin Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline	10	CO1 CO2 CO3 CO4
[2]	Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. Macrolide: Erythromycin Clarithromycin, Azithromycin Miscellaneous: Chloramphenicol*, Clindamycin Prodrugs: Basic concepts and application of prodrugs design Antimalarials: Etiology of malaria Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovaquone	10	CO1 CO2 CO3 CO4 CO5
[3]	Anti-tubercular Agents	10	CO1

	<p>Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*</p> <p>Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycin, Capreomycin sulphate</p> <p>Urinary tract anti-infective agents</p> <p>Quinolones: SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin</p> <p>Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine</p> <p>Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirdine, Ribavirin, Saquinavir, Indinavir, Ritonavir</p>		CO2 CO3 CO4 CO5
[4]	<p>Antifungal agents:</p> <p>Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.</p> <p>Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconazole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.</p> <p>Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.</p> <p>Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.</p> <p>Sulphonamides and Sulfones Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine</p> <p>Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole</p> <p>Sulfones: Dapsone*</p>	08	CO1 CO2 CO3 CO4 CO5
[5]	<p>Introduction to Drug Design Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett's electronic parameter, Taft's steric parameter and Hansch analysis.</p> <p>Pharmacophore modeling and docking techniques.</p> <p>Combinatorial Chemistry: Concept and applications chemistry: solid phase and solution phase synthesis.</p>	07	CO1

C. TEXT BOOKS

1. Alagarsamy, V. Textbook of Medicinal Chemistry, Volume I and Volume II, 3rd ed.; CBS Publishers, India, 2016
2. Kadam, S.S., Mahadik, K.R., Bothara, K.G. Principles of Medicinal Chemistry, Volume I and II, 20th ed.; Nirali Prakashan, India, 2010

D. REFERENCE BOOKS

1. Hansch, C., Semmes, P.G., Taylor, J.B. Comprehensive Medicinal Chemistry, Volume I to VI, 1st ed.; Elsevier, India, 2005
2. Abraham, D.J. Burger's Medicinal Chemistry and Drug Discovery, Volume I to VI, 6th ed.; Wiley-Interscience, New Jersey, 2003
3. Lendnicher, D., Mitscher, L.A. The Organic Chemistry of Drug Synthesis, Volume I to VI, Wiley-Interscience, New Jersey, 2008
4. Johnson, D.S., Li, J.J. Art of Drug Synthesis, 1st ed.; Wiley-Interscience, New Jersey, 2007
5. Patrick, G.L. An Introduction to Medicinal Chemistry, 3rd ed.; Oxford University Press, Oxford, 2006
6. Silverman, R.B. The Organic Chemistry of Drug Design and Drug Action, 2nd ed.; Academic Press, Burlington, 2004
7. Lemke, T.L., Williams, D.A. FOYE'S Principles of Medicinal Chemistry, 7th ed.; Lippincott Williams & Wilkins, Baltimore, 2013
8. Baele, J.M., Block J. H. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th ed.; Lippincott Williams & Wilkins; Baltimore, 2011
9. Smith, J.H., Williams, H. Smith and Williamson's Introduction to the Principles of Drug Design and Action, 3rd ed; CRC Press, The Netherlands, 2005
10. Vardanyan, R., Hruby, V. Synthesis of Essential Drugs, Volume I & II, 1st ed.; Elsevier, The Netherlands, 2006

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To explain the fundamentals of drug design, different techniques of drug design and combinatorial chemistry
CO2	Understand and remember	To describe classification and chemistry of drugs
CO3	Understand and remember	To discuss action of drugs, their metabolism, adverse effects and therapeutic value of drugs
CO4	Analysis	To explain structural activity relationship of different class of drugs
CO5	Apply	To describe synthesis of selected drugs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	2	-	-	-	-	-	-	3	2	2	3	2	1
CO2	3	-	2	1	-	-	-	-	-	-	3	2	3	2	1	1
CO3	3	-	2	2	-	-	-	-	-	-	3	2	2	3	1	1
CO4	3	-	2	1	-	-	-	-	-	-	3	2	1	3	2	1
CO5	3	3	3	3	3	-	-	-	-	3	3	2	2	3	2	3
Avg	3	0.6	2	1.8	0.6	-	-	-	-	0.6	3	2	2	2.8	1.6	1.4

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: PHARMACOLOGY-III–THEORY (BP602T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and Chrono pharmacology.

Objectives: Upon completion of this course the student should be able to:

- understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
- comprehend the principles of toxicology and treatment of various poisonings and
- appreciate correlation of pharmacology with related medical sciences

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Pharmacology of drugs acting on Respiratory system a. Anti-asthmatic drugs b. Drugs used in the management of COPD c. Expectorants and antitussives d. Nasal decongestants e. Respiratory stimulants Pharmacology of drugs acting on the Gastrointestinal Tract a. Antiulcer agents. b. Drugs for constipation and diarrhoea. c. Appetite stimulants and suppressants. d. Digestants and carminatives. e. Emetics and anti-emetics.	10	CO1, CO2, CO3.
[2]	Chemotherapy a. General principles of chemotherapy. b. Sulphonamides and cotrimoxazole. c. Antibiotics- Penicillin's, cephalosporin's, chloramphenicol, macrolides, quinolones and fluoroquinolones, tetracycline and aminoglycosides	10	CO1, CO2, CO3.
[3]	Chemotherapy a. Anti-tubercular agents b. Anti-leprotic agents c. Anti-fungal agents d. Antiviral drugs e. Anthelmintics f. Antimalarial drugs g. Anti-amoebic agents	10	CO1, CO2, CO3.
[4]	Chemotherapy Urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy.	08	CO4, CO5.

	Immunopharmacology a.Immunostimulants b. Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilar.		
[5]	Principles of toxicology a. Definition and basic knowledge of acute, subacute and chronic toxicity. b. Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity c. General principles of treatment of poisoning. d. Clinical symptoms and management of barbiturates, morphine, organophosphorus compound and lead, mercury and arsenic poisoning. Chronopharmacology a. Definition of rhythm and cycles. b. Biological clock and their significance leading to chronotherapy.	07	CO4, CO5.

C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; Mcgraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; Knollmann B. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; Mcgraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.
10. N Udupa; Gupta, P. D. *Concepts in Chronopharmacology*; Shyam Prakashan: Jaipur, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases.
CO2	Understand and Apply	Understand the resistance mechanism of drug action in the treatment of different infectious diseases.
CO3	Remember, Evaluate and Apply	Select the drug, its necessity, frequency, duration, prophylaxis and test for cure of the treatment of infectious diseases.
CO4	Understand, Remember and Apply	Appreciate correlation of pharmacology with related medical sciences and Chrono-pharmacology.
CO5	Understand, Evaluate and analyse	Comprehend the principles of toxicology and treatment of various poisonings.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	3	3	3	2	3	1	3	1	3	3	-	3	3	3
CO2	3	-	3	3	3	1	3	1	3	3	2	3	-	3	3	3
CO3	3	1	3	3	2	2	3	2	3	2	2	3	-	3	3	3
CO4	3	1	3	3	3	1	3	3	3	3	3	3	-	3	3	3
CO5	3	1	3	3	3	2	3	1	3	1	3	3	-	3	3	3
Avg	3	0.6	3	3	2.8	1.6	3	1.6	3	2.2	2.6	3	-	3	3	3

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: HERBAL DRUG TECHNOLOGY–THEORY (BP603T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

Objectives: Upon completion of this course the student should be able to:

- Understand raw material as source of herbal drugs from cultivation to herbal drug product
- Know the WHO and ICH guidelines for evaluation of herbal drugs
- Know the herbal cosmetics, natural sweeteners, nutraceuticals
- Appreciate patenting of herbal drugs, GMP.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Herbs as raw materials Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation. Source of Herbs, Selection, identification and authentication of herbal materials Processing of herbal raw material Biodynamic Agriculture Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides. Indian Systems of Medicine a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asavas, Ghutika, Churna, Lehya and Bhasma.	11	CO1 CO5
[2]	Nutraceuticals General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypericum, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.	07	CO3
[3]	Herbal Cosmetics Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products. Herbal excipients:	10	CO3 CO5

	Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes. Herbal formulations : Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes		
[4]	Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. Patenting and Regulatory requirements of natural products: a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.	10	CO2 CO4
[5]	General Introduction to Herbal Industry Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Schedule T–Good Manufacturing Practice of Indian systems of medicine Components of GMP (Schedule–T) and its objectives, Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.	07	CO3 CO4

C. TEXT BOOKS

1. Dr. Arora, P. & Dr. Arora, V., A text book of “Herbal Drug Technology” Pee Vee Books, S. Vikas & Company (Medical Publishers) ,2019.
2. Dr. Lodhi, S., Dr. Usman, R. Md ., Dr. Deshmukh Ta., Darvekar, VM. & Dr. Kori ML., “Herbal Drug Technology”, 1st Edition, Nirali Prakashan, 2019.

D. REFERENCE BOOKS

1. Dr. Mukherjee, PK. & Dr. Verpoorte, R., “GMP for Botanicals” 1st Edition, Business Horizons Pharmaceutical Publishers, 2003.
2. Dr. Mukherjee, PK.”Quality Control of Herbal Drugs: An Approach to Evaluation of botanicals” 1st Edition reprint, Elsevier Science Publication, 2017.
3. Agrawal, SS. & Paridhavi M., “Herbal Drug Technology” 2nd edition, Orient Blackswan , 2012.
4. Shah, B., & Seth, AK., “Textbook of Pharmacognosy & Phytochemistry” , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
5. Rangari VD., “Pharmacognosy & Phytochemistry” Volume-I 3rd Edition, Career Publications, 2017.
6. Rangari VD., “Pharmacognosy & Phytochemistry” Volume-II 3rd Edition, Career Publications, 2017.
7. Quadry, JS., “Textbook of Pharmacognosy (Theory & Practical)” 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
8. Dr. Shinde, VM. & Mrs. Bodas-yadav, KS., “Herbal Drug Technology”, 2nd edition, Nirali Prakashan, 2020.
9. Dr. Tiwari V., “Herbal Drug Technology”, 1st edition, Nirali Prakashan, 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	Describe concept of raw material as source of herbal drugs from cultivation for herbal drug production.
CO2	Understand, Remember and Apply	Application of WHO and ICH guidelines for standardisation of herbal drugs.
CO3	Understand and Remember	Explain the concept of herbal medicines, Herbal cosmetics and nutraceuticals and herbal industry.
CO4	Understand and Apply	Describe Good manufacturing practice, Patenting and Regulatory requirements of natural products.
CO5	Understand and Analyse	Detail description and analysis of various ayurvedic formulations.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	-	2	2	1	2	1	3	3	2	2	-	1
CO2	3	2	2	2	-	2	3	1	2	1	3	3	2	2	3	1
CO3	3	2	2	2	-	2	2	1	3	1	3	3	2	2	-	1
CO4	3	2	2	2	-	2	3	1	3	1	3	3	2	2	3	1
CO5	3	2	2	2	-	2	2	1	2	1	3	3	2	2	3	1
Avg	3	2	2	2	-	2	2.4	1	2.4	1	3	3	2	2	1.8	1

B. PHARM. SEMESTER – VI (BPH)**SUBJECT: BIOPHARMACEUTICS AND PHARMACOKINETICS-THEORY (BP604T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart knowledge and skills of Biopharmaceutics and pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arising therein.

Objectives: Upon completion of the course student shall be able to:

- Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
- Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
- To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
- Understand various pharmacokinetic parameters, their significance & applications.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Biopharmaceutics Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption through GIT, absorption of drug from Non-per oral extra-vascular routes. Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs	10	CO1
[2]	Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non-renal routes of drug excretion of drugs Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, <i>in-vitro</i> drug dissolution models, <i>in-vitro-in-vivo</i> correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.	10	CO1 CO5
[3]	Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non-compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - KE , $t_{1/2}$, V_d , AUC , K_a , Cl_t and CLR - definitions methods of eliminations, understanding of their significance and application.	08	CO1 CO2 CO5
[4]	Multicompartment models: Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.	8	CO2 CO4
[5]	Nonlinear Pharmacokinetics:	7	CO2

	a. Introduction, b. Factors causing Non-linearity. c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.		CO4
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C. TEXT BOOKS

1. Brahankar, D. M.; Jaiswal, S. B. *Biopharmaceutics and Pharmacokinetics : A Treatise*; Vallabh Prakashan: Delhi, 2014.

D. REFERENCE BOOKS

1. Abdou, H. M. Dissolution, Bioavailability and Bioequivalence; Mack Publishing Company: Easton, 1989.
2. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics; Lea & Febiger: Philadelphia, 1984.
3. Gibaldi, M.; Perrier, D. Pharmacokinetics; Infroma Healthcare: New York, 2007.
4. Notari, R. E. Biopharmaceutics and Pharmacokinetics : An Introduction; M. Dekker: New York, 1975.
5. Notari, R. E. Biopharmaceutics and Clinical Pharmacokinetics : An Introduction; M. Dekker: New York, 1987.
6. Remington, J. P.; Gennaro, A. R. Remington's Pharmaceutical Sciences; Mack Pub. Co: Easton, Pa., 1990.
7. Rowland, M.; Tozer, T. N. Clinical Pharmacokinetics and Pharmacodynamics : Concepts and Applications; Wolters Kluwer-Lippincott William & Wilkins: Philadelphia, 2011.
8. Shargel, L.; Yu, A. B. C. Applied Biopharmaceutics & Pharmacokinetics; Mcgraw-Hill Education: Singapore, 2016.
9. Gibaldi M and Prescott L, Hand Book of Clinical Pharmacokinetics, ADIS Health Science Press, 1989
10. Swarbrick, Biopharmaceutics, Lea & Febiger, U.S., 1971

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember and Understand	Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
CO2	Understand and Apply	To understand and apply plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
CO3	Understand	To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
CO4	Understand and Remember	To understand various pharmacokinetic parameters and their significance.
CO5	Apply and evaluate	To apply the IVIVC co-relation for different dosage forms.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	1	2	1	2	2	3	3	3	3	2	2
CO2	3	2	3	3	1	2	-	2	2	1	2	3	3	3	2	2
CO3	3	2	2	3	2	2	2	2	-	1	3	3	3	3	2	2
CO4	3	2	2	3	1	1	-	3	-	2	3	3	2	2	2	2
CO5	3	3	3	3	2	1	2	3	2	2	2	3	3	3	1	2
Avg	3	2.2	2.6	3	1.6	1.4	1.2	2.2	1.2	1.6	2.6	3	2.8	2.8	1.8	2

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: PHARMACEUTICAL BIOTECHNOLOGY-THEORY (BP605T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to learn biotechnology, long promise to revolutionize the biological sciences and technology. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. Biotechnology has already produced transgenic crops and animals and the future promises a lot more. It is basically a research-based subject.

Objectives: Upon completion of the course the student shall be able to understand Enzymes, Genetic engineering and fermentation technology and importance of biotechnology in industry.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. b) Enzyme Biotechnology- Methods of enzyme immobilization and applications. c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries. d) Brief introduction to Protein Engineering. e) Use of microbes in industry. Production of Enzymes- General consideration Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. f) Basic principles of genetic engineering.	10	CO1
[2]	a) Study of cloning vectors, restriction endonucleases and DNA ligase. b) Recombinant DNA technology. Application of genetic engineering in medicine. c) Application of r DNA technology and genetic engineering in the production of: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones- Insulin. d) Brief introduction to PCR	10	CO2 CO3
[3]	Types of immunity- humoral immunity, cellular immunity a) Structure of Immunoglobulins b) Structure and Function of MHC c) Hypersensitivity reactions, Immune stimulation and Immune suppressions. d) General method of the preparation of bacterial vaccines, toxoids, viral vaccines, antitoxins, serum-immune blood derivatives and other products relative to immunity. e) Storage conditions and stability of official vaccines f) Hybridoma technology- Production, Purification and Applications	10	CO5
[4]	a) Immunoblotting techniques- ELISA, Western blotting, Southern blotting. b) Genetic organization of Eukaryotes and Prokaryotes	08	CO2 CO5

	c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. d) Introduction to Microbial biotransformation and applications. e) Mutation: Types of mutation/mutants.		
[5]	a) Fermentation methods and general requirements, study of media, equipment, sterilization methods, aeration process, stirring. b) Large scale production fermenter design and its various controls. c) Study of the production of - penicillin, citric acid, Vitamin B12, Glutamic acid, Griseofulvin, d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma substitutes.	07	CO4

C. TEXT BOOKS

1. Primrose, S. B. *Molecular Biotechnology*; Blackwell Scientific Publications: Oxford ; Boston, 2001.
2. Stanbury, P. F.; Whitaker, A.; Hall, S. J. *Principles of Fermentation Technology*; 2017.

D. REFERENCE BOOKS

1. Glick, B. R.; Patten, C. L. *Molecular Biotechnology: Principles and Applications of Recombinant DNA*; Asm Press: Washington, Dc, 2017.
2. Kindt, T. J.; Goldsby, R. A.; Anne, B. *Kuby Immunology*; W.H. Freeman and Company: New York, 2007.
3. Goding, J. W. *Monoclonal Antibodies: Principles and Practice: Production and Application of Monoclonal Antibodies in Cell Biology, Biochemistry and Immunology*; Academic Press: London, 1996.
4. Walker, J. M.; Gingold, E. B. *Molecular Biology and Biotechnology*; Royal Society of Chemistry: London, 1993.
5. Zaborsky, O. R. *Immobilized Enzymes*; Krieger: Malabar, Fla., 1984.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember and Understand	To Understand the importance of Immobilized enzymes in Pharmaceutical Industries.
CO2	Remember and Understand	To learn genetic engineering applications in relation to production of pharmaceuticals
CO3	Understand and Apply	To learn Importance of Monoclonal antibodies in Industries
CO4	Understand and Remember	To learn the use of microorganisms in fermentation technology
CO5	Understand	To learn antigen-antibody reaction and immunity of Human system

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
C01	2	—	1	3	—	-	1	1	1	3	3	3	3	3	2	3
C02	2	—	2	3	—	1	1	1	2	3	3	2	3	3	3	3
C03	2	—	2	3	—	-	1	1	2	3	3	3	3	3	3	3
C04	2	—	2	3	—	2	1	1	2	3	3	3	3	3	2	3
C05	2	—	2	2	—	2	2	1	1	2	2	1	2	3	1	1
Avg	2	—	1.8	2.8	—	1	1.2	1	1.6	2.8	2.8	2.4	2.8	3	2.2	2.6

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: INSTRUMENTAL METHODS OF ANALYSIS - THEORY (BP606T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

Objectives: Upon completion of the course student shall be able to:

- understand the cGMP aspects in a pharmaceutical industry
- appreciate the importance of documentation
- understand the scope of quality certifications applicable to pharmaceutical industries
- understand the responsibilities of QA & QC departments

B. COURSE CONTENT

NO	TOPIC	L Hrs)	COs
[1]	Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP Total Quality Management (TQM): Definition, elements, philosophies ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines Quality by design (QbD): Definition, overview, elements of QbD program, tools ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration NABL accreditation: Principles and procedures	10	CO1 CO3
[2]	Organization and personnel: Personnel responsibilities, training, hygiene and personal records. Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination. Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.	10	CO1 CO3 CO4
[3]	Quality Control: Quality control test for containers, rubber closures and secondary packing materials. Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities	10	CO3 CO4
[4]	Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal. Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.	08	CO2
[5]	Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and	07	CO5

	scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation. Warehousing: Good warehousing practice, materials management		
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C. TEXT BOOKS

1. P P Sharma. *How to Practice GMPs*, 6th ed.; vandana publications Pvt. Ltd.: Delhi, 2010.
2. Hirsch, A. F. *Good Laboratory Practice Regulations*; M. Dekker: New York ; Basel, 1989.

D. REFERENCE BOOKS

1. Weinberg, S. *Good Laboratory Practice Regulations*; M. Dekker: New York, 1995.
2. World Health Organization. *Quality Assurance of Pharmaceuticals. 2: A Compendium of Guidelines and Related Materials*; 1999.
3. World Health Organization. Pharmaceuticals Programme. The International pharmacopoeia = Pharmacopoeia Internationalis. Vol. 4, Tests, methods and general requirements: quality specifications for pharmaceutical substances, excipients and dosage forms
4. ICH Official web site: ICH <http://www.ich.org/>.
5. ISO. ISO 14000 Environmental management <https://www.iso.org/iso-14001-environmental-management.html>.
6. Ghosh S K; Maitra K. *A Guide to Total Quality Management*, 4th ed.; Oxford Publishing House, 2005.
7. S K Ghosh. *Introduction to ISO 9000 and Total Quality Management*, 4th ed.; Oxford Publishing House, 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the cGMP, GLP and ICH aspects in a pharmaceutical industry
CO2	Understand Apply and Evaluate	To understand and appreciate the importance of QbD and documentation
CO3	Understand and remember	To understand the scope of quality certifications applicable to pharmaceutical industries
CO4	Understand and remember	To understand the responsibilities of QA & QC departments
CO5	Understand Apply and Evaluate	To learn the aspects of calibration, validation and Material management

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	-	-	3	3	2	2	-	3	3	3	1	2	3
CO2	3	2	2	2	-	3	3	2	2	-	3	3	3	1	2	3
CO3	3	2	1	-	-	3	3	2	2	2	3	3	3	1	2	3
CO4	3	2	1	-	2	3	3	2	2	-	3	3	3	1	2	3
CO5	3	2	1	-	-	2	2	2	2	2	3	3	3	1	2	2
Avg	3	2	1.2	0.4	0.4	2.8	2.8	2	2	0.8	3	3	3	1	2	2.8

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: MEDICINAL CHEMISTRY III -PRACTICAL (BP607P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	-	05	10	50

A. COURSE OVERVIEW

Medicinal Chemistry III practical subject imparts practical knowledge regarding synthesis and analysis of drugs by various methods via experiments in laboratory. The subject also focuses on chemical structure, reaction and mechanism drawing experiment using various offline and online tools. Experiments involving prediction of various physicochemical properties-drug likeness properties would help to understand important aspect of drug design.

Objectives: Upon completion of the course student shall be able to

- Use ChemDraw for chemical structure and reaction drawing
- Synthesize and purify organic compounds
- Perform analysis of drugs using various analytical methods

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Preparation of drugs and intermediates 1 Sulphanilamide 2 7-Hydroxy, 4-methyl coumarin 3 Chlorobutanol 4 Triphenyl imidazole 5 Tolbutamide 6 Hexamine Assay of drugs 1 Isonicotinic acid hydrazide 2 Chloroquine 3 Metronidazole 4 Dapsone 5 Chlorpheniramine maleate 6 Benzyl penicillin Preparation of medicinally important compounds or intermediates by Microwave irradiation technique Drawing structures and reactions using chem draw Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeness screening (Lipinski's RO5)	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Kar, A. Advanced Practical Medicinal Chemistry, 3rd ed.; New Age International Publishers, India, 2020
2. Vogel, A.I., Tatchell, A.R., Furniss, B.S., Smith, P.W.G. Text book of practical organic chemistry, 5th ed.; Longman Scientific and Technical; New York, 2011

C. REFERENCE BOOKS

1. Lendnicher, D., Mitscher, L.A. The Organic Chemistry of Drug Synthesis, Volume I to VI, Wiley-Interscience, New Jersey, 2008
2. Mann, F.G., Saunders, B.G., Practical Organic Chemistry, 4th ed.; Pearson, India, 2009

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Apply, analysis and evaluate	To assess the drug-likeness properties of drugs using various online tools
CO2	Understand and apply	To draw chemical structure, reaction and mechanism drawing using offline and online tools
CO3	Apply	To synthesize some drugs and intermediates by conventional synthesis
CO4	Apply	To perform synthesis of selected drugs by microwave assisted organic synthesis technique
CO5	Apply and evaluate	To carry out analysis of various drugs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	2	3	1	-	-	-	-	-	3	2	2	3	2	1
CO2	2	1	1	3	-	-	-	-	-	-	3	1	2	1	1	1
CO3	3	2	3	3	1	-	-	-	-	3	3	3	3	2	2	3
CO4	3	2	3	3	1	-	-	-	-	3	3	3	3	2	2	3
CO5	3	2	3	3	1	-	-	-	-	3	3	3	3	2	2	1
Avg	2.8	1.4	2.4	3	0.8	-	-	-	-	1.2	3	2.4	2.6	2	1.8	1.8

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: PHARMACOLOGY-III–PRACTICAL (BP608P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and Chrono pharmacology.

Objectives: Upon completion of this course the student should be able to:

- Evaluate different types of toxicity studies.
- Apply different types of statistical analysis in different pharmacological experiments.
- Analyse and evaluate various receptor actions using isolated tissue preparation.
- Create the observation data and correlate them using statistical analysis.
- To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1) Dose calculation in pharmacological experiments. 2) Anti-allergic activity by mast-cell stabilization assay. 3) Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model. 4) Study of effect of drugs on gastrointestinal motility. 5) Effect of agonist and antagonists on guinea pig ileum. 6) Estimation of serum biochemical parameters by using semi- auto analyser. 7) Effect of saline purgative on frog intestine. 8) Insulin hypoglycaemic effect in rabbit. 9) Test for pyrogens (rabbit method). 10) Determination of acute oral toxicity (LD50) of a drug from a given data. 11) Determination of acute skin irritation / corrosion of a test substance. 12) Determination of acute eye irritation /corrosion of a test substance. 13) Calculation of pharmacokinetic parameters from a given data. 14) Biostatistics methods in experimental pharmacology (student's t test, ANOVA) 15) Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)	60	CO1, CO2, CO3, CO4, CO5.

C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; McGraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; Knollmann B. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; McGraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.
10. N Udupa; Gupta, P. D. *Concepts in Chronopharmacology*; Shyam Prakashan: Jaipur, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember and Evaluate.	Evaluate different types of toxicity studies.
CO2	Apply and Analyse	Apply different types of statistical analysis in different pharmacological experiments.
CO3	Analyse an Evaluate.	Analyse and evaluate various receptor actions using isolated tissue preparation.
CO4	Create and Correlate	Create the observation data and correlate them using statistical analysis.
CO5	Evaluate and analyse	To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3
CO3	3	2	3	3	3	3	2	3	3	2	2	3	3	3	3	3
CO4	3	2	3	3	3	3	2	3	3	2	2	3	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3	2	2	3	3	3	2	3
Avg	3	2.4	3	3	3	3	2.4	3	3	2.4	2.2	3	2.6	3	2.8	3

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: HERBAL DRUG TECHNOLOGY - PRACTICAL (BP609P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

Objectives: Upon completion of this course the student should be able to:

- Understand raw material as source of herbal drugs from cultivation to herbal drug product
- Know the WHO and ICH guidelines for evaluation of herbal drugs
- Know the herbal cosmetics, natural sweeteners, nutraceuticals
- Appreciate patenting of herbal drugs, GMP.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. To perform preliminary phytochemical screening of crude drugs. 2. Determination of the alcohol content of Asava and Arista 3. Evaluation of excipients of natural origin 4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation. 5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeia requirements. 6. Monograph analysis of herbal drugs from recent Pharmacopoeias 7. Determination of Aldehyde content. 8. Determination of Phenol content 9. Determination of total alkaloids.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Dr. Usman, R. Md., Darvhekar, VM., Dr.Akhila, S. &Dr. Kumar, V., A practical Book of “Herbal Drug Technology” 1st edition, NiraliPrakashan, 2019.
2. Dr. Lodhi, S. A practical Book fo “Herbal Drug Technology” Pee Vee Books, S. Vikas & Company (Medical Publishers) ,2020.
- 3.

D. REFERENCE BOOKS

1. Dr.Khadabadi, SS., Dr.Deore, SL. & Mr. Baviskar, BA., “Experimental Phytopharmacognosy” A comprehensive Guide, 1st edition, Nirali Prakashan, 2011.
2. Dr. Mukherjee, PK. &Dr.Verpoorte, R., “GMP for Botanicals” 1st Edition, Business Horizons Pharmaceutical Publishers, 2003.
3. Dr. Mukherjee, PK.”Quality Control of Herbal Drugs: An Approach to Evaluation of botanicals” 1st Edition reprint, Elsevier Science Publication, 2017.

- Agrawal, SS. & Paridhavi M., "Herbal Drug Technology" 2nd edition, Orient Blackswan , 2012.
- Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry" , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
- Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
- Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
- Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	Analysis of Natural excipients.
CO2	create and standardise	Preparation and standardisation of herbal Products, herbal cosmetics and Ayurvedic formulations.
CO3	understand and apply	Description and application of phytochemical screening of crude drugs.
CO4	Understand and Analysis	Monograph Analysis of herbal drugs as per the Pharmacopoeial standard.
CO5	Understand and Analysis	To perform Quantitative analysis of phytoconstituents present in crude drugs.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	-	2	2	1	2	1	3	3	3	3	2	-
CO2	3	2	2	3	-	2	2	1	2	1	3	3	3	3	1	-
CO3	3	2	2	3	-	2	2	1	2	1	3	3	3	3	1	-
CO4	3	2	2	3	-	2	2	1	2	1	3	3	3	3	2	-
CO5	3	2	2	3	-	2	2	1	2	1	3	3	3	3	2	-
Avg	3	2	2	3	-	2	2	1	2	1	3	3	3	3	1.6	-

Bachelor of Pharmacy Program

Semester VII

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH711	Dosage Form Design	100	100	3	3
PH712	Medicinal Chemistry – III	100	100	3	3
PH713	Pharmaceutical Analysis – III	100	100	3	3
PH714	Pharmacognosy-V	100	100	3	3
PH715	Pharmacology & Pathophysiology-II	100	100	3	3
PH716	Pharmaceutical Management	100	-	2	-
	Total	600	500	17	15

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PH711 Dosage Form Design

Theory

3 hours/Week

No.	Chapter	Hours
01	Preformulation studies: a) Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution and organoleptic property and their effect on formulation, stability and bioavailability. b) Study of chemical properties of drugs like hydrolysis, oxidation, reduction, polymorphisms, racemization, polymerization etc., and their influence on formulation and stability of products. c) Study of prodrugs in solving problems related to stability, bioavailability and elegance of formulations.	11
02	Pharmaceutical necessities: Effect of following adjuvants on formulation of different pharmaceutical products: Antioxidants, preservatives, colours, flavours, diluents, binders, disintegrants, antifirctional agents, emulsifiers, suspending agents, ointment bases, solvents etc. and other formulation additives.	6
03	Stability of pharmaceuticals: a) Kinetic principles and stability testing: Reaction rate and order, acid base catalysis, decomposition reactions and stabilization of pharmaceuticals. b) Stability of formulation, factors affecting formulation stability, MKT, climatic zones, matrixing and bracketing instability study, accelerated stability testing, real time stability. Current WHO, USFDA and stability testing as per ICH guidelines for pharmaceutical drug substances and drug products. c) Product stability: Requirements, shelf-life, overages, containers, closures. d) Overage calculations	8
04	Controlled and sustained release dosage forms Design of oral sustained release systems: Biological factors, Physicochemical factors Diffusional systems: - Reservoir system, Lag time, Burst effect, Matrix system, Effect of porosity and tortuosity Dissolution controlled system, Cube root dissolution equation, Diffusion layer controlled dissolution. Bioerodible and Combination of diffusion and dissolution systems. Design, development and evaluation of oral and parenteral controlled release formulations.	8
05	Novel drug delivery system (a) Modified drug delivery systems: Fundamentals, rationale of modified release drug delivery, factors influencing the design and performance, pharmacokinetic and pharmacodynamic basis for modified drug delivery systems, estimation of loading and maintenance dose. (b) Design and development of oral modified release dosage forms:	22

	<p>Matrix tablets, microspheres, hydrogels, osmotic pressure controlled systems, gastro retentive systems, colon targeting.</p> <p>(c) Fabrication of parenteral drug delivery systems: Parenteral emulsions & parenteral suspensions, microspheres, liposomes, niosomes, nanoparticles.</p> <p>(d) Formulation and evaluation of Transdermal drug delivery systems.</p> <p>(e) A brief study of site specific and targeted drug delivery systems, transmucosal and ocular drug delivery systems.</p>	
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Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

Books Recommended

1. The Theory & Practice of industrial pharmacy by Leon Lachmen et al., Lea & Febiger, Philadelphia.
2. Remington's Pharmaceutical Sciences, ed. A.R. Gennaro, Mack Publishing Co.
3. Modern Pharmaceutics ed. G.S. Banker & C.T. Rhodes, Marcel Dekker Inc. N.Y.
4. Pharmaceutical dosage forms: Tablets, Parenterals, Disperse systems. Vol.: 1,2,3 Leon, Lachman. Et.al.
5. Pharmaceutics: The science of dosage form design. M.E. Aulton. ELBS/Churchill Livingstone.
6. Drug Stability, T. Carstensen, Marcel Dekker Inc. N.Y.
7. Physical Pharmacy, A.N. Martin et al, K.M. Verghese & Co.
8. Pharmacokinetics, Gibaldi & D. Perrier Marcel Dekker Inc., N.Y.
9. Pharmaceutical calculation, N.J. Stoklosa, Lea & Febiger, Philadelphia.
10. Pharmaceutical Statistics, Sanford Bolton. Marcel Dekker Inc.
11. Novel drug delivery systems: Fundamentals & Developmental concepts. Y.W. Chien, Marcel Dekker Inc.
12. Biopharmaceutics & Pharmacokinetics - an introduction. R.E. Notary, Marcel Dekker Inc., N.Y.
13. Controlled drug Delivery, Fundamentals and applications, J.R. Robinson & Lee, Marcel Dekker Inc.
14. Handbook of Pharmaceutical Excipients" By James C. Boylan, Pub., American Pharmaceutical Association & The Pharmaceutical Society of Great Britain.
15. Pharmaceutical Dissolution testing, Umesh V. Bankar, Marcel Dekker Inc.

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PH712 Medicinal Chemistry – III

Theory

3 hours/Week

No.	Chapter	Hours
01	Drug Metabolism - Various processes of drug metabolism and its importance in drug design with specific examples and concepts in prodrugs	07
02	Drug design - Introduction various approaches for lead optimization, physicochemical parameters used in QSAR and different methods of QSAR. Introduction to Molecular modeling	06
03	Synthetic procedures of official drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs: A. Anti-hypertensives (03) B. Anti-arrythmic agents (03) C. Anti-anginal agents (02) D. Anti-hyperlipaemic agents (02) E. Cardiotonics (02) F. Anti-coagulants, Anti-Platelets and Anti-thrombolytic agents (03) G. Diuretics (03)	18
04	Thyroid and Antithyroid drugs	04
05	Insulin and hypoglycemic agents.	05
06	Steroid hormones: Detailed study of sex hormones and adrenal cortex hormones including synthetic substitutes, SAR in synthetic substitutes.	05

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Selected drug synthesis from the course content.
2. Special analysis of the drug synthesized.
3. Organic spotting of binary mixtures with derivative preparation and TLC.
4. Establishing the Pharmacopoeial standards of the drugs synthesized.

Books Recommended

1. J.N.Delagado and W.A.R. Remers, Eds, Wilson and Giswild's Text book of Organic, Medicinal and Pharmaceutical Chemistry, J.Lipincott., Philadelphia.
2. H.E.Wolf,Ed., Burger's Medicinal Chemistry, John Wiley & Sons, New York.
4. B.N.Ladu, H.G.Mandel & E.L.Way, Fundamentals of Drug Metabolism & Disposition, William & Wilkins Co., Baltimore.
5. Popst and Perrum, "Computer Aided Drug Design", Acedemic Press, New York.
6. C.Hanch, Compresive Medicinal, Vol:IV, Quantitive Drug Design, Pregamon Peress, Oxford.
7. Y.C.Martin, Quatitative Drug Design - A Critical Introduction (Medicinal Research Monograph, Vol:8). Marcel Dekker.Inc., New York.

8. Exploring QSAR: Vol:I, Fundamentals and Applications in Chemistry and Biology by C.Hansch and A.Leo. and Vol:II, Hydrophobic, Electronic and Steric constants by C.Hansch, A.Leo. and D.Hockman.
9. P.C.Jurs, Computer Software Application in Chemistry, John Wiley & Sons, New York.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH713 Pharmaceutical Analysis – III

Theory

3 hours/Week

No.	Chapter	Hours
01	Ultraviolet and Visible Spectrophotometry: Electromagnetic Radiation (EMR), properties of EMR, Mechanism of Absorption of EMR by molecules, Factors affecting absorption position and absorption intensity, Laws of photochemistry, Deviations from Beer's Law, Instrumentation (components and their general working principles), single beam and double beam instruments, sample handling, selection of wavelength and band width, Applications (direct methods, indirect methods, analysis of mixtures)	13
02	Fluorimetry: Origin of fluorescence and phosphorescence, Factors affecting fluorescence intensity, Relationship of fluorescence and phosphorescence to molecular structure, Instrumentation (components and their general working principles), Applications	06
03	Infrared Spectrophotometry Origin of an I.R. spectrum, Instrumentation (components and their general working principles), Sample handling, A brief introduction to Fourier transform infrared spectroscopy (FTIR), Applications, Analytical shortcomings	10
04	Nuclear Magnetic Resonance Spectroscopy: Magnetic properties of the nucleus, Origin of NMR spectrum, Chemical shift, Coupling, Factors affecting chemical shift and coupling, Instrumentation (CW and FTNMR), Brief introduction to ¹³ CNMR	08
05	Mass Spectrometry Origin of mass spectra, Fragmentation rules, Recognition of molecular ion peak, Instrumentation, Applications	08

Practical

3 hours/Week

To illustrate the topics included under theory

Quantitative estimation and general tests of formulations containing single drug, using instrumental techniques based on theory.

Books Recommended

1. Principles of Instrumental Analysis - Skoog, Holler, Nieman, 5th Ed. Saunders College Publishing.
2. A Textbook of Pharmaceutical Analysis - Kenneth A. Connors, 3rd Ed., John Wiley & Sons.
3. Instrumental Methods of Chemical Analysis - Galin W. Ewing, 5th Ed., McGraw Hill International Editions.
4. Principles of Instrumental Analysis - Skoog, Leary, 4th Ed., Saunders college Publishing
5. Instrumental Methods of Analysis - Willard, Merritt, Dean, Settle, CBS Publishers 7th Ed.
6. Spectrometric Identification of Organic compounds - Silverstein, Morrill, 5th Ed., John Wiley & Sons, Inc.

7. Pharmaceutical Analysis: Modern Methods, James W. Munson, Marcel Dekker, Inc.
8. Practical Pharmaceutical Chemistry-I & II, A.H. Beckett and J.B. Stenlake, 4th Ed. CBS Publishers.
9. Indian Pharmacopoeia.
10. British Pharmacopoeia.
11. United States Pharmacopoeia.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH714 Pharmacognosy-V

Theory

3 hours/Week

No.	Chapter	Hours
01	Plant Tissue Culture Techniques & its Application in Pharmacy : Introduction and types of PTC. Equipment and facilities require for PTC. Media composition. Immobilized cell techniques, Micropropagation, protoplast, static, suspension, hairy root cultures and some other new techniques in PTC. Biotransformation studies including recent developments in production of biological active constituents in PTC.	09
02	Marine Pharmacognosy, novel medicinal agents from marine sources.	05
03	Role of medicinal plant and aromatic plants in national economy.	01
04	Chemical and spectral approaches to simple molecules of natural origin.	03
05	Concept of stereoisomerism taking examples of Natural Products such as Sennoside, hyoscyamine, citral, menthol, quinine, ephedrine & papaverine.	03
06	Terpenoids: Chemistry, Biogenesis and Pharmacological activity of Geraniol, Menthone, Carvone, Pinene, Abietic acid, β -amyrin, Oleanolic acid, Vitamin – A.	08
07	Traditional drugs: Common vernacular names, botanical sources, morphology, microscopy, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs: Entire herb: Punarnava, Apamarg, Brahmi, Shankhapushpi, Kantakari. Root & Rhizomes: Satavari, Majith, Chitrak, Vaj, Rasna, Nagarmotha Bark: Arjuna, Ashoka. Flower: Palash. Unorganised drugs: Guggal, Shilajit.	16

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Identification of crude drugs mentioned in theory.
2. Microscopical study of characters of selected drugs given in the theory in entire and powdered form.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.

2. Pharmacognosy and pharmacobiotechnology, Ashutosh Kar, New Age International (P) Ltd, Publishers, 2nd edition 2007.
3. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahmedabad, 8th edition, 1990
4. Trease and Evan's Pharmacognosy: W. C. Evans, W.B.Saunders Co., Singapore, 15th Edition, 2008.
5. Text Book Pharmacognosy: T.E. Wallis, CBS Publishers and Distributors Delhi- 5th Edition, Reprint, 1997.
6. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,.
7. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbars, Lea and Febgir Philadelphia, 8th Edition, 1981.
8. Cultivation and Utilization of Aromatic Plants, Handa S.S. and Kaul M.K., Regional Research Laboratory, Jammu, 1st Edition, 1997.
9. Pharmacognosy of powdered crude drugs: M. A. Iyenger, Manipal Power Press, 1st Edition, 1974.
10. Mukherji P. K., Quality Control of Herbal Drugs, Business Horizon Pharma. Publishers, 1st Edition, 2002.
11. Herbal drug technology, S. S. Agrawal and M. Paridhavi, Universities Press, 1st Edition, 2007.
12. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
13. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
14. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH715 Pharmacology & Pathophysiology-II

Theory

3 hours/Week

No.	Chapter	Hours
01	Pathophysiology of various diseases including: <ul style="list-style-type: none"> • CNS disorders: Epilepsy, Parkinsonism, Schizophrenia, Depression • Joint and connective tissue disorders: Rheumatoid arthritis, Gout and Hyperuricemia • Renal disorders: Acute Renal Failure & Chronic Renal Failure • Haematopoietic disorders: Anemia • Endocrine: Diabetes mellitus and thyroid disorders 	15
02	Central Nervous system: <ul style="list-style-type: none"> • Neurohumoral transmission in the C.N.S • General anesthetics • Alcohols and disulfiram • Sedatives, hypnotics & anxiolytics agents • Antiepileptic drugs • Anti-parkinsonian drugs • Psychopharmacological agents (Antipsychotic, antidepressants, antimaniacs and hallucinogens) • Opioid analgesics • Non- opioid analgesics • C.N.S stimulants • Drug addiction and drug abuse • Drug used in Alzheimer's disease • Drug used in migraine 	26
03	Immunopharmacology	04

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Experiments on CNS:

- a) Spontaneous motor activity
- b) Analgesic activity
- c) Anti-convulsant activity
- d) Anti-parkinsonism activity
- e) CNS stimulant and CNS depressant activity
- f) Sedative and hypnotics activity
- g) Anti-inflammatory activity
- h) Muscle relaxant activity of drugs using simple experiments.

2. Experiments on clinical pharmacy:

- a) To audit given prescription for format of prescription, essentiality and rationality and suggest carry home message (three experiments containing three prescriptions each, in totality nine prescriptions, covering various diseases or organ-systems).

- b) To evaluate formulations on anemia, diarrhoea and cough for their essentiality and rationality and also provide carry home message.
- c) To suggest appropriate parenteral nutrition for hospitalized patients after proper nutritional assessments in different conditions, and enlist importance of medications necessary in a pharmacy for Intensive Care Unit management.
- d) To evaluate drug-drug interactions for the type of drug interaction, the mechanism responsible for drug interactions, possible outcomes or clinical manifestations of interaction and suggestion corrective measure to overcome or prevent the drug interaction.
- e) To evaluate case for Interpretation of laboratory data.
- f) To evaluate case involving skills of pharmacist for patient counseling.
- g) To evaluate case for dose adjustment in geriatrics, pediatrics and pregnant women.
- h) To evaluate case for Therapeutic Drug Monitoring (TDM).

Books Recommended

1. Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
2. Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
3. Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn. Vallabh Prakashan, New Delhi.
4. Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
5. Rang h.P., dale M.M., etal-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
6. Satoskar R.S., etal-Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.
7. Harvel, R.A., Champe P.C. etal –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
8. Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.
9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn. Pergamon Press, Singapore.
10. Seth, S.D. text Book of pharmacology, B.I. Churchill, 1997.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH716 Pharmaceutical Management

Theory

2 hours/Week

No.	Chapter	Hours
01	Concept of Management: Administrative Management (Planning, Organizing, Staffing, Directing and Controlling), entrepreneurship development, Principles of Management (Co-ordination, Communication, Motivation, Decision-making, leadership, Innovation, Creativity, Delegation of Authority/Responsibility, Record Keeping). Identification of key points to give maximum thrust for development and perfection, total quality management (TQM).	05
02	Accountancy : Principles of Accountancy, Brief introduction to Ledger, book entries, Trial balance, Cash book, Bank reconciliation statement, Profits and loss account, Balance sheet.	03
03	Economics: Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves.	02
04	Pharmaceutical Marketing: Functions buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.	04
05	Salesmanship: Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing.	02
06	Market Research: Recruitment, training, evaluation, compensation to the pharmacist , Pre-requisition: Basic information services.	02
07	Materials Management: A brief exposure of the basic principles of Materials. Management Purchase, stores and inventory control (Eligibility, Efficiency Evaluation, Recruitment Methodology, Service Conditions, Termination Performance Evaluation, etc.).	06
08	Production Management: A brief exposure of the different aspects of Production Management Visible and Invisible inputs, Methodology of Activities, Performance Evaluation Technique, Process-Flow, Process Know-how, Maintenance Management.	06

Books Recommended

1. J.A. Stoner, R.E. Freeman & D.R. Gilbert "Management" Prentice Hall, New Delhi.
2. P. Kotler, "Marketing Management analysis, planning, implementation & control, Prentice hall. New Delhi,

3. H.A. Smith, "Principles and Method of Pharmacy Management", Lea & Febiger, Philadelphia,
4. P. Gopalkrishnan and M. Sundaresan, "Material management: An integrated approach", Prentice hall, New Delhi.
5. C.B. Mannoria, "Personal management", Himalaya publishing house, Bombay, Latest edition.
6. L. Lachman, H.A. Liberman and J.L. Kanic, "Theory & practice of Industrial Pharmacy", Lea & Febiger, U.S.A.
7. P. Kotler, "Principles of marketing" Prentice Hall, New Delhi.

Bachelor of Pharmacy Program

Semester VIII

Scheme of Teaching & Examination

Subject code	Subjects	Marks		Hours/ Week	
		Theory	Practical	Theory	Practical
PH811	Biopharmaceutics & Pharmacokinetics	100	100	3	3
PH812	Medicinal Chemistry – IV	100	100	3	3
PH813	Pharmaceutical Analysis – IV	100	100	3	3
PH814	Pharmacognosy-VI	100	100	3	3
PH815	Clinical Pharmacy	100	-	3	-
PH816	Elective	-	100	-	3
	Total	500	500	15	15

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BACHELOR OF PHARMACY
PH811 Biopharmaceutics & Pharmacokinetics

Theory

3 hours/Week

No.	Chapter	Hours
01	Introduction to Biopharmaceutics and pharmacokinetics and their role in formulation development and clinical setting	02
02	Biopharmaceutics: a) Introduction to biopharmaceutics and its role in formulation development. b) Passage of drugs across biological barriers (passive diffusion, active transport, facilitated diffusion and pinocytosis). c) Factors influencing absorption- physiochemical, physiological and pharmaceutical. d) Drug distribution in the body, plasma protein binding and drug excretion.	15
03	Pharmacokinetics (a) Definition and scope, significance of plasma drug concentration measurement. (b) Compartment model: Pharmacokinetics of drug absorption Zero order and first order absorption rate constant using Wagner- Nelson and Loo-Riegelman method. (c) Volume of distribution and distribution coefficient. (d) Compartment kinetics- one compartment and two compartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intra vascular and oral route. (e) Curve fitting (Method of Residuals), regression procedures. (f) Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance. (g) Hepatic elimination of drugs, first pass effect, extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation. (h) Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaelis Menten Equation, detection of nonlinearity (Saturation mechanism). (i) Numericals related to pharmacokinetic parameters using one compartmental model.	20
03	Bioavailability and Bioequivalence: a) Measures of bioavailability, C _{max} , t _{max} and area under the curve (AUC). b) Design of single dose bio-equivalence study and relevant statistics. c) Review of regulatory requirements for conduction of bio-equivalent studies.	8

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

Books Recommended

1. The Theory & Practice of industrial pharmacy by Leon Lachmen et al., Lea & Febiger, Philadelphia.
2. Remington's Pharmaceutical Sciences, ed. A.R. Gennaro, Mack Publishing Co.
3. Modern Pharmaceutics ed. G.S. Banker & C.T. Rhodes, Marcel Dekker Inc. N.Y.
4. Pharmaceutical dosage forms: Tablets, Parenterals, Disperse systems. Vol.: 1,2,3 Leon, Lachman. Et.al.
5. Pharmaceutics: The science of dosage form design. M.E. Aulton. ELBS/Churchill Livingstone.
6. Drug Stability, T. Carstensen, Marcel Dekker Inc. N.Y.
7. Physical Pharmacy, A.N. Martin et al, K.M. Verghese & Co.
8. Pharmacokinetics, Gibaldi & D. Perrier Marcel Dekker Inc., N.Y.
9. Pharmaceutical calculation, N.J. Stoklosa, Lea & Febiger, Philadelphia.
10. Pharmaceutical Statistics, Sanford Bolton. Marcel Dekker Inc.
11. Novel drug delivery systems: Fundamentals & Developmental concepts. Y.W. Chien, Marcel Dekker Inc.
12. Biopharmaceutics & Pharmacokinetics - an introduction. R.E. Notary, Marcel Dekker Inc., N.Y.
13. Controlled drug Delivery, Fundamentals and applications, J.R. Robinson & Lee, Marcel Dekker Inc.
14. Handbook of Pharmaceutical Excipients" By James C. Boylan, Pub., American Pharmaceutical Association & The Pharmaceutical Society of Great Britain.
15. Pharmaceutical Dissolution testing, Umesh V. Bankar, Marcel Dekker Inc.

DHARMSINH DESAI UNIVERSITY

BACHELOR OF PHARMACY

PH812 Medicinal Chemistry – IV

Theory

3 hours/Week

No.	Chapter	Hours
01	Synthetic procedures of official drugs, mode of action, uses, structure activity relationship (including physicochemical aspects) of the following classes of drugs A. Sulphonamides and Fluoroquinolones (03) B. Anti-malarial drugs (03) C. Anti-Leprotic drugs (02) D. Anti-tubercular drugs (02) E. Anti-septics and Disinfectants (03) F. Anti-fungal agents (02) G. Anti-amoebic agents (02) H. Anti-viral Drugs including anti-HIV agents (08) I. Anti-Neoplastic agents (08) J. Immunosuppressive agents (02)	35
02	Antibiotics: General Chemistry of (β -lactum antibiotics, Aminoglycoside antibiotics Tetracyclines, Chloramphenicol, Macrolide antibiotics, Polyene and Polypeptide antibiotics	10

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Selected drug synthesis from the course content.
2. Special analysis of the drug synthesized.
3. Organic spotting of binary mixtures with derivative preparation and TLC.
4. Establishing the Pharmacopoeial standards of the drugs synthesized.

Books Recommended

1. J.N.Delagado and W.A.R. Remers, Eds, Wilson and Giswild's Text book of Organic, Medicinal and Pharmaceutical Chemistry, J.Lipincott., Philadelphia.
2. H.E.Wolf,Ed., Burger's Medicinal Chemistry, John Wiley & Sons, New York.
3. T.Nogradydey, Medicinal Chemistry - A Biochemical approach, Oxford University Press, New York
4. B.N.Ladu, H.G.Mandel and E.L.Way. Fundamentals of Drug Metabolism & Disposition, William & Welkins Co. 428E, Prestone street, Baltimore.
5. Vogel's Textbook of Practical Organic Chemistry, ELBS, Longman, London.
6. Mann & Saunder, Practical Organic Chemistry, Orient Longman, UK.
7. Shriner, Heremann, Morrill, Curtin & Fusion, The Systemic identification of Organic Compounds, John Wiley & Sons, New York.
8. W.C.Foye, Principles of Medicinal Chemistry, Lea and Feiber, Philadelphia.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH813 Pharmaceutical Analysis – IV

Theory

3 hours/Week

No.	Chapter	Hours
01	Atomic Absorption and Atomic Emission Spectroscopy: Origin of atomic absorption and atomic emission spectra, Instrumentation, Qualitative and quantitative application of flame photometry	06
02	Quality Assurance: Introduction to Basic principles and applications of QA and GLP: Importance and applications of ISO 9000 & 14000. Quality review and documentation in QC laboratory and analytical method validation	04
03	Harmonization of Pharmaceutical Standards, Outsourcing of pharmaceuticals, SUPAC guidelines, etc.	04
04	Validation	04
05	High Performance Liquid Chromatography Introduction, theory – migration equation, theoretical plate, measurement of column performance and its optimization, instruments for liquid chromatography including column packing for various types of chromatography, mobile phase characteristics for normal and reversed phases, polarity and selectivity of the solvents, scope and applications. Super critical fluid chromatography, exclusion chromatography	10
06	Gas Chromatography: Introduction, principles of Gas – Liquid Chromatography, instruments for Gas –Liquid Chromatography, columns and stationary phases, qualitative and quantitative applications to pharmaceuticals, brief introduction to hyphenated techniques like GC-MS, LC-MS, etc.	08
07	X – Ray Crystallography: Introduction, X-ray absorption and X-ray diffraction methods, Instrumentation for relevant instruments	04
08	Principle, instrumentation, types and applications of electrophoresis.	03

Practical

3 hours/Week

1. Quantitative estimation and general tests of formulations containing single drug, using instrumental techniques based on theory.

Books Recommended

- 1.Principles of Instrumental Analysis - Skoog, Holler, Nieman, 5th Ed. Saunders College Publishing.
- 2.A Textbook of Pharmaceutical Analysis - Kenneth A. Connors, 3rd Ed., John Wiley & Sons.
- 3.Instrumental Methods of Chemical Analysis - Galin W. Ewing, 5th Ed., McGraw Hill International Editions.
- 4.Principles of Instrumental Analysis - Skoog, Leary, 4th Ed., Saunders college Publishing
- 5.Instrumental Methods of Analysis - Willard, Merritt, Dean, Settle, CBS Publishers 7th Ed.

6. Understanding ISO 9000 and implementing the basics to Quality-D.H. Stamatis, Marcel Dekker, Inc.
7. Guidelines for Laboratory Quality Auditing - Donald C. Singer, Ronald P. Upton, Marcel Dekker, Inc.
8. Good Manufacturing Practices for Pharmaceuticals: A plan for total quality control - Sidney H Willing, James R. Stoker, Marcel Dekker, Inc.
10. O.P.P.I. Manual.
11. Good Laboratory Practice Regulations - Ed. by Sandy Weinberg, Marcel Dekker, Inc.
12. Pharmaceutical Analysis: Modern Methods, James W. Munson, Marcel Dekker, Inc.
13. Practical Pharmaceutical Chemistry-I & II, A.H. Beckett and J.B. Stenlake, 4th Ed. CBS Publishers.
14. Indian Pharmacopoeia.
15. British Pharmacopoeia.
16. United States Pharmacopoeia.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH814 Pharmacognosy-VI

Theory

3 hours/Week

No.	Chapter	Hours
01	Herbal Cosmetics: Introduction, classification, importance, preparation and evaluation of herbal cosmetics.	04
02	Standardisation of Herbal Drugs: <ul style="list-style-type: none"> Importance of Standardisation and problem involved in the standardisation of herbs. Standardisation of single drugs and compound formulations. WHO Guidelines for quality standardized herbal formulation. Estimation of the parameter limits used for standardisation. Preparation and evaluation of Herbal Extract. 	06
03	Herbal formulations: The holistic concept of drug administration in traditional system & modern system of medicine. <ul style="list-style-type: none"> General introduction, their importance, Classification. Principles of Siddha, Ayurveda, Homeopathy, Unani & Naturopathy systems of medicine. Introduction for different Ayurvedic dosage forms. Toxicity studies of different complimentary medicine. Rules and regulatory requirements for the production of the Ayurvedic medicines as per FDA. General introduction and different stages required for herbal formulation. Dosage forms and its Evaluation parameters. 	12
04	Traditional drugs : Common vernacular names, botanical sources, morphology, microscopy, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs: Stem: Galo Underground stem: Garlic Leaf: Tylophora, Nagod, Adusa, Karen, Gymnema, Neem. Fruit: Amla, Gokhru, Pepper, Bhilama, Kalijiri. Seed: Methi, Chakramadu, Malkangni, Karanj.	17
05	World - wide trade in medicinal plants and derived products with special reference to diosgenin (Dioscorea), taxol (Taxus spp.), digitalis, tropane alkaloid containing plants, papain, cinchona, Ipecac, Liquorice, ginseng, aloe, valerian, rauwolfia and plants containing laxatives, artemisia, camptotheca.	04
06	A brief account of plant based industries and institution involved in work on medicinal and aromatic plants in India.	02

Practical

3 hours/Week

To illustrate the topics included under theory

Suggested Practical:

1. Demonstration of various traditional dosage forms.
2. Microscopical study of characters of selected drugs given in the theory in entire and powdered form.
3. Preparation and evaluation herbal cosmetics.
4. Preparation and evaluation of Ayurvedic formulation.

Books Recommended

1. Pharmacognosy: C.K.Kokate, A.P.Purohit, S.B.Gokhale, Nirali prakashan, Pune, 39th Edition, 2007.
2. Pharmacognosy and pharmacobiotechnology, Ashutosh Kar, New Age International (P) Ltd, Publishers, 2nd edition 2007.
3. A Text Book of Pharmacognosy: C. S. Shah, J. S. Quadry, B. S. Shah Prakashan, Ahemedabad, 8th edition, 1990.
4. Pharmacognosy and Phytochemistry, Part I and II and Vinod D. Rangari, Carrier Publications, 1st Edition, Reprint, 2007,.
5. Pharmacognosy: V. E. Tylar, L. R. Brady, J. E. Habbars, Lea and Febgir Philadelphia, 8th Edition, 1981.
6. Pharmacognosy of powdered crude drugs: M. A. Iyenger, Manipal Power Press, 1st Edition, 1974.
7. Mukherji P. K., Quality Control of Herbal Drugs, Business Horizon Pharma. Publishers, 1st Edition, 2002.
8. Herbal drug technology, S. S. Agrawal and M. Paridhavi, Univeristies Press, 1st Edition, 2007.
9. Essentials of Pharmacognosy, S. H. Ansari, Birla Publications Pvt. Ltd., 1st edition, 2005-2006.
10. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 1, Leaf drugs, (2005), Gujarat Ayurved University, Jamnagar.
11. Microscopic profile of powdered drugs used in Indian systems of medicine, Malti G. Chauhan and Pillai A.P.G., volume 2, bark drugs, (2007), Gujarat Ayurved University, Jamnagar.
12. Herbal cosmetics, hand book By H. Panda
13. Cosmetics formulation, manufacturing and their quality control by P.P. Sharma
14. Textbook of Pharmacognosy and Phytochemistry by Edwin Jarald and Sheeja Jarald
15. Modern Methods of Plant Analysis by Peach & Tracey
16. Biotechnology by S.S. Purohit

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH815 Clinical Pharmacy

Theory

3 hours/Week

No.	Chapter	Hours
01	Endocrine system: <ul style="list-style-type: none"> Hypothalamic and pituitary hormones Thyroid hormones and anti-thyroid drugs Insulin and oral hypoglycemic agents and glucagon. ACTH and corticosteroids Androgen and anabolic steroids Estrogen, progesterone and oral contraceptives Drug acting on uterus 	15
02	Introduction to clinical pharmacy: <ul style="list-style-type: none"> Development and scope of clinical pharmacy Concept of health care team Role of clinical pharmacist as a member of health care team and important function. 	05
03	Basic concept of pharmacotherapy: <ul style="list-style-type: none"> Therapeutic Drug Monitoring. Critical care Unit: Blood and Plasma Volume expanders Drug used during infancy and in the elderly (Pediatrics and Geriatrics) Drug used during pregnancy Drug induced diseases The basics of drug interactions General principle of toxicology: Heavy Metals and Antagonists. Interpretation of clinical Laboratory test 	22
04	Clinical Trials & GCP guidelines.	03

Books Recommended

- Goyal R.K.-Practicals in pharmacology (1994-95) 1st Edn. M/s B.S.Shah Prakashan, Ahmedabad.
- Sheth U.K. et al-Selected topics in experimental pharmacology (1972) 1st Edn. The Kothari Book Depot, Mumbai.
- Kulakarni S.K.- handbook of experimental pharmacology (1993) 2nd Edn. Vallabh Prakashan, New Delhi.
- Ghosh M.N-Essentials of experimental pharmacology scientific book agency, Calcutta, 1984,
- Rang h.P., dale M.M., et al-Pharmacology (1995) 3rd Edn. Churchill livingstone USA.
- Satoskar R.S., et al-Pharmacology and pharmacotherapeutics (1999) 16th Edn. Popular Prakashan, Mumbai.
- Harvel, R.A., Champe P.C. et al –Pharmacology (1997) 2nd Edn. Lippincott-Raven Company, Philadelphia, New York.
- Craig C.R., Stitzel, R.E-Modern pharmacology (1994) 4th Edn. Little brown and Company, USA.

9. Goodman and Gilman's –the pharmacological basis of therapeutics (1996) 9th Edn.
Pergamon Press, Singapore.
10. Seth, S.D. text Book of pharmacology, B.I. Churchill, 1997.

DHARMSINH DESAI UNIVERSITY
BACHELOR OF PHARMACY
PH816 Elective

3 hours/Week

- ❖ Topics for preparation of project report will be given on the basis of result of B. Pharm Semester - VI (merit list is to be prepared)
- ❖ Topics will be given from all the area of pharmaceutical sciences viz. pharmaceutical technology, pharmacology, pharmaceutical analysis, medicinal chemistry, Pharmacognosy, etc
- ❖ Preparation and submission of project report should be mandatory for all the students of B. Pharm semester-VIII.
- ❖ Evaluation of students will be done at the end of the year by preparing a power point presentation by students
- ❖ Presentations will be evaluated by external referee.

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Bachelor of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table-I: Course of study for semester I

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP101T	Human Anatomy and Physiology I– Theory	3	1	4
BP102T	Pharmaceutical Analysis I – Theory	3	1	4
BP103T	Pharmaceutics I – Theory	3	1	4
BP104T	Pharmaceutical Inorganic Chemistry – Theory	3	1	4
BP105T	Communication skills – Theory *	2	-	2
BP106RBT BP106RMT	Remedial Biology/ Remedial Mathematics – Theory*	2	-	2
BP107P	Human Anatomy and Physiology – Practical	4	-	2
BP108P	Pharmaceutical Analysis I – Practical	4	-	2
BP109P	Pharmaceutics I – Practical	4	-	2
BP110P	Pharmaceutical Inorganic Chemistry – Practical	4	-	2
BP111P	Communication skills – Practical*	2	-	1
BP112RBP	Remedial Biology – Practical*	2	-	1
Total		32/34^S/36[#]	4	27/29^S/30[#]

[#]Applicable ONLY for the students who have studied Mathematics / Physics / Chemistry at HSC and appearing for Remedial Biology (RB)course.

^SApplicable ONLY for the students who have studied Physics / Chemistry / Botany / Zoology at HSC and appearing for Remedial Mathematics (RM)course.

* Non University Examination (NUE)

Table-II: Course of study for semester II

Course Code	Name of the course	No. of hours	Tutorial	Credit points
BP201T	Human Anatomy and Physiology II – Theory	3	1	4
BP202T	Pharmaceutical Organic Chemistry I – Theory	3	1	4
BP203T	Biochemistry – Theory	3	1	4
BP204T	Pathophysiology – Theory	3	1	4
BP205T	Computer Applications in Pharmacy – Theory *	3	-	3
BP206T	Environmental sciences – Theory *	3	-	3
BP207P	Human Anatomy and Physiology II –Practical	4	-	2
BP208P	Pharmaceutical Organic Chemistry I– Practical	4	-	2
BP209P	Biochemistry – Practical	4	-	2
BP210P	Computer Applications in Pharmacy – Practical*	2	-	1
Total		32	4	29

*Non University Examination (NUE)

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Bachelor of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table-III: Course of study for semester III

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP301T	Pharmaceutical Organic Chemistry II – Theory	3	1	4
BP302T	Physical Pharmaceutics I – Theory	3	1	4
BP303T	Pharmaceutical Microbiology – Theory	3	1	4
BP304T	Pharmaceutical Engineering – Theory	3	1	4
BP305P	Pharmaceutical Organic Chemistry II – Practical	4	-	2
BP306P	Physical Pharmaceutics I – Practical	4	-	2
BP307P	Pharmaceutical Microbiology – Practical	4	-	2
BP 308P	Pharmaceutical Engineering –Practical	4	-	2
Total		28	4	24

Table-IV: Course of study for semester IV

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP401T	Pharmaceutical Organic Chemistry III– Theory	3	1	4
BP402T	Medicinal Chemistry I – Theory	3	1	4
BP403T	Physical Pharmaceutics II – Theory	3	1	4
BP404T	Pharmacology I – Theory	3	1	4
BP405T	Pharmacognosy and Phytochemistry I– Theory	3	1	4
BP406P	Medicinal Chemistry I – Practical	4	-	2
BP407P	Physical Pharmaceutics II – Practical	4		2
BP408P	Pharmacology I – Practical	4	-	2
BP409P	Pharmacognosy and Phytochemistry I – Practical	4	-	2
Total		31	5	28

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Bachelor of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table-V: Course of study for semester V

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP501T	Medicinal Chemistry II – Theory	3	1	4
BP502T	Industrial PharmacyI– Theory	3	1	4
BP503T	Pharmacology II – Theory	3	1	4
BP504T	Pharmacognosy and Phytochemistry II– Theory	3	1	4
BP505T	Pharmaceutical Jurisprudence – Theory	3	1	4
BP506P	Industrial PharmacyI – Practical	4	-	2
BP507P	Pharmacology II – Practical	4	-	2
BP508P	Pharmacognosy and Phytochemistry II – Practical	4	-	2
Total		27	5	26

Table-VI: Course of study for semester VI

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP601T	Medicinal Chemistry III – Theory	3	1	4
BP602T	Pharmacology III – Theory	3	1	4
BP603T	Herbal Drug Technology – Theory	3	1	4
BP604T	Biopharmaceutics and Pharmacokinetics – Theory	3	1	4
BP605T	Pharmaceutical Biotechnology – Theory	3	1	4
BP606T	Quality Assurance –Theory	3	1	4
BP607P	Medicinal chemistry III – Practical	4	-	2
BP608P	Pharmacology III – Practical	4	-	2
BP609P	Herbal Drug Technology – Practical	4	-	2
Total		30	6	30

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Bachelor of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table-VII: Course of study for semester VII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP701T	Instrumental Methods of Analysis – Theory	3	1	4
BP702T	Industrial PharmacyII – Theory	3	1	4
BP703T	Pharmacy Practice – Theory	3	1	4
BP704T	Novel Drug Delivery System – Theory	3	1	4
BP705P	Instrumental Methods of Analysis – Practical	4	-	2
BP706PS	Practice School*	12	-	6
Total		28	5	24

* Non University Examination (NUE)

Table-VIII: Course of study for semester VIII

Course code	Name of the course	No. of hours	Tutorial	Credit points
BP801T	Biostatistics and Research Methodology	3	1	4
BP802T	Social and Preventive Pharmacy	3	1	4
BP803ET	Pharma Marketing Management	3 + 3 = 6	1 + 1 = 2	4 + 4 = 8
BP804ET	Pharmaceutical Regulatory Science			
BP805ET	Pharmacovigilance			
BP806ET	Quality Control and Standardization of Herbals			
BP807ET	Computer Aided Drug Design			
BP808ET	Cell and Molecular Biology			
BP809ET	Cosmetic Science			
BP810ET	Experimental Pharmacology			
BP811ET	Advanced Instrumentation Techniques	12	-	6
BP812ET	Dietary Supplements and Nutraceuticals			
BP813PW	Project Work			
Total		24	4	22

B. PHARM. SEMESTER – I (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY I -THEORY (BP101T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the various experiments related to special senses and nervous system.
- Appreciate coordinated working pattern of different organs of each system

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to human body Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology. Cellular level of organization Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine Tissue level of organization Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.	10	CO1
[2]	Integumentary system Structure and functions of skin Skeletal system Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction Joints Structural and functional classification, types of joints movements and its articulation	10	CO1 CO2 CO3

[3]	Body fluids and blood Body fluids, composition and functions of blood, hemopoiesis, formation of hemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo endothelial system. □ Lymphatic system Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system	10	CO2 CO3 CO4 CO5
[4]	Peripheral nervous system: Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves. Special senses Structure and functions of eye, ear, nose and tongue and their disorders.	08	C01 CO2 CO3 C04 C05
[5]	Cardiovascular system Heart – anatomy of heart, blood circulation, blood vessels, structure and functions of artery, vein and capillaries, elements of conduction system of heart and heart beat, its regulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation of blood pressure, pulse, electrocardiogram and disorders of heart	08	C01 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.

D. REFERENCE BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.
4. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic anatomy and function of the body and remember the position of the various parts of our body
CO2	Remember, Understand and Apply	To know about the working mechanism of the body part and measure the activity of certain body parts by various techniques.
CO3	Understand Apply and Evaluate	To understand about the mechanism behind the action produced by various body part
CO4	Understand	To know about how disease occurs, and for that which organ system is required to defence those disease condition
CO5	Remember, Understand, Apply and evaluate	To get knowledge about functioning and dysfunctioning of various parts of the body/system and disease occur due to these imbalances.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	1	3	1	3	3	1	3	3	3	3	1	1
CO2	3	2	2	3	2	2	2	2	3	1	3	3	3	3	2	2
CO3	3	3	3	3	2	2	2	2	3	2	2	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.6	3	2.4	1.8	2.4	2.2	2.2	2.8	1.6	2.4	2.8	3	3	2.2	1.8

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL ANALYSIS I-THEORY (BP102T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	04	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs

Objectives: Upon completion of the course student shall be able to

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- Develop analytical skills

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	(a) Pharmaceutical analysis Definition and scope i) Different techniques of analysis ii) Methods of expressing concentration iii) Primary and secondary standards. iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate (b)Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures	10	CO1 CO5
[2]	Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves Non aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl	10	CO2 CO3 CO4 CO5
[3]	Precipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride. Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.	10	CO2 CO3 CO4 CO5
[4]	Redox titrations (a) Concepts of oxidation and reduction (b) Types of redox titrations (Principles and applications)	08	CO2 CO3 CO4 CO5

	Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate		
[5]	Electrochemical methods of analysis Conductometry - Introduction, Conductivity cell, Conductometric titrations, applications. Potentiometry - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications. Polarography - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications	07	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. G. H. Jeffery J. Bassett J. Mendham R C. Denney, *Vogel's textbook of quantitative chemical analysis*, 5th ed.; Bath press, Avon : Great Britain, 1989.
2. Sharma B. K., *Analytical Chemistry*, 2nd ed.; Krishna Prakashan media (p) Ltd: Delhi, India, 2006.

D. REFERENCE BOOKS

1. P. Gundu Rao, *Inorganic Pharmaceutical Chemistry (Pharma Chemistry-I)*, 2010
2. Arthur Owen Bentley; John Edmund Driver; Lewis Malcolm Atherden. *Bentley and Driver's Textbook of Pharmaceutical Chemistry*.; Oxford University Press: Oxford, 1977.
3. Kennedy, J. H. *Analytical Chemistry : Principles*; Saunders College Pub: New York, 1990.
4. Health, O. Indian Pharmacopoeia 2010. Vol. 1; Ghaziabad Indian Pharmacopoeia Commission, 2010.
5. Skoog, Douglas A, F J. Holler, and Timothy A. Nieman, *Principles of Instrumental Analysis*, 7th ed.; Saunders College Pub: United states of America, 2016.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the importance, scope and fundamentals of analytical chemistry.
CO2	Remember, Understand and learn	Understand and learn different analytical and electroanalytical methods
CO3	Understand, remember Apply	Remember and apply various analytical and electroanalytical methods in pharmaceutical drug analysis
CO4	Understand, analyse and evaluate	Analyse and evaluate various volumetric and electrochemical titrations results
CO5	Development and evaluation	Evaluation of sources of errors, promoting ethical practises and development of analytical skills

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	1	3	1	1	1	-	3	3	3	2	2	-
CO2	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO3	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO4	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	1
CO5	3	1	3	1	1	3	1	1	1	-	3	3	3	2	2	-
Avg.	3	1	3	2	1	3	1	1	1	-	3	3	3	2	2	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICS I -THEORY (BP103T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Prepare various conventional dosage forms

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia. • Dosage forms: Introduction to dosage forms, classification and definitions • Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription. • Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.	10	CO1 CO3 CO4
[2]	Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, alligation, proof spirit and isotonic solutions based on freezing point and molecular weight. • Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions. • Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques	10	CO2 CO5
[3]	Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions. • Biphasic liquids: • Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability problems and methods to overcome. • Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.	10	CO2 CO5

[4]	Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. · Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.	8	CO1 CO2 CO5
[5]	Semisolid dosage forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semi solid dosages forms	7	CO2 CO5

C. TEXT BOOKS

1. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

D. REFERENCE BOOKS

2. Ansel, H. C.; Allen, L. V.; Popovich, N. G. Pharmaceutical Dosage Forms and Drug Delivery Systems; Philadelphia, Pa Lippincott-Williams & Wilkins, 1999.
3. Arthur Owen Bentley; Ernest Alexander Rawlins. Bentley's Textbook of Pharmaceutics.; All India Traveller Book Seller: New Delhi, 2002.
4. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
5. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.
6. Françoise Nielloud; Marti-Mestres, G. Pharmaceutical Emulsions and Suspensions; Informa Healthcare, Cop: New York, 2010.
7. Ghebre-Sellassie, I. Pharmaceutical Pelletization Technology; Dekker: New York U.A., 1989.
8. Parikh, D. M. Handbook of Pharmaceutical Granulation Technology; Informa Healthcare: New York, N.Y., 2007.
9. Remington, J. P.; Gennaro, A. R. Remington : Volume 1 : The Science and Practice of Pharmacy; Mack Pub. Co: Easton, Pa., 1995.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand and remember the professional way of handling the prescription
CO2	Understand and Remember	To understand the basics of different dosage forms and pharmaceutical incompatibilities
CO3	Understand	To understand the history of profession of pharmacy
CO4	Perform	To perform the pharmaceutical calculations
CO5	Prepare and evaluate	To prepare and evaluate various conventional dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	3	3	2	3	3	3	3	3	3
CO2	3	2	3	3	1	2	1	2	2	1	2	3	3	3	2	2
CO3	3	2	2	1	1	3	-	2	2	-	3	2	2	3	3	3
CO4	3	1	3	3	-	1	1	1	1	1	2	3	2	3	2	1
CO5	3	1	3	3	-	1	1	1	1	1	2	3	3	3	1	1
Avg	3	1.8	2.8	2.6	0.6	2	1.2	1.8	1.8	1	2.6	2.8	2.6	3	2.2	2

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL INORGANIC CHEMISTRY -THEORY (BP104T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of the course the student shall be able to

- Know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- Understand the medicinal and pharmaceutical importance of inorganic compounds

B. COURSE CONTENT

General methods of preparation, assay for the compounds superscripted with **asterisk (*)**, properties and medicinal uses of inorganic compounds belonging to the following classes

NO	TOPIC	L (Hrs)	COs
[1]	Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate	10	CO1 CO2
[2]	Acids, Bases and Buffers: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity. Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance. Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.	10	CO2 CO3 CO4 CO5
[3]	Gastrointestinal agents Acidifiers: Ammonium chloride* and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations	10	CO2 CO3 CO4 CO5
[4]	Miscellaneous compounds Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate Haematinics: Ferrous sulphate*, Ferrous gluconate Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite Astringents: Zinc Sulphate, Potash Alum	8	CO2 CO3 CO4 CO5

[5]	Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α , β , γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I_{131} , Storage conditions, precautions & pharmaceutical application of radioactive substances.	7	CO2 CO3 CO4 CO5
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C. TEXT BOOKS (LATEST EDITION)

1. Anand & G.R. Chatwal, Inorganic Pharmaceutical Chemistry, India, 2010
2. Suhagia B. N., Inorganic Pharmaceutical Chemistry, Nirav Prakashan, India, 2013

D. REFERENCE BOOKS (LATEST EDITION)

1. Schroff, M. L. Pharmaceutical Chemistry; National Book Centre: Calcutta, 1968.
2. Arthur Owen Bentley; John Edmund Driver; Lewis Malcolm Atherden. Bentley and Driver's Textbook of Pharmaceutical Chemistry.; Oxford University Press: Oxford, 1977.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
CO2	Understand and Remember	To understand the medicinal and pharmaceutical importance of inorganic compounds
CO3	Understand	To understand and learn about various types of inorganic compounds
CO4	Understand and Remember	To study preparation and assay of selected inorganic compounds
CO5	Understand and Remember	To understand and remember synonyms and chemical formula of various inorganic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	1	-	-	1	-	2	1	3	2	3	1	1	1
CO2	3	-	-	1	-	1	-	-	2	1	3	2	3	1	1	1
CO3	3	-	-	1	-	-	-	-	1	1	3	2	2	1	1	1
CO4	3	-	-	1	-	-	-	-	1	-	3	2	2	1	-	-
CO5	3	-	-	1	-	-	-	-	-	-	3	2	-	-	-	-
Avg	3	-	-	1	-	0.2	0.2	-	1.2	0.6	3	2	2	0.8	0.6	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: COMMUNICATION SKILLS -THEORY (BP105T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac.	Total
2	-	-	2	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

Objectives: Upon completion of the course the student shall be able to

- Understand the behavioural needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
- Communicate effectively (Verbal and Non-Verbal)
- Effectively manage the team as a team player
- Develop interview skills
- Develop Leadership qualities and essentials

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Communication Skills: Introduction, Definition, The Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment	07	CO1 CO2
[2]	Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication Communication Styles: Introduction, The Communication Styles Matrix with example for each -Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style	07	CO1 CO2
[3]	Basic Listening Skills: Introduction, Self-Awareness, Active Listening, Becoming an Active Listener, Listening in Difficult Situations Effective Written Communication: Introduction, When and When Not to Use Written Communication - Complexity of the Topic, Amount of Discussion' Required, Shades of Meaning, Formal Communication Writing Effectively: Subject Lines, Put the Main Point First, Know Your Audience, Organization of the Message	07	CO1 CO2 CO3
[4]	Interview Skills: Purpose of an interview, Do's and Dont's of an interview	05	CO4

	Giving Presentations: Dealing with Fears, planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery		CO5
[5]	Group Discussion: Introduction, Communication skills in group discussion, Do's and Dont's of group discussion	04	CO3 CO5

C. TEXT BOOKS

1. Mosam Sinha. *Effective Communication Skills*; Aavishkar Publishers, Distributors: Jaipur, 2017.
2. Lisel Erasmus-Kritzinger. *Introductory Communication : The Ultimate Guide to Effective Communication Skills, Study Skills, Life Skills*; Nasou Via Afrika: Cape Town, 2007.

D. REFERENCE BOOKS

1. Rutherford, A. J. *Basic Communication Skills for Technology*; Englewood Cliffs, Nj Prentice Hall, 1991.
2. Worth, R. *Communication Skills.*; Ferguson: New York, 2019.
3. Nira Konar. *Communication Skills for Professionals*; Phi Learning Private Limited: New Delhi, 2011.
4. Mitra, B. K. *Personality Development and Soft Skills*; Oxford University Press: New Delhi, 2011.
5. Wentz, F. H. *Soft Skills Training : A Workbook to Develop Skills for Employment*; Createspace: Charleston, Sc, 2012.
6. Peter, F. S. J. *Soft Skills and Professional Communication*; Tata Mcgraw-Hill: New Delhi, 2012.
7. Araya, M. MTD Training Effective Communication Skills. www.academia.edu.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the behavioural needs for a Pharmacist to function effectively in the areas of pharmaceutical operation
CO2	Learn	Learn to communicate effectively (Verbal and Non Verbal) and apply appropriate communication style in professional context
CO3	Understand	Understand the effective team management as a team player
CO4	Understand and Remember	Understand and remember the requisites for development of an effective interview skills
CO5	Understand and learn	Develop Leadership qualities and essentials

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	1	3	-	3	-	-	3	1	1	-	3	-
CO2	-	-	-	-	3	3	-	3	-	-	3	1	1	-	3	-
CO3	-	-	-	-	3	1	-	1	-	-	3	1	1	-	3	-
CO4	-	-	-	-	-	1	-	1	-	-	3	1	1	-	3	-
CO5	-	-	-	-	3	3	-	3	-	-	3	1	1	-	3	-
Avg.	-	-	-	-	2	2.2	-	2.2	-	-	3	1	1	-0	3	-

B. PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL BIOLOGY -THEORY (BP106RBT)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	--	---	2	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Objectives: Upon completion of the course the student shall be able to

- know the classification and salient features of five kingdoms of life
- Understand the basic components of anatomy & physiology of plant
- Know understand the basic components of anatomy & physiology animal with special reference to human

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Living world: Definition and characters of living organisms <ul style="list-style-type: none"> • Diversity in the living world • Binomial nomenclature • Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus, Morphology of Flowering plants <ul style="list-style-type: none"> • Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed. • General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledones 	7	CO1 CO4 CO5
[2]	Body fluids and circulation <ul style="list-style-type: none"> • Composition of blood, blood groups, coagulation of blood • Composition and functions of lymph • Human circulatory system • Structure of human heart and blood vessels • Cardiac cycle, cardiac output and ECG Digestion and Absorption <ul style="list-style-type: none"> • Human alimentary canal and digestive glands • Role of digestive enzymes • Digestion, absorption and assimilation of digested food Breathing and respiration <ul style="list-style-type: none"> • Human respiratory system • Mechanism of breathing and its regulation • Exchange of gases, transport of gases and regulation of respiration • □ Respiratory 	7	CO2 CO3

[3]	Excretory products and their elimination <ul style="list-style-type: none"> • Modes of excretion • Human excretory system- structure and function • Urine formation • Rennin angiotensin system Neural control and coordination <ul style="list-style-type: none"> • Definition and classification of nervous system • Structure of a neuron • Generation and conduction of nerve impulse • Structure of brain and spinal cord • Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata Chemical coordination and regulation <ul style="list-style-type: none"> • Endocrine glands and their secretions • Functions of hormones secreted by endocrine glands Human reproduction <ul style="list-style-type: none"> • Parts of female reproductive system • Parts of male reproductive system • Spermatogenesis and Oogenesis • □ Menstrual cycle 	07	CO2 CO3
[4]	Plants and mineral nutrition: <ul style="list-style-type: none"> • Essential mineral, macro and micronutrients • Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation Photosynthesis <ul style="list-style-type: none"> • Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting photosynthesis. 	05	CO2 CO3
[5]	Plant respiration: Respiration, glycolysis, fermentation (anaerobic). Plant growth and development <ul style="list-style-type: none"> • Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators Cell - The unit of life <ul style="list-style-type: none"> • Structure and functions of cell and cell organelles. Cell division Tissues <ul style="list-style-type: none"> • Definition, types of tissues, location and functions 	04	CO1 CO4 CO5

C. TEXT BOOKS

1. A Gokhale, S. B.; Kokate, C. K.; Gokhale, A. S.; Kalaskar, M. G. Pharmacognosy of Traditional Drugs - I; Nirali Prakashan, August: Pune, 2014.
2. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.

D. REFERENCE BOOKS

1. Gokhale, S. B.; Kokate, C. K.; Gokhale, A. S.; Kalaskar, M. G. Pharmacognosy of Traditional Drugs - I; Nirali Prakashan, August: Pune, 2014.
2. Dutta, A. C. Botany for Degree Students.; Oxford University Press: Kolkata, 1996.
3. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To get knowledge about the basic part of the living world i.e plants, the parts of plant, its morphology and physiology, classification of kingdom. diversity in the world.
CO2	Remember and understand	To know about the anatomy and function of the various parts of the body
CO3	Understand Remember and Evaluate	To understand about the mechanism behind the action produced by various body part, evaluation of functions of the body part. To know about how disease occurs, and for that which organ system is required to defence those disease condition
CO4	Understand and evaluate	To know about plant photosynthesis, minerals, and factor affecting photosynthesis
CO5	Remember, Understand, Apply and evaluate	To get knowledge about plant respiration, plant growth and detail about the cell and tissue structure and function.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	2	3	3	3	2	3	3	3	2	2	3	2	1
CO2	3	1	2	3	2	2	2	2	3	2	3	3	3	3	2	2
CO3	3	2	3	3	2	2	2	2	3	2	2	3	3	3	2	3
CO4	3	2	3	3	2	3	3	2	3	2	2	3	3	3	3	3
CO5	3	2	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	1.6	2.4	2.6	2.5	2.4	2.6	2	2.8	2.2	2.4	2.6	2.8	3	2.2	2.2

B.PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL MATHEMATICS-THEORY (BP106RMT)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	-	-	2	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and La Place transform.

Objectives: Upon completion of this course the student should be able to

- Know the theory and their application in Pharmacy.
- Solve the different types of problems by applying theory.
- Appreciate the important application of mathematics in Pharmacy.
- Apply mathematics in solving statistical problems in pharmacy.
- Know the basics of mathematical problem-solving skills in Pharmacy.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Partial fraction Introduction, Polynomial, Rational fractions, Proper and Improper fractions, Partial fraction, Resolving into Partial fraction, Application of Partial Fraction in Chemical Kinetics and Pharmacokinetics Logarithms Introduction, Definition, Theorems/Properties of logarithms, Common logarithms, Characteristic and Mantissa, worked examples, application of logarithm to solve pharmaceutical problems. Function: Real Valued function, Classification of real valued functions. Limits and continuity: Introduction, Limit of a function, Definition of limit of a function. (ϵ - δ definition) $\lim_{x \rightarrow a} \frac{x^2 - a^2}{x - a} = 2a$, $\lim_{x \rightarrow 0} \frac{e^{2x} - 1}{x} = 2$	06	CO1, CO2, CO4.
[2]	Matrices and Determinant: Introduction matrices, Types of matrices, Operation on matrices, Transpose of a matrix, Matrix Multiplication, Determinants, Properties of determinants, Product of determinants, Minors and co-Factors, Adjoin or adjutant of a square matrix, Singular and non-singular matrices, Inverse of a matrix, Solution of system of linear equations using matrix method, Cramer's rule, Characteristics equation and roots of a square matrix, Cayley-Hamilton theorem, Application of Matrices in solving Pharmacokinetic equations.	06	CO1, CO2, CO4.
[3]	Calculus Differentiation: Introductions, Derivative of a function, Derivative of a constant, Derivative of a product of a constant and a function, Derivative of the sum or difference of two functions, Derivative of the product of two functions (product formula), Derivative of the quotient of two functions (Quotient formula)–Without Proof, Derivative of x^n w.r.t. x, where n is any rational number, Derivative of e^x Derivative of log	06	CO1, CO3, CO5.

	e^x , Derivative of a^x , Derivative of trigonometric functions from first principles (without Proof), Successive Differentiation, Conditions for a function to be a maximum or a minimum at a point. Application		
[4]	Analytical Geometry Introduction: Signs of the Coordinates, Distance formula, Straight Line: Slope or gradient of a straight line, Conditions for parallelism and perpendicularity of two lines, Slope of a line joining two points, Slope– intercept form of a straight line Integration: Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, definite integrals, application	06	CO1, CO3, CO4.
[5]	Differential Equations: Some basic definitions, Order and degree, Equations in separable form, Homogeneous equations, Linear Differential equations, Exact equations, Application in solving Pharmacokinetic equations Laplace Transform: Introduction, Definition, Properties of Laplace transform, Laplace Transforms of elementary functions, Inverse Laplace transforms, Laplace transform of derivatives, Application to solve Linear differential equations, Application in solving Chemical kinetics and Pharmacokinetics equations	06	CO3, CO4, CO5.

C. TEXT BOOKS

1. Hari Kishan. *Differential Calculus*; Atlantic Publishers & Distributors: New Delhi, 2007.
2. Ranganath, G. K. *Remedial Mathematics*. 2017.

D. REFERENCE BOOKS

1. Hari Kishan. *Differential Calculus*; Atlantic Publishers & Distributors: New Delhi, 2007.
2. Ranganath, G. K. *Remedial Mathematics*. 2017.
3. Hyma, P. *Pharmaceutical Mathematics with Application to Pharmacy*; Anmol Publications Pvt. Ltd: New Delhi, India, 2017.
4. H S Govinda Rao. *Higher Engineering Mathematics*; Viva Books: New Delhi, 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Know the theory and their application in Pharmacy.
CO2	Understand and apply	Solve the different types of problems by applying theory.
CO3	Evaluate	Appreciate the important application of mathematics in Pharmacy.
CO4	Apply and Remember	Apply mathematics in solving statistical problems in pharmacy.
CO5	Analyse and Evaluate	Know the basics of mathematical problem solving skills in Pharmacy.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	0	3	1	1	3	3	3	3	1
CO2	3	1	3	3	1	3	3	0	1	1	0	3	3	3	3	1
CO3	3	1	3	3	1	3	3	0	2	1	1	3	3	3	3	1
CO4	3	1	3	3	2	3	3	1	1	1	0	2	3	3	3	1
CO5	3	1	3	3	1	3	3	1	1	1	1	2	3	3	3	1
Avg	3	1.4	3	3	1.2	3	3	0.4	1.6	1	0.6	2.6	3	3	3	1

B. PHARM. SEMESTER – I (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY I-PRACTICAL (BP107 P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
---	--	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives:

- Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Study of compound microscope. 2. Microscopic study of epithelial and connective tissue 3. Microscopic study of muscular and nervous tissue 4. Identification of axial bones 5. Identification of appendicular bones 6. Introduction to hemocytometry. 7. Enumeration of white blood cell (WBC) count 8. Enumeration of total red blood corpuscles (RBC) 9. Determination of bleeding time 10. Determination of clotting time 11. Estimation of haemoglobin count 12. Determination of blood group 13. Determination of erythrocyte sedimentation rate (ESR) 14. Determination of heart rate and pulse rate 15. Recording of blood pressure.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
2. Sri Nageswari K; Sharma, R. Practical Workbook of Human Physiology; Jaypee Brothers Medical Publishers (P) Ltd, 2006.

D. REFERENCE BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.
2. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.

3. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic instruments used in this subject and how to operate it
CO2	Remember, Understand and evaluate	To know about the working mechanism of the instruments, understanding of models and result evaluation.
CO3	Understand Apply and Evaluate remember	To understand about procedure for measurement of various biochemical parameter, evaluation of result and after interpretation of result
CO4	Understand Apply and Evaluate	To know the value, obtain from the test and apply it in healthy or disease condition and give interpretation
CO5	Remember, Apply and evaluate	To get knowledge about parts of the instrument used in lab, its working principle, measurement and interpretation of result

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	3	3	2	3	3	3	2	3	3	3	1
CO2	3	2	2	3	1	3	2	2	3	1	3	3	3	3	2	1
CO3	3	3	3	3	2	2	2	3	3	1	2	3	3	3	2	2
CO4	3	2	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	3	3	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.4	2.8	3	1.6	2.6	2.6	2.2	2.8	1.8	2.4	2.6	3	3	2.4	1.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICAL ANALYSIS I-PRACTICAL (BP108P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.

Objectives: Upon completion of the course student shall be able to

- understand the principles of volumetric and electro chemical analysis
- carryout various volumetric and electrochemical titrations
- Develop analytical skills

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Preparation and standardization of (1) Sodium hydroxide (2) Sulphuric acid (3) Sodium thiosulfate (4) Potassium permanganate (5) Ceric ammonium sulphate Assay of the following compounds along with Standardization of Titrant (1) Ammonium chloride by acid base titration (2) Ferrous sulphate by Cerimetry (3) Copper sulphate by Iodometry (4) Calcium gluconate by complexometry (5) Hydrogen peroxide by Permanganometry (6) Sodium benzoate by non-aqueous titration (7) Sodium Chloride by precipitation titration Determination of Normality by electro-analytical methods (1) Conductometric titration of strong acid against strong base (2) Conductometric titration of strong acid and weak acid against strong base (3) Potentiometric titration of strong acid against strong base	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Ministry, India.; Indian Pharmacopoeia Commission. *Indian Pharmacopoeia, 2010*; Indian Pharmacopoeia Commission: Ghaziabad, 2010.
2. Jain, D. S. M.; Patel, D. V. B. *Pharmaceutical Analysis*; Nirali Prakashan, 2018.

D. REFERENCE BOOKS

1. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988
2. Muhammad Sajid Hamid Akash; Kanwal Rehman. *Essentials of Pharmaceutical Analysis*; Singapore Springer, 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, learn and remember	Understand, learn and remember various calculations for quantification of drugs by analytical and electroanalytical methods.
CO2	Learn and remember	Learn and remember the concept of calibration of apparatus and instruments
CO3	Understand and apply	Understand and apply the analytical and electroanalytical methods for assay and quantification of drugs in an unknown samples.
CO4	Understand	Understand the importance of data integrity and ethical practices in every steps of drugs quantification
CO5	Develop	Develop skills in performing the volumetric titration and handling electroanalytical instruments

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	1	1	1	1	2	-	3	3	3	2	2	-
CO2	3	3	2	1	1	2	1	1	2	-	3	3	3	2	2	-
CO3	3	3	3	3	2	2	1	1	2	1	3	3	3	2	2	1
CO4	3	1	3	1	2	2	1	1	2	-	3	3	3	2	2	1
CO5	3	3	1	1	1	2	1	1	2	1	3	3	3	2	2	-
Avg	3	2.6	2.2	1.8	1.4	1.8	1	1	2	0.4	3	3	3	2	2	0.4

B. PHARM. SEMESTER – I (BPH)
SUBJECT: PHARMACEUTICS I-PRACTICAL (BP109P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	-	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Course enables the student to impart a fundamental knowledge on the preparatory pharmacy with arts and science of preparing the different conventional dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the history of profession of pharmacy
- Understand the basics of different dosage forms, pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Prepare various conventional dosage forms

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Syrups a) Syrup IP'66 b) Compound syrup of Ferrous Phosphate BPC'68 2. Elixirs a) Piperazine citrate elixir b) Paracetamol pediatric elixir 3. Linctus a) Terpin Hydrate Linctus IP'66 4. Solutions b) Iodine Throat Paint (Mandles Paint) a) Strong solution of ammonium acetate b) Cresol with soap solution c) Lugol's solution 5. Suspensions a) Calamine lotion b) Magnesium Hydroxide mixture c) Aluminium Hydroxide gel 6. Emulsions a) Turpentine Liniment b) Liquid paraffin emulsion 7. Powders and Granules a) ORS powder (WHO) b) Effervescent granules c) Dusting powder d) Divided powders 8. Suppositories a) Glycero gelatin suppository b) Cocoa butter suppository c) Zinc Oxide suppository 8. Semisolids a) Sulphur ointment b) Non staining-iodine ointment with methyl salicylate c) Carbopol gel	60	CO1 CO2 CO3 CO4 CO5

	9. Gargles and Mouthwashes a) Iodine gargle b) Chlorhexidine mouthwash		
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C. TEXT BOOKS

1. Sanmathi. Dispensing Pharmacy : A Practical Manual.; Pharma Book Syndicate, 2010.
2. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

D. REFERENCE BOOKS

1. Ansel, H. C.; Allen, L. V.; Popovich, N. G. Pharmaceutical Dosage Forms and Drug Delivery Systems; Philadelphia, Pa Lippincott-Williams & Wilkins, 1999.
2. Arthur Owen Bentley; Ernest Alexander Rawlins. Bentley's Textbook of Pharmaceutics.; All India Traveller Book Seller: New Delhi, 2002.
3. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
4. Gunn, C.; Cooper, J. W.; Sidney James Carter. Cooper and Gunn's Dispensing for Pharmaceutical Students; Cbs: New Delhi, 2008.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To convert the values of different parameters in different unit system for the calculation of ingredients in the formulation.
CO2	Apply	To perform the calculation for preparation of different dosage forms.
CO3	Create and prepare	To prepare the conventional dosage forms.
CO4	Evaluate	To evaluate the conventional dosage forms.
CO5	Apply and evaluate	To learn the packaging conditions, labeling and storage conditions for different dosage forms.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	3	3	2	2	-	2	2	-	3	3	3	3	3	1
CO2	3	1	3	3	1	2	1	3	2	2	3	3	3	3	3	2
CO3	3	1	3	3	1	1	-	1	1	1	3	3	3	3	3	1
CO4	3	1	3	3	1	1	-	1	1	1	3	3	3	3	3	1
CO5	3	3	3	3	3	3	2	2	3	3	3	3	3	3	3	3
Avg	3	1.6	3	3	1.6	1.8	0.6	1.8	1.8	1.4	3	3	3	3	3	1.6

B. PHARM. SEMESTER – I (BPH)**SUBJECT: PHARMACEUTICAL INORGANIC CHEMISTRY -PRACTICAL (BP110P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with the monographs of inorganic drugs and pharmaceuticals.

Objectives: Upon completion of the course the student shall be able to

- know the sources of impurities and methods to determine the impurities in inorganic drugs and pharmaceuticals
- understand the medicinal and pharmaceutical importance of inorganic compounds

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	Limit tests for following ions Limit test for Chlorides and Sulphates Modified limit test for Chlorides and Sulphates Limit test for Iron Limit test for Heavy metals Limit test for Lead Limit test for Arsenic Identification test Magnesium hydroxide Ferrous sulphate Sodium bicarbonate Calcium gluconate Copper sulphate Test for purity Swelling power of Bentonite Neutralizing capacity of aluminum hydroxide gel Determination of potassium iodate and iodine in potassium Iodide Preparation of inorganic pharmaceuticals Boric acid Potash alum Ferrous sulphate	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Dhake A S, Inorganic pharmaceutical chemistry, First edition, Career publications, India, 2004

D. REFERENCE BOOKS (LATEST EDITION)

1. Ministry, India.; Indian Pharmacopoeia Commission. Indian Pharmacopoeia, 2010. Addendum 2012; Indian Pharmacopoeia Commission: Ghaziabad, 2012.
2. Anand & G.R. Chatwal, Inorganic Pharmaceutical Chemistry, India, 2010

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To study limit tests of various inorganic compounds
CO2	Understand and Remember	To perform identification tests of various inorganic compounds
CO3	Understand and Remember	To understand and remember the preparations of various inorganic pharmaceuticals
CO4	Understand and Remember	To understand and remember the reactions involved in preparation of various inorganic pharmaceuticals
CO5	Understand and Evaluate	To understand and evaluate tests for purity of various inorganic pharmaceuticals

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	-	1	-	1	1	-	2	3	3	3	2	1	1
CO2	3	1	1	-	1	-	-	1	-	-	3	3	2	2	-	-
CO3	2	1	1	-	1	-	-	1	-	-	3	3	2	-	-	1
CO4	2	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-
CO5	3	1	1	-	1	-	1	1	1	-	3	3	3	2	1	1
Avg	2.6	0.8	0.8	-	0.8	-	0.4	0.8	0.2	0.4	3	2.6	2	1.2	0.4	0.6

B. PHARM. SEMESTER – I (BPH)
SUBJECT: COMMUNICATION SKILLS -PRACTICAL (BP111P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac.	Total
-	-	2	2	1	15	5	5	-	25

A. COURSE OVERVIEW

Scope: This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business

Objectives: Upon completion of the course the student shall be able to

- Communicate effectively (Verbal and Non-Verbal)
- Effectively manage the team as a team player
- Develop interview skills, writing skills, Leadership qualities and essentials

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Basic communication covering the following topics Meeting People Asking Questions Making Friends What did you do?</p> <p>Pronunciations covering the following topics Pronunciation (Consonant Sounds) Pronunciation and Nouns Pronunciation (Vowel Sounds)</p> <p>Advanced Learning Listening Comprehension / Direct and Indirect Speech Figures of Speech Effective Communication Writing Skills Effective Writing Interview Handling Skills E-Mail etiquette Presentation Skills</p>	30	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Fujishin, R. *The Art of Communication : Improving Your Fundamental Communication Skills*; Rowman & Littlefield: Lanham, 2016.
2. Pandey, M.; Phil, M.; Lit, E.; Lib, M. *FIRST YEAR B. PHARM. Semester I*

D. REFERENCE BOOKS

1. Burton, L.; Dalley, D.; University Of Learning Ltd. *Developing Your Influencing Skills : A Guide to Developing the 7 Traits of Influential People*; Universe Of Learning: Great Britain, 2010.
2. Shikha Kapoor. *Personality Development and Soft Skills : Preparing for Tomorrow*; I.K. International Publishing House Pvt. Ltd: New Delhi, 2018.
3. Thomson, A. J.; Martinet, A. V. *A Practical English Grammar*; Oxford Univ. Press, 2012.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and learn	Understand and learn the basics of communication and apply it appropriately in professional and social context
CO2	Learn, remember and apply	Learn, remember and apply the key concepts of pronunciations in speaking
CO3	Display/ Demonstrate	Display competence in oral, written, and visual communication
CO4	Learn	Learn to prepare an audience – centric presentation
CO5	Understand, learn and apply	Understand, Learn and apply the requisites for an effective writing skills and listening skills

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	-	-	-	3	-	3	1	-	3	1	-	-	3	-
CO2	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO3	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO4	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
CO5	-	-	-	-	-	3	-	3	3	-	3	1	-	-	3	-
Avg.	-	-	-	-	-	3	-	3	2.6	-	3	1	-	-	3	-

B. PHARM. SEMESTER – I (BPH)
SUBJECT: REMEDIAL BIOLOGY – PRACTICAL (BP112RBP)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
--	--	1	2	1	15	10	5	-	25

A. COURSE OVERVIEW

1. Scope: To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Objectives: Upon completion of the course the student shall be able to

- know the classification and salient features of five kingdoms of life
- Understand the basic components of anatomy & physiology of plant
- Know understand the basic components of anatomy & physiology animal with special reference to human

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. Introduction to Experiments in Biology <ol style="list-style-type: none"> A) Study of Microscope B) Section Cutting Techniques C) Mounting and Staining D) Permanent Slide Preparation 2. Study of Cell and Its Inclusions 3. Study of Stem, Root, Leaf, Seed, Fruit, Flower and Their Modifications 4. Detailed Study of Frog by Using Computer Models 5. Microscopic Study and Identification of Tissues Pertinent To Stem, Root 6. Leaf, Seed, Fruit and Flower 7. Identification of Bones 8. Determination of Blood Group 9. Determination of Blood Pressure 10. Determination of Tidal Volume 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.
2. Kale, S. R.; Kale, R. R. Practical Human Anatomy and Physiology for First Year Diploma Course in Pharmacy; Nirali Prakashan: Pune, India, 2007.

D. REFERENCE BOOKS

1. Kale, S. R.; Kale, R. R. Practical Human Anatomy and Physiology for First Year Diploma Course in Pharmacy; Nirali Prakashan: Pune, India, 2007.
2. Gokhale, S. B.; Kokate, C. K.; Pharmaceutical Biology; Nirali Prakashan, August: Pune, 2015.
3. Shafi, M.J.H. Biology practical manual according to National core curriculum .Biology forum of Karnataka.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the basic instruments used in this subject and how to operate and what is the procedure behind it.
CO2	Remember, Understand and evaluate	To know about the working mechanism of the instruments, understanding of models and result evaluation.
CO3	Understand Apply and Evaluate remember	To understand about parts of the plant and animals, evaluation of study in both animals and plants
CO4	Understand Apply and Evaluate	To know the about the parts and function of the parts of body
CO5	Remember, Apply and evaluate	To get knowledge about parts of the instrument used in lab, its working principle, measurement and interpretation of result

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	2	3	3	3	2	3	3	3	3
CO2	3	2	2	3	2	2	2	2	3	2	3	3	3	3	2	2
CO3	3	3	3	3	2	2	2	2	3	2	2	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	3	2	2	3	3	3	3	2
CO5	3	3	2	2	2	2	3	2	2	2	2	2	3	3	2	2
Avg	3	2.8	2.6	2.8	2	2.4	2.6	2	2.8	2.2	2.4	2.6	3	3	2.4	2.2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY II -THEORY (BP201T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the haematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time, etc. and also record blood pressure, heart rate, pulse and respiratory volume.
- Appreciate coordinated working pattern of different organs of each system.
- Appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Nervous system Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)	10	CO1
[2]	Digestive system Anatomy of GI Tract with special reference to anatomy and functions of stomach, (Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT. Energetics Formation and role of ATP, Creatinine Phosphate and BMR.	06	CO2 CO4

[3]	Respiratory system Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respiration. Lung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods. Urinary system Anatomy of urinary tract with special reference to anatomy of kidney and Nephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidney and disorders of kidney.	10	CO3 CO4
[4]	Endocrine system Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, Adrenal gland, pancreas, pineal gland, thymus and their disorders.	10	C04
[5]	Reproductive system Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition Introduction to genetics Chromosomes, genes and DNA, protein synthesis, genetic pattern of inheritance	09	CO4 CO5

C. TEXT BOOKS

1. Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991.

D. REFERENCE BOOKS

1. Sembulingam, K. Essentials of Medical Physiology: With Free Review of Medical Physiology. Jaypee Brothers: S.L., 2019.
2. Waugh, A.; Ross, J. S.; Grant, A.; Wilson, K. J. W. Ross and Wilson Anatomy and Physiology in Health and Illness : Anne Waugh, Allison Grant ; Illustrations by Graeme Chambers.; Churchill Livingstone: Edinburgh, 2001.
3. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
4. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020.
5. Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.
6. Singh, I. Textbook of Human Histology: (with Colour Atlas & Practical Guide); Jaypee Brothers Medical Publishers: New Delhi, 2011.
7. Ghai, C. L. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
8. Srinageswari, K.; Sharma, R. Practical workbook of Human Physiology; Jaypee brother's medical publishers, New Delhi
9. Charles Herbert Best; Brobeck, J. R.; Norman Burke Taylor. Best & Taylor's Physiological Basic of Medical Practice; Williams & Wilkins: Baltimore, 1980.
10. Chatterjee, C. C. Human Physiology: For Preclinical Medical and Degree Courses in Physiology; CBS Publishers & Distributors: New Delhi, 2016.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember, Understand and Apply	To know the basic fundamental structural features of neurons, mechanism of neurotransmitters along with processes of neuroconduction and neurotransmission.
CO2	Remember, Understand and Apply	To understand the basic biochemical processes occurs in the body related to digestion and energy production
CO3	Understand and remember	To understand the structure and basic functioning of the respiratory tract and urinary tract.
CO4	Understand and remember	To know about various hormones in the body and its related disorders
CO5	Understand and remember	To get knowledge about human reproductive system and its importance and know the basic genetics processes

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO2	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO3	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO4	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
CO5	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2
Avg	3	1	2	3	2	3	2	3	3	2	2	3	3	3	3	2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY I-THEORY (BP202T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

B. COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

NO	TOPIC	L (Hrs)	COs
[1]	Classification, nomenclature and isomerism Classification of Organic Compounds Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds) Structural isomerisms in organic compounds	07	CO1 CO2
[2]	Alkanes*, Alkenes* and Conjugated dienes SP ³ hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP ² hybridization in alkenes E1 and E2 reactions – kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E 1 verses E 2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation. Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement	10	CO1 CO3 CO4 CO5
[3]	Alkyl halides SN1 and SN2 reactions - kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations. SN1 versus SN2 reactions, Factors affecting SN1 and SN2 reactions Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform. Alcohols*- Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol	10	CO1 CO3 CO4 CO5
[4]	Carbonyl compounds	10	CO1

	Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests, Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.		CO3 CO4 CO5
[5]	Carboxylic acids Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid Aliphatic amines - Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine	8	CO1 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

D. REFERENCE BOOKS (LATEST EDITION)

1. Robert Thornton Morrison; Robert Neilson Boyd. Organic Chemistry. 2 : Study Guide; Allyn And Bacon: Boston, Mass., 1987.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Education: India, 2003.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To learn about name, structure, isomerism and uses of organic compound
CO2	Understand and Remember	To understand about various factors which affect the reactions of organic compounds
CO3	Understand and Apply	To know the reaction, name of the reaction and orientation of reactions
CO4	Understand	To understand the reactivity/stability of organic compounds
CO5	Understand and Remember	To understand and remember the preparation of organic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO2	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO3	3	1	1	2	-	-	-	1	1	-	3	3	2	2	1	-
CO4	3	-	-	2	-	-	-	1	1	-	3	3	2	2	1	-
CO5	3	-	-	2	-	-	-	1	1	3	3	3	2	3	1	-
Avg	3	0.2	0.2	2	-	-	-	1	1	0.6	3	3	2	2.2	1	-

B. PHARM. SEMESTER – II (BPH)
SUBJECT: BIOCHEMISTRY (BP203T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
3	1	-	04	04	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Objectives: Upon completion of course student shall able to

- Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
- Understand the metabolism of nutrient molecules in physiological and pathological conditions.
- Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Carbohydrate metabolism Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics and significance HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency Glycogen metabolism Pathways and glycogen storage diseases (GSD) Gluconeogenesis- Pathway and its significance Hormonal regulation of blood glucose level and Diabetes mellitus Biological oxidation Electron transport chain (ETC) and its mechanism. Oxidative phosphorylation & its mechanism and substrate level phosphorylation Inhibitors ETC and oxidative phosphorylation/Uncouplers	10	CO2 CO4
[2]	Lipid metabolism β-Oxidation of saturated fatty acid (Palmitic acid) Formation and utilization of ketone bodies; ketoacidosis De novo synthesis of fatty acids (Palmitic acid) Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity. Amino acid metabolism General reactions of amino acid metabolism: Transamination, deamination & decarboxylation, urea cycle and its disorders	10	CO2 CO4

	Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, alcaptonuria, tyrosinemia) Synthesis and significance of biological substances; 5-HT, melatonin, dopamine, noradrenaline, adrenaline Catabolism of heme; hyperbilirubinemia and jaundice		
[3]	Nucleic acid metabolism and genetic information transfer Biosynthesis of purine and pyrimidine nucleotides Catabolism of purine nucleotides and Hyperuricemia and Gout disease Organization of mammalian genome Structure of DNA and RNA and their functions DNA replication (semi conservative model) Transcription or RNA synthesis Genetic code, Translation or Protein synthesis and inhibitors	10	CO3 CO4
[4]	Biomolecules Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins. Bioenergetics Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; Redox potential. Energy rich compounds; classification; biological significances of ATP and cyclic AMP	08	CO2 CO4 CO5
[5]	Enzymes Introduction, properties, nomenclature and IUB classification of enzymes Enzyme kinetics (Michaelis plot, Line Weaver Burke plot) Enzyme inhibitors with examples Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation Therapeutic and diagnostic applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions	07	CO1

C. TEXT BOOKS

1. Murray, R.; Bender, D.; Botham, K.; Kennelly, P.; Rodwell, V.; Weil, P.; York, N.; San, C.; Lisbon, F.; Madrid, L.; City, M.; Delhi, M.; Juan, S. *Twenty-Eighth Edition*..
2. U Satyanarayana. *Biochemistry*; Elsevier India: New Delhi, 2021.

D. REFERENCE BOOKS

1. Cox, D. L. *Lehninger principles of biochemistry: International Edition*.; W H Freeman & Co Ltd: S.L., 2021..
2. Berg, J. M.; Tymoczko, J. L.; J, G.; Lubert Stryer. *Biochemistry*; W.H. Freeman/Mcmillan Learning: New York, 2019..

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and learn	Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
CO2	Understand and learn	Understand the metabolism of nutrient molecules in physiological and pathological conditions.
CO3	Understand and learn	Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.
CO4	Learn and remember	Learn and remember the basic chemical structure of nutrient molecules and biological importance of biological macromolecules
CO5	Understand	Explain biological mechanisms, such as the processes and control of bioenergetics and metabolism, as chemical reactions

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
CO2	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
CO3	3	-	3	1	-	2	1	1	2	-	3	3	3	3	1	1
CO4	3	-	3	1	-	2	1	1	2	-	3	3	3	3	1	1
CO5	3	-	3	1	-	2	1	1	3	-	3	3	3	3	1	1
Avg.	3	-	3	1	-	2	1	1	2.6	-	3	3	3	3	1	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: PATHOPHYSIOLOGY-THEORY (BP 204T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	---	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

Objectives: Upon completion of the course the student shall be able to

- Describe the etiology and pathogenesis of the selected disease states;
- Name the signs and symptoms of the diseases; and
- Mention the complications of the diseases.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Basic principles of Cell injury and Adaptation: Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance Basic mechanism involved in the process of inflammation and repair: Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis	10	CO1
[2]	Cardiovascular System: Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis) • Respiratory system: Asthma, Chronic obstructive airways diseases. • Renal system : Acute and chronic renal failure .	10	CO2 CO3 CO4 CO5

[3]	Haematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia <ul style="list-style-type: none"> ● Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones ● Nervous system: Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease. ● Gastrointestinal system: Peptic Ulcer 	10	CO2 CO3 CO4 CO5
[4]	Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease. <ul style="list-style-type: none"> ● Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout ● Principles of cancer: classification, etiology and pathogenesis of cancer 	08	CO2 CO3 CO4 CO5
[5]	Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections <ul style="list-style-type: none"> ● Sexually transmitted diseases: AIDS, Syphilis, Gonorrhea 	07	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Harsh Mohan; Damjanov, I. Textbook of Pathology; Jaypee Brothers Medical Publishers: New Delhi, 2019.
2. Walker, R.; Cate Whittlesea. Clinical Pharmacy and Therapeutics; Churchill Livingstone: Edinburgh ; New York, 2007.

D. REFERENCE BOOKS

1. Hall, J. E.; Hall, M. E. Guyton and Hall Textbook of Medical Physiology; Elsevier - Health Science: S.L., 2020
2. Walker, R.; Cate Whittlesea. Clinical Pharmacy and Therapeutics; Churchill Livingstone: Edinburgh ; New York, 2007.
3. Blumenthal, D. K.; Rollins, D. E. Workbook and Casebook for "Goodman and Gilman's the Pharmacological Basis of Therapeutics"; Mcgraw Hill: New York ; Madrid Etc, 2016.
4. Davidson's Principles and Practice of Medicine.; Elsevier Health Sciences: S.L., 2022.

RECOMMENDED JOURNALS

1. Toner, P. G. The Journal of Pathology 1999, 187 (1), 187. [https://doi.org/3.0.co;2-n">10.1002/\(sici\)1096-9896\(199901\)187:1<187::aid-path269>3.0.co;2-n](https://doi.org/3.0.co;2-n).
2. Robbins, J. KCNQ Potassium Channels: Physiology, Pathophysiology, and Pharmacology. Pharmacology & Therapeutics 2001, 90 (1), 1–19. [https://doi.org/10.1016/s0163-7258\(01\)00116-4](https://doi.org/10.1016/s0163-7258(01)00116-4).
3. Quiz Page. Indian Journal of Pathology and Microbiology 2015, 58 (4), 568. <https://doi.org/10.4103/0377-4929.168897>.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about the mechanism behind cell death, inflammatory process and repair mechanism in human body
CO2	Remember, Understand and Apply	To know about the system and function of the body and disease associated with dysfunctioning of the system
CO3	Understand Apply and Evaluate	To understand about the mechanism behind generation of the disease and/or cause of diseases
CO4	Understand	To know about cause, and treatment of the communicable and non-communicable diseases.
CO5	Remember, Understand, Apply and evaluate	To get knowledge about medication used to treat the disease according to the pathway of disease production.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2	1	1	3	3	2	2	3	3	3	2	1
CO2	3	2	2	3	1	1	1	3	3	2	2	3	3	3	2	1
CO3	3	2	3	3	2	3	2	3	3	1	2	3	3	3	2	1
CO4	3	1	3	3	1	3	3	3	3	2	2	3	3	3	3	2
CO5	3	3	2	3	2	2	3	3	2	3	2	2	3	3	2	2
Avg	3	2	2.4	2.8	1.6	2	2	3	2.8	2	2	2.8	3	3	2.2	1.4

B. PHARM. SEMESTER – II (BPH)
SUBJECT: COMPUTER APPLICATIONS IN PHARMACY-THEORY (BP205T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	-	-	3	3	50	15	10	-	75

A. COURSE OVERVIEW

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

Objectives: Upon completion of the course the student shall be able to

- Know the various types of application of computers in pharmacy
- Know the various types of databases
- Know the various applications of databases in pharmacy

B. COURSE CONTENT

NO	TOPIC	L(Hrs)	COs
[1]	Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division Concept of Information Systems and Software : Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project	06	CO2
[2]	Web technologies: Introduction to HTML, XML, CSS and Programming languages, introduction to web servers and Server Products Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database	06	CO3 CO4
[3]	Application of computers in Pharmacy – Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Prescribing and discharge (EP) systems, barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System	06	CO1
[4]	Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics, Impact of Bioinformatics in Vaccine Discovery	06	CO5
[5]	Computers as data analysis in Preclinical development: Chromatographic data analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS)	06	CO1

C. TEXT BOOKS

1. V. Bhagat, S. Narkhede, D. Kardile, S. Shankar. *Computer Application in Pharmacy*. NiraliPrakashan, Pune. 1st Edition 2018.

D. REFERENCE BOOKS

1. William E Fassett; Dale B Christensen. *Computer Application in Pharmacy*. Lea and Febiger, USA, 1986.
2. Sean Ekins. *Computer Application in Pharmaceutical Research and Development*. Wiley-Interscience, USA, 2006.
3. S.C. Rastogi. *Bioinformatics: Concept, Skills and Applications*. CBS Publishers and Distributors, New Delhi, 2nd Edition 2019.
4. Cary N. Prague. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath*. Wiley Dreamtech India (P) Ltd., New Delhi,

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand various applications of computers in pharmacy
CO2	Understand and apply	Understand and apply concept of Information Systems and Software
CO3	Remember and Evaluate	Remember and evaluate various types of databases
CO4	Understand and Remember	Understand and remember about Web technologies
CO5	Understand and analyse	Understand and analyse concept of Bioinformatics

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	3	-	2	-	-	1	-	3	2	2	1	-	-
CO2	2	1	1	2	-	1	-	-	1	-	2	1	2	1	-	-
CO3	1	-	2	2	-	-	-	-	-	-	1	1	1	-	-	-
CO4	-	-	1	1	-	-	-	1	-	-	2	2	1	-	-	-
CO5	2	1	-	3	-	-	1	-	1	-	-	2	3	1	-	-
Avg	1.4	0.8	1.2	2.2	-	0.6	0.2	0.2	0.6	-	1.6	1.6	1.8	0.6	-	-

B. PHARM. SEMESTER – II (BPH)**SUBJECT: ENVIRONMENTAL SCIENCES- THEORY (BP206T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
2	-	-	2	3	50	15	10	-	75

A. COURSE OVERVIEW

Scope: Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.

Objectives: Upon completion of the course the student shall be able to:

- Create the awareness about environmental problems among learners.
- Impart basic knowledge about the environment and its allied problems.
- Develop an attitude of concern for the environment.
- Motivate learner to participate in environment protection and environment improvement.
- Acquire skills to help the concerned individuals in identifying and solving environmental problems.
- Strive to attain harmony with Nature.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	The Multidisciplinary nature of environmental studies Natural Resources Renewable and non-renewable resources: Natural resources and associated problems a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.	10	CO1 CO3 CO4
[2]	Ecosystems <ul style="list-style-type: none">▪ Concept of an ecosystem.▪ Structure and function of an ecosystem.▪ Introduction, types, characteristic features, structure and function of the ecosystems: Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	10	CO1 CO2 CO3
[3]	Environmental Pollution: Air pollution; Water pollution; Soil pollution	10	CO1 CO3 CO5

C. TEXT BOOKS

1. S.S. Randhava, Environmental Sciences, Vikas and Company Medical Publishers, Peevee publication, Jalandhar, 2019.
2. Prof. M. K. Gupta, Prof. Manish Jaimini, Environmental sciences, Vikas Pandey, published by Nirali Prakashan, Pune, 2018

D. REFERENCE BOOKS

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. Environmental Biology, Nidi Publ. Ltd. Bikaner, 2001
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2001, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down of Earth, Centre for Science and Environment

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and create	Discuss environmental problems among learners and create the awareness and strive to attain harmony with Nature.
CO2	Understand and remember	Describe concept of Ecosystems and remember structure and function of it.
CO3	Create	To create an attitude of concern for the environment protection and environment improvement.
CO4	Understand and remember	Explain Natural Resources of Environment
CO5	Understand and analyse	Describe and analyse the environmental pollution.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	3	2	1	2	2	3	3	3	2	2	2	2
CO2	2	3	3	1	2	2	1	2	2	3	3	3	2	2	2	2
CO3	2	3	3	2	2	2	1	2	2	3	3	3	3	2	2	2
CO4	2	3	2	2	2	2	2	2	2	3	3	3	3	2	2	2
CO5	2	3	3	2	3	2	2	2	2	3	3	3	3	2	2	2
Avg	2.2	3	2.8	1.6	2.4	2	1.4	2	2	3	3	3	2.6	2	2	2

B. PHARM. SEMESTER – II (BPH)
SUBJECT: HUMAN ANATOMY AND PHYSIOLOGY II - PRACTICAL (BP207P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Practical physiology is complimentary to the theoretical discussions in physiology.

Objectives: Practical allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals or normal human beings. This is helpful for developing an insight on the subject.

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	1. To study the integumentary and special senses using specimen, models, etc., 2. To study the nervous system using specimen, models, etc., 3. To study the endocrine system using specimen, models, etc 4. To demonstrate the general neurological examination 5. To demonstrate the function of olfactory nerve 6. To examine the different types of taste. 7. To demonstrate the visual acuity 8. To demonstrate the reflex activity 9. Recording of body temperature 10. To demonstrate positive and negative feedback mechanism. 11. Determination of tidal volume and vital capacity. 12. Study of digestive, respiratory, cardiovascular systems, urinary and reproductive systems with the help of models, charts and specimens. 13. Recording of basal mass index 14. Study of family planning devices and pregnancy diagnosis test. 15. Demonstration of total blood count by cell analyser 16. Permanent slides of vital organs and gonads.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

- Ghai, C. L. A Textbook of Practical Physiology; Jaypee Brothers Medical Publishers (P) Ltd: New Delhi, 2013.
- Scanlon, V. C.; Sander, T. Student Workbook for Essentials of Anatomy and Physiology; F.A. Davis: Philadelphia, 1991

D. REFERENCE BOOKS

- Waugh, A.; Ross, J. S.; Grant, A.; Wilson, K. J. W. Ross and Wilson Anatomy and Physiology in Health and Illness : Anne Waugh, Allison Grant ; Illustrations by Graeme Chambers.; Churchill Livingstone: Edinburgh, 2001.
- Tortora, G. J.; Derrickson, B. Principles of Anatomy and Physiology, 15th ed.; Wiley: Hoboken, 2017.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To get knowledge about basic anatomy and physiology of the human organ systems
CO2	Remember, Understand and evaluate	To know about performance of experiments like neurological reflex, body temperature measurement, body mass index, olfaction, gestation reflex and eye sight, etc.
CO3	Understand Apply and Evaluate remember	To understand about procedure for measurement of various haematological parameter, evaluation and interpretation of result
CO4	Understand Apply and Evaluate	To know about family planning
CO5	Remember, Apply and evaluate	To know the histological structures of the body organs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	3	3	3	1	3	3	1	2	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	1	1	3	3	3	1	3	3	3	3	3	3	3	3	3
Avg	3	2.2	2.2	3	3	3	2.2	3	3	2.6	2.8	3	3	3	3	3

B. PHARM. SEMESTER – II (BPH)**SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY I-PRACTICAL (BP208P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- identify/confirm the identification of organic compound

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Systematic qualitative analysis of unknown organic compounds like Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc. 2. Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test 3. Solubility test 4. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides. 5. Melting point/Boiling point of organic compounds 6. Identification of the unknown compound from the literature using melting point/ boiling point. 7. Preparation of the derivatives and confirmation of the unknown compound by melting point/ boiling point. 8. Minimum 5 unknown organic compounds to be analysed systematically. 2. Preparation of suitable solid derivatives from organic compounds 3. Construction of molecular models	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav & Roopal Prakashan, India, 2008

D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.

3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand the various preliminary test for organic compounds
CO2	Understand and apply	To perform nature identification test for various organic compounds
CO3	Understand and evaluate	Detection of elements like Nitrogen, Sulphur and Halogen by Lassaigne's test
CO4	Understand and evaluate	To study about various functional groups identification for organic compounds
CO5	Understand & Apply	Identification of unknown organic compound from the literature using melting point/boiling point

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO2	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO3	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO4	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
CO5	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1
Avg	3	1	2	-	1	-	-	1	1	1	2	3	2	3	1	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: BIOCHEMISTRY PRACTICAL (BP209P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4		35	10	5	-	50

A. COURSE OVERVIEW

Scope: The scope of the subject deals with complete understanding of different qualitative test to be performed for identification of carbohydrates, lipids and proteins. It is also emphasizing on quantitative estimation of sugars and proteins, preparation of buffers and studying the activity of enzyme.

Objectives: Upon completion of course, student shell able to

- Perform various qualitative tests for identification of carbohydrates, proteins and abnormal constituents.
- Understand the Principles for quantitative estimation of glucose and cholesterol.
- Understand and evaluate activity of salivary amylase enzyme

B. COURSE CONTENT

NO	TOPIC	P(Hrs)	COs
[1]	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and starch) Identification tests for Proteins (albumin and Casein) Qualitative analysis of urine for abnormal constituents Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method) Determination of blood creatinine Determination of blood sugar Determination of serum total cholesterol Preparation of buffer solution and measurement of pH Study of enzymatic hydrolysis of starch. Determination of Salivary amylase activity Study the effect of Temperature on Salivary amylase activity. Study the effect of substrate concentration on salivary amylase activity.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. G. Raval, H. Practicals in biochemistry
2. Gupta, R. C. *Practical Biochemistry*; Cbs Publishers And Distributors: New Delhi, 2006.

D. REFERENCE BOOKS

1. Plummer David T. *An Introduction to Practical Biochemistry*; Tata Mcgraw Hill: New Delhi, 1990.
2. G Rajagopal; Es Rāmakiruşṇan. *Practical Biochemistry for Medical Students*; Orient Longman ; New York, Ny: Hyderabad, 1983.
3. Varley, H. *Practical Clinical Biochemistry*; Cbs Publishers & Distributors: Delhi, 1988.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, remember and learn	Understand, remember, learn principles and perform various test ethically for qualitative analysis of carbohydrates, proteins and abnormal constituent in urine.
CO2	Understand, learn and apply and evaluate	Understand, learn and perform the quantitative test for analysis of reducing sugars and protein.
CO3	Understand Apply and Evaluate	Analyse and evaluate the factors affecting enzyme activity
CO4	Understand Apply and Evaluate	Understand and learn the concept of buffers
CO5	Understand Apply and Evaluate	Evaluation and interpretation of data emanating from a pathological lab for various carbohydrates, lipids and protein.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO2	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO3	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO4	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
CO5	3	3	3	1	2	2	1	1	3	-	3	3	2	-	2	1
Avg.	3	3	3	1	2	2	1	1	3	-	3	3		-	2	1

B. PHARM. SEMESTER – II (BPH)
SUBJECT: COMPUTER APPLICATIONS IN PHARMACY-PRACTICAL(BP210P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	2	2	1	15	5	5	-	25

A. COURSE OVERVIEW

Scope: This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases

Objectives: Upon completion of the course the student shall be able to

- Know the various types of office tools and their applications
- Create the various databases
- Know the various applications of databases in pharmacy

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	CO
[1]	1. Design a questionnaire using a word processing package to gather information about a particular disease. 2. Create a HTML web page to show personal information 3. Retrieve the information of a drug and its adverse effects using online tools 4. Creating mailing labels Using Label Wizard , generating label in MS WORD 5. Create a database in MS Access to store the patient information with the required fields Using access 6. Design a form in MS Access to view, add, delete and modify the patient record in the database 7. Generating report and printing the report from patient database 8. Creating invoice table using – MS Access 9. Drug information storage and retrieval using MS Access 10. Creating and working with queries in MS Access 11. Exporting Tables, Queries, Forms and Reports to web pages 12. Exporting Tables, Queries, Forms and Reports to XML pages	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. V. Bhagat, S. Narkhede, D. Kardile, S. Shankar. *Computer Application in Pharmacy*. NiraliPrakashan, Pune. 1st Edition 2018.

D. REFERENCE BOOKS

1. William E Fassett; Dale B Christensen. *Computer Application in Pharmacy*. Lea and Febiger, USA, 1986.

2. Sean Ekins. *Computer Application in Pharmaceutical Research and Development*. Wiley-Interscience, USA, 2006.
3. S.C. Rastogi. *Bioinformatics: Concept, Skills and Applications*. CBS Publishers and Distributors, New Delhi, 2nd Edition 2019.
4. Cary N. Prague. *Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath*. Wiley Dreamtech India (P) Ltd., New Delhi,

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	Understand basic tools of MS Word, MS Excel and MS Power point and apply them to create documents.
CO2	Remember, Understand and Create	Remember and Understand HTML tags and create HTML web page.
CO3	Create	Create mailing labels Using Label Wizard, generating label in MS WORD
CO4	Design	Design questionnaire/reports using a word processing package to gather information about a particular disease.
CO5	Understand and Apply	Understand tools of MS Access and apply in creating database, queries, relationship and reports from patient database

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	-	1	2	-	-	-	2	-	-	1	1	2	-	-	-
CO2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	1	-	-	-	1	-	-	1	1	-	-	1	-
CO4	1	-	1	2	-	-	-	1	1	-	-	1	1	-	-	-
CO5	1	-	1	2	-	-	-	-	-	-	-	1	-	-	-	-
Avg	0.6	-	0.6	1.6	-	-	-	0.8	0.2	-	0.4	0.8	0.6	-	0.2	-

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY II -THEORY (BP301T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- prepare organic compounds

B. COURSE CONTENT

General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

NO	TOPIC	L (Hrs)	COs
[1]	Benzene and its derivatives A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel crafts alkylation- reactivity, limitations, Friedelcrafts acylation. C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction D. Structure and uses of DDT, Saccharin, BHC and Chloramine	10	CO1 CO3 CO4 CO5
[2]	Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols Aromatic Amines* - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts Aromatic Acids* – Acidity, effect of substituents on acidity and important reactions of benzoic acid.	10	CO1 CO3 CO4 CO5
[3]	Fats and Oils a. Fatty acids – reactions. b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.	10	CO1 CO3 CO5
[4]	Polynuclear hydrocarbons: a. Synthesis, reactions b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives	8	CO1 CO3 CO5

[5]	Cyclo alkanes* Stabilities – Baeyer’s strain theory, limitation of Baeyer’s strain theory, Coulson and Moffitt’s modification, Sachse Mohr’s theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only	7	CO1 CO3 CO4 CO5
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C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

D. REFERENCE BOOKS (LATEST EDITION)

1. Robert Thornton Morrison; Robert Neilson Boyd. Organic Chemistry. 2 : Study Guide; Allyn And Bacon: Boston, Mass., 1987.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Education: India, 2003.

E. COURSE OUTCOMES

CO Number	Skill		Statement
CO1	Understand and Apply		To write the structure, name of organic compound
CO2	Understand and Remember		To understand the type of isomerism of the compound
CO3	Understand and Remember		To know the reaction, name of the reaction and orientation of reactions
CO4	Understand and Remember		To understand the reactivity/stability of organic compounds
CO5	Understand and Remember		To understand and remember the preparation of organic compounds

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	1	2	1	1	-	1	2	3	3	3	3	1	1	1
CO2	3	1	1	1	1	1	-	1	3	2	3	3	3	1	1	1
CO3	3	1	1	1	1	1	-	1	3	2	3	3	3	3	1	1
CO4	3	1	1	1	1	1	-	1	3	1	3	3	3	3	1	1
CO5	3	1	1	1	1	1	-	1	2	2	3	3	3	2	1	1
Avg	2.8	1	1	1.2	1	1	-	1	2.6	2	3	3	3	2	1	1

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS I-THEORY (BP302T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Understand various physicochemical properties of drug molecules in the designing the dosage forms
- Know the principles of solubility, pH & buffers to use them for designing of formulations

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications	10	CO1
[2]	States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid crystalline, amorphous & polymorphism. Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications	10	CO2 CO3
[3]	Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilisation, detergency, adsorption at solid interface.	10	CO4
[4]	Complexation and protein binding: Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants	08	CO3
[5]	pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.	07	CO5

C. TEXT BOOKS

1. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	Understand and analyse the principles of solubility and partition coefficient
CO2	Remember, Evaluate and apply	Remember and evaluate various physicochemical properties of drug molecules and apply in the designing the dosage form
CO3	Understand and Apply	Understand and apply physical principles of states of matter and complexation
CO4	Remember and evalaute	Remember and evaluate the role of surfactants, interfacial phenomenon and adsorption
CO5	Understand	Understand the importance of pH and buffers in pharmaceutical dosage forms and maintaining stability

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	1	-	-	-	-	1	-	-	3	1	3	-	1
CO2	3	-	-	1	-	-	-	-	1	-	-	3	1	2	-	-
CO3	3	-	-	-	-	-	-	-	1	-	-	3	1	2	-	1
CO4	3	-	-	-	-	-	-	-	1	-	-	3	1	1	-	-
CO5	3	-	-	-	-	-	-	-	1	-	-	3	1	1	-	-
Avg	3	-	-	0.4	-	-	-	-	1	-	-	3	1	1.8	-	0.4

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL MICROBIOLOGY-THEORY (BP303T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to learn all categories of microorganisms especially for the production of alcohol, antibiotics, vaccines, vitamins, enzymes etc.

Objectives: Upon completion of the course the student shall be able to understand the concepts related to various microorganisms, sterility testing and its application in pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes Study of ultrastructure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count). Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.	10	CO1
[2]	Identification of bacteria using staining techniques (simple, Gram's & Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits and applications of physical, chemical gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Equipment employed in large scale sterilization. Sterility indicators.	10	CO2 CO3
[3]	Study of morphology, classification, reproduction/replication and cultivation of Fungi and Viruses. Classification and mode of action of disinfectants Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions Evaluation of bactericidal & Bacteriostatic. Sterility testing of products (solids, liquids, ophthalmic and other sterile products) according to IP, BP and USP.	10	CO5
[4]	Designing of aseptic area, laminar flow equipment; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic.	08	CO2 CO5
[5]	Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage.	07	CO4

	Preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research.		
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C. TEXT BOOKS

1. Pelczar, M. J.; Chan, E. C. S.; Krieg, N. R. *Microbiology*; Tata Mcgraw-Hill: New Delhi, 2010.

D. REFERENCE BOOKS

1. Denyer, S. P.; Hodges, N. A.; Gorman, S. P.; Hugo, W. B.; Russell, A. D. *Pharmaceutical Microbiology*; Blackwell Science: Malden, 2004.
2. Prescott; Dunn. *Industrial Microbiology*, 4th edition.; CBS Publishers & Distributors, Delhi.
3. Denyer, S. P.; Hugo, W. B. *Hugo and Russell's Pharmaceutical Microbiology*; Wiley-Blackwell: Chichester, West Sussex, Uk ; Hoboken, Nj, 2011.
4. Rose, A. H. *Industrial Microbiology*; Butterworths: London, 1961.
5. Probisher; Hinsdill. *Fundamentals of Microbiology*, 9th ed.; Japan.
6. Cooper, J. W.; Gunn, C.; Sidney James Carter. *Cooper and Gunn's Tutorial Pharmacy*; Cbs Publishers: Editorial: New Delhi, 2005.
7. Peppler, H. J.; Perlman, D. *Microbial Technology*.; New York, Etc., Academic P, 1979.
8. I.P., B.P., U.S.P.- latest editions.
9. Edward Alcamo. *Fundamentals of Microbiology*; Jones And Bartlett: Sudbury, Mass., 2001.
10. Jain, N. K. *Pharmaceutical Microbiology*.; Vallabh Prakashan: Delhi, 2001.
11. Brenner, D. J.; Krieg, N. R.; Staley, J. T.; Garrity, G. M. *Bergey's Manual of Systematic Bacteriology. Volume Two, the Proteobacteria. Part A, Introductory Essays. Part B, the Gammaproteobacteria. Part C, the Alpha-, Beta-, Delta-, and Epsilonproteobacteria*; Springer: New York, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand Apply and Evaluate	To Understand methods of identification, cultivation and preservation of various microorganisms
CO2	Remember, and Understand Evaluate	To understand the importance and implementation of sterilization in pharmaceutical processing and industry
CO3	Understand Apply and Evaluate	To Understand the cell culture technology and its applications in pharmaceutical industries
CO4	Understand and Remember	To understand structure and growth of bacteria, virus and fungi
CO5	Understand Apply and Evaluate	To perform and evaluate microbial assay of various antibiotics and vitamin

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	2	3	3	0	2	0	3	2	3	3	3	1	3	2	3
C02	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
C03	3	-	2	3	2	2	0	2	1	2	2	3	3	3	2	3
C04	3	2	2	2	2	2	2	2	1	3	3	3	1	3	2	3
C05	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
Avg	3	2	2.6	2.8	1.6	2.4	1.6	2.6	2	2.8	2.8	3	2.2	3	2.4	3

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL ENGINEERING - THEORY (BP304T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Objectives: Upon completion of the course student shall be able:

- To know various unit operations used in Pharmaceutical industries.
- To understand the material handling techniques.
- To perform various processes involved in pharmaceutical manufacturing process.
- To carry out various test to prevent environmental pollution.
- To appreciate and comprehend significance of plant lay out design for optimum use of resources.
- To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.</p> <p>Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.</p> <p>Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.</p>	10	CO2 CO3 CO1
[2]	<p>Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.</p> <p>Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator & Economy of multiple effect evaporator.</p> <p>Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation</p>	10	CO2 CO3
[3]	<p>Drying: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits</p>	10	CO2 CO3

	of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer. Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles & Silverson Emulsifier		
[4]	Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter. Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.	8	CO2 CO3
[5]	Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.	7	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. C V S Subrahmanyam; J Thimma Setty; Suresh, S.; V Kusum Devi. Pharmaceutical Engineering : Principles and Practices.; Vallabh Prakashan: Delhi, 2002.
2. C V S Shubramanyam. Pharmaceutical Engineering : Unit Operations - II; Vallabh Prakashan: Delhi, 2014.

D. REFERENCE BOOKS

1. Badger, W. L. Introduction to Chemical Engineering; Mc Graw Hill: Auckland, 1987.
2. Cooper, J. W.; Gunn, C.; Sidney James Carter. Cooper and Gunn's Tutorial Pharmacy; Cbs Publishers: Editorial: New Delhi, 2005.
3. Joseph Price Remington; Eric Wentworth Martin. Remington's Practice of Pharmacy Easton, Pa. Mack, 1961.
4. Khar, R. K.; Vyas, S. P.; Ahmad, F. J.; Jain, G. K. Lachman/Lieberman's the Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributor, Repr: New Delhi, 2015.
5. McCabe, W. L.; Smith, J. C.; Harriott, P. Unit Operations of Chemical Engineering; Chennai McGraw-Hill Education (India) Private Limited, 2014.
6. Simpson, N. J. K. Solid-Phase Extraction Principles, Techniques, and Applications; New York, N.Y. Dekker, 2000.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember and Understand	To understand and remember the various unit operations used in Pharmaceutical industries.
CO2	Understand	To understand the material handling techniques.
CO3	Apply and Evaluate	To perform various processes involved in pharmaceutical manufacturing process.
CO4	Understand and apply	To appreciate and comprehend significance of plant lay out design for optimum use of resources and to carry out various test to prevent environmental pollution.
CO5	Apply and evaluate	To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	2	-	2	2	2	3	3	3	3	3	3
CO2	3	1	3	3	2	2	-	2	2	2	2	3	3	3	2	2
CO3	3	2	2	3	2	1	2	2	1	2	3	3	3	2	3	2
CO4	3	1	2	3	-	1	1	-	-	3	3	3	2	2	2	3
CO5	3	1	2	3	-	1	1	2	2	3	2	3	3	3	1	3
Avg	3	1.4	2.4	3	1.2	1.4	0.8	1.6	1.4	2.4	2.6	3	2.8	2.6	2.2	2.6

B. PHARM. SEMESTER – III (BPH)**SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY II -PRACTICAL (BP305P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives: Upon completion of the course the student shall be able to

- write the structure, name and the type of isomerism of the organic compound
- write the reaction, name the reaction and orientation of reactions
- account for reactivity/stability of compounds,
- prepare organic compounds

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<p>Experiments involving laboratory techniques</p> <ul style="list-style-type: none"> • Recrystallization • Steam distillation <p>Determination of following oil values (including standardization of reagents)</p> <ul style="list-style-type: none"> • Acid value • Saponification value • Iodine value <p>Preparation of compounds</p> <ul style="list-style-type: none"> • Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction. • 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/ Acetanilide by halogenation (Bromination) reaction. 1-Phenyl azo-2-naphthol from Aniline by diazotization and coupling reactions. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction. • Benzoic acid from Benzyl chloride by oxidation reaction. • Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction. Benzil from Benzoin by oxidation reaction. • Dibenzal acetone from Benzaldehyde by Claisen Schmidt reaction • Cinnamic acid from Benzaldehyde by Perkin reaction, <i>P</i>-Iodo benzoic acid from <i>P</i>-amino benzoic acid 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav & Roopal Prakashan, India, 2008

D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.
3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To understand the experimental laboratory techniques
CO2	Understand and Remember	Determination of oils values for fats and oils
CO3	Understand and Apply	To study the name of the reaction involved in the organic compound
CO4	Understand and Remember	To understand the preparation of organic compound
CO5	Understand & Evaluate	To perform the purification of compound

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	1	1	-	1	1	2	1	1	2	3	3	1	1
CO2	3	1	2	1	1	-	1	1	3	1	2	2	3	3	1	1
CO3	3	1	2	1	1	-	-	1	3	2	1	2	3	2	1	1
CO4	3	1	2	1	1	-	1	1	3	1	2	2	3	2	1	1
CO5	3	1	2	1	1	-	1	1	3	2	1	2	3	3	1	1
Avg	3	1	2	1	1	-	0.8	1	2.8	1.4	1.4	2	3	2.6	1	1

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS I-PRACTICAL (BP306P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principals involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know and determine physical properties such as solubility, surface tension, partition coefficient and pKa and apply in the design of dosage forms.
- Know the principles of solubility, pH & buffers to use them for designing of formulations

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Determination the solubility of drug at room temperature 2. Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation 3. Determination of Partition co- efficient of benzoic acid in benzene and water 4. Determination of Partition co- efficient of Iodine in CCl ₄ and water 5. Determination of % composition of NaCl in a solution using phenol-water system by CST method 6. Determination of surface tension of given liquids by drop count and drop weight method 7. Determination of HLB number of a surfactant by saponification method 8. Determination of Freundlich and Langmuir constants using activated char coal 9. Determination of critical micellar concentration of surfactants 10. Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method 11. Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Sen, K. K., Dutta, S. K. A Laboratory Manual of Physical Pharmaceutics. India: PharmaMed Press. 2019.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.
8. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand, Evaluate and Apply	Understand and evaluate physical properties such as solubility, surface tension, partition coefficient and pKa and apply in the design of dosage forms.
CO2	Understand and apply	Understand and apply Henderson – Hasselbalch equation for determination of pKa value of drugs.
CO3	Understand and Evaluate	Understand and evaluate the HLB value and critical micellar concentration of a surfactant.
CO4	Understand and Evaluate	Understand adsorption isotherms and determine Freundlich-Langmuir adsorption isotherm.
CO5	Evaluate	Evaluate the stability constants of complexes by various methods.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO2	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO3	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO4	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
CO5	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-
Avg	3	-	1	-	-	-	-	-	1	-	-	3	-	3	-	-

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL MICROBIOLOGY-PRACTICAL (BP307P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: Course enables the student to learn all categories of microorganisms especially for the production of alcohol, antibiotics, vaccines, vitamins enzymes etc..

Objectives: Upon completion of the course the student shall be able to

- Understand methods of identification, cultivation and preservation of various microorganisms.
- To understand the importance and implementation of sterilization in pharmaceutical processing and industry
- Learn sterility testing of pharmaceutical products.
- Carried out microbiological standardization of Pharmaceuticals.
- Understand the cell culture technology and its applications in pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology. 2. Sterilization of glassware, preparation and sterilization of media. 3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations. 4. Staining methods- Simple, Grams staining and acid fast staining (Demonstration with practical). 5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques 6. Microbiological assay of antibiotics by cup plate method and other methods 7. Motility determination by Hanging drop method. 8. Sterility testing of pharmaceuticals. 9. Bacteriological analysis of water 10. Biochemical test.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

(1) Arora, B.; Arora, D. R. *Practical Microbiology*; Cbs Publishers & Distributors, Pvt Ptd: New Delhi, 2020.

D. REFERENCE BOOKS

- (1) G Sirockin; Cullimore, S. *Practical Microbiology*; London Mcgraw-Hill C, 1969.
- (2) Pelczar, M. J.; Chan, E. C. S.; Krieg, N. R. *Microbiology*; Tata Mcgraw-Hill: New Delhi, 2010.

E. COURSE OUTCOMES

CO Number	Skill		Statement
CO1	Understand and Evaluate	Apply	To perform and Evaluate sterility testing of pharmaceutical products.
CO2	Understand and Evaluate	Apply	To perform microbiological standardization of Pharmaceuticals.
CO3	Understand and Evaluate	Apply	To perform staining techniques for different microbes
CO4	Understand and Evaluate	Apply	To evaluate motility of microorganism
CO5	Understand and Evaluate	Apply	To perform microbial assay of antibiotics

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	1	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	1	1	3	3	3	3	2	3	3	3	2	2
CO3	3	3	3	2	1	1	1	2	1	2	1	2	2	3	2	1
CO4	3	3	3	2	1	1	1	1	1	1	1	1	1	3	1	1
CO5	3	3	3	2	1	1	2	3	3	3	2	3	2	3	2	3
Avg	3	3	3	2.4	1	1	2	2.4	2.2	2.4	1.8	2.4	2.2	3	2	2

B. PHARM. SEMESTER – III (BPH)
SUBJECT: PHARMACEUTICAL ENGINEERING-PRACTICAL (BP308P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	-	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Objectives: Upon completion of the course student shall be able:

- To know various unit operations used in Pharmaceutical industries.
- To understand the material handling techniques.
- To perform various processes involved in pharmaceutical manufacturing process.
- To carry out various test to prevent environmental pollution.
- To appreciate and comprehend significance of plant lay out design for optimum use of resources.
- To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Determination of radiation constant of brass, iron, unpainted and painted glass. 2. Steam distillation – To calculate the efficiency of steam distillation. 3. To determine the overall heat transfer coefficient by heat exchanger. 4. Construction of drying curves (for calcium carbonate and starch). 5. Determination of moisture content and loss on drying. 6. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method. 7. Description of Construction working and application of Pharmaceutical 8. Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier. 9. Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots. 10. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill. 11. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment. 12. Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity) 13. To study the effect of time on the Rate of Crystallization. 14. To calculate the uniformity Index for given sample by using Double Cone Blender.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Momin M, Mehta T, Practical Manual of Pharmaceutical Engineering, B.S. Shah Prakashan, Ahmedabad, Gujarat, 2002.

D. REFERENCE BOOKS

1. C V S Shubramanyam. Pharmaceutical Engineering : Unit Operations - II; Vallabh Prakashan: Delhi, 2014.
2. C V S Subrahmanyam; J Thimma Setty; Suresh, S.; V Kusum Devi. Pharmaceutical Engineering : Principles and Practices.; Vallabh Prakashan: Delhi, 2002.
3. Badger, W. L. Introduction to Chemical Engineering; Mc Graw Hill: Auckland, 1987.
4. Cooper, J. W.; Gunn, C.; Sidney James Carter. Cooper and Gunn's Tutorial Pharmacy; Cbs Publishers: Editorial: New Delhi, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand and convert the values of factors in different units to perform various unit operations in Pharmaceutical industries.
CO2	Apply	To perform basic unit operations such as filtration, centrifugation, drying etc.
CO3	Evaluate	To check the effect of various processing parameters on different unit operations.
CO4	Apply	To create plant lay out design for optimum use of resources and to carry out various tests to prevent environmental pollution.
CO5	Apply and evaluate	To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	-	1	1	2	1	3	3	3	2	2	2
CO2	3	2	3	3	2	2	-	2	2	2	3	3	3	3	1	2
CO3	3	2	3	3	-	2	-	2	2	2	3	3	3	3	2	2
CO4	3	2	3	3	2	-	-	2	1	1	3	3	3	2	3	2
CO5	3	3	3	3	2	3	2	3	3	3	3	3	3	2	3	3
Avg	3	2.2	3	3	1.6	1.4	0.6	2	2	1.8	3	3	3	2.4	2.2	2.2

B. PHARM. SEMESTER – VII (BPH)
SUBJECT: INTRODUCTION TO YOGA (BP309P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	2	2	-	-	-	-	-	-

* Non-University Examination with grading satisfactory/ unsatisfactory

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge and practical skill of Yoga

Objectives: Upon completion of the course student shall be able

- To introduce the student to the fundamentals of a Yoga practice in a safe, supportive and academic environment.
- To learn proper body alignment & the basics of breathing techniques (pranayama)
- To understand various forms of yoga mediation & yogic asanas.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)
[1]	<p>TRAINING IN YOGIC ASANAS, PRANAYAMS AND MUDRAS</p> <ul style="list-style-type: none"> - Kapalbhati, Anulom-vilom, Pranayam, Omkar Pranayam, Bharmari, Pranayam, Body Rotation, Shavasan, Suryanamaskar, - Asans for Meditation: Padmasan, Swastikasan, Siddhasan, Bhadrasan, Vajrasan, Makarasan, Savasan. - Asans to be performed in Standing Position: Trikonasan, Pervatasan, Utkatukasan, Hastapadsan - Asans to be performed while lying in Supine position: Servangasan, Halasan, Savasan, Kosthavishramasan, Matshendrasan, Suptavajrasan - Asans to be performed while lying in Prone position: Uttanpadasan, Uttanadhasan, Serpasan, Bhujasan, Salabhasan, Dhanurasan, Makarasan - Asans to be performed in sitting position: Pavanmuktasan, Hastapadasan, Vajrasan, Ardhamatshyendrasan, Shishuasan, Saptamudrasan, Gomukhasan. - Yoga Mudras (Seven Types) 	30

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACEUTICAL ORGANIC CHEMISTRY III -THEORY (BP401T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Objectives: At the end of the course, the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

B. COURSE CONTENT

To emphasize on definition, types, mechanisms, examples, uses/applications

NO	TOPIC	L (Hrs)	COs
[1]	Stereo isomerism Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers Reactions of chiral molecules Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute	10	CO3
[2]	Geometrical isomerism Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems) Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions	10	CO3
[3]	Heterocyclic compounds: Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene	10	CO1 CO2 CO4
[4]	Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis & medicinal uses of Pyrimidine, Purine, azepines and their dvts	8	CO2 CO3 CO4
[5]	Reactions of synthetic importance	7	CO5

	Metal hydride reduction (NaBH ₄ and LiAlH ₄), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement. Claisen-Schmidt condensation		
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C. TEXT BOOKS (LATEST EDITION)

1. Mehta, B.; Mehta, M. Organic Chemistry; Prentice Hall Of India: New Delhi, 2005.

D. REFERENCE BOOKS (LATEST EDITION)

1. Bansal R, Heterocyclic Chemistry; New Age International (P) Limited, Publishers: New Delhi, 2014.
2. Finar, I. L. Organic Chemistry : Volume 1: The Fundamental Principles; Pearson Education: India, 2003.

E. COURSE OUTCOMES

CO Number	Skill		Statement
CO1	Understand and Remember		To understand the methods of preparation for various organic compounds
CO2	Understand and Remember		To understand chemical properties for various organic compounds
CO3	Understand and Apply		To know the stereo chemical aspects of organic compounds and stereochemical reactions
CO4	Understand and Apply		To know medicinal uses and Other application of organic compounds
CO5	Understand and Remember		To understand and remember the reaction of synthetic importance

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	3	-	-	-	-	1	1	3	3	2	3	1	1
CO2	3	-	-	3	-	-	-	-	1	-	3	3	2	3	1	1
CO3	3	-	-	3	-	-	-	-	1	-	3	3	2	3	1	1
CO4	3	-	-	2	-	-	-	-	1	-	3	3	3	3	1	1
CO5	3	-	-	2	-	-	-	-	1	-	3	3	3	3	2	1
Avg	3	-	-	2.6	-	-	-	-	1	0.2	3	3	2.4	3	1.2	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: MEDICINAL CHEMISTRY I-THEORY (BP402T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

B. COURSE CONTENT

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Medicinal Chemistry History and development of medicinal chemistry Physicochemical properties in relation to biological action Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism. Drug metabolism Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects.	10	CO1 CO2
[2]	Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters: Biosynthesis and catabolism of catecholamine. Adrenergic receptors (Alpha & Beta) and their distribution. Sympathomimetic agents: SAR of Sympathomimetic agents Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. <ul style="list-style-type: none"> • Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. • Agents with mixed mechanism: Ephedrine, Metaraminol. Adrenergic Antagonists: Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide. Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.	10	CO2 CO3 CO4 CO5
[3]	Cholinergic neurotransmitters:	10	CO2

	<p>Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.</p> <p>Parasympathomimetic agents: SAR of Parasympathomimetic agents</p> <p>Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.</p> <p>Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorophate, Echothiophate iodide, Parathion, Malathion.</p> <p>Cholinesterase reactivator: Pralidoxime chloride.</p> <p>Cholinergic Blocking agents: SAR of cholinolytic agents</p> <p>Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.</p> <p>Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.</p>		CO3 CO4 CO5
[4]	<p>Drugs acting on Central Nervous System</p> <p>A. Sedatives and Hypnotics:</p> <p>Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem</p> <p>Barbiturates: SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital</p> <p>Miscellaneous: Amides & imides: Glutethimide. Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.</p> <p>B. Antipsychotics</p> <p>Phenothiazines: SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.</p> <p>Ring Analogues of Phenothiazines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.</p> <p>Fluorobutyrophenones: Haloperidol, Droperidol, Risperidone.</p> <p>Beta amino ketones: Molindone hydrochloride.</p> <p>Benzamides: Sulpieride.</p> <p>C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action</p> <p>Barbiturates: Phenobarbital, Methobarbital. Hydantoins: Phenytoin*, Mephénytoin, Ethotoin Oxazolidine diones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Phenacemide, Carbamazepine* Benzodiazepines: Clonazepam Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate</p>	8	CO2 CO3 CO4 CO5
[5]	<p>Drugs acting on Central Nervous System</p> <p>General anesthetics:</p> <p>Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.</p>	7	CO2 CO3 CO4 CO5

	<p>Ultra short acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.</p> <p>Dissociative anesthetics: Ketamine hydrochloride.*</p> <p>Narcotic and non-narcotic analgesics</p> <p>Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anileridine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.</p> <p>Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride.</p> <p>Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.</p>		
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C. TEXT BOOKS (LATEST EDITION)

1. Kadam S S, Bothara, K G Principles of Medicinal Chemistry, Volume I & II, 17th edition, Nirali Prakashan, India, 2008
2. Alagaraswamy, V Textbook of Medicinal Chemistry, Volume I & II, Elsevier, India 2012

D. REFERENCE BOOKS (LATEST EDITION)

1. Delgado, J. N.; Remers, W. A. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry; Lippincott-Raven: Philadelphia, 1998.
2. Foye, W. O.; Lemke, T. L.; Williams, D. A. Principles of Medicinal Chemistry; Williams & Wilkins, Cop: Baltimore Etc., 1995.
3. Remington, J. P.; Gennaro, A. R. Remington's Pharmaceutical Sciences; Mack Pub. Co: Easton, Pa., 1990.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand the chemistry of drugs with respect to their pharmacological activity
CO2	Understand and Remember	To understand the classification of drugs with their structures
CO3	Understand	To understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
CO4	Understand and Remember	To know the Structural Activity Relationship (SAR) of different class of drugs
CO5	Understand and Apply	To learn about the chemical synthesis of some drugs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	-	1	1	1	-	-	2	-	3	3	3	2	1	1
CO2	3	-	-	1	1	1	-	-	2	-	3	3	1	2	1	1
CO3	3	-	-	1	1	1	-	-	2	-	3	3	3	2	1	1
CO4	3	-	-	1	1	1	-	-	1	-	3	3	2	2	1	1
CO5	3	-	-	1	1	1	-	-	2	-	3	3	1	2	1	1
Avg	3	-	-	1	1	1	-	-	1.8	-	3	3	2	2	1	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS-II-THEORY (BP403T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Know basics of the dispersed systems and colloidal dispersions.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization & protective action.	07	CO1
[2]	Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus	08	CO2
[3]	Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.	10	CO1 CO3
[4]	Micromeretics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.	10	CO4
[5]	Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention	10	CO3 CO4

C. TEXT BOOKS

1. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Understand basics of the dispersed systems and apply principles of colloidal dispersions.
CO2	Interpret and Evaluate	Interpret the rheological behaviour of fluids and evaluate the physics of tablet compression.
CO3	Evaluate and apply	Formulate and evaluate coarse dispersions making use of rheological and electrical properties.
CO4	Understand, Evaluate and apply	Understand and evaluate the properties of powders and apply them in formulation development.
CO5	Understand and Analyse	Understand principles of kinetics in the stabilization of dosage forms. Analyze the chemical stability of various drug products

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO2	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO3	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO4	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO5	3	-	2	-	-	-	-	-	3	-	-	3	2	3	-	-
Avg	3	-	1.2	-	-	-	-	-	2.2	-	-	3	2	3	-	-

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACOLOGY I -THEORY (BP401T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	---	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

Objectives: Upon completion of the course the student shall be able to

- Understand the pharmacological actions of different categories of drugs
- Explain the mechanism of drug action at organ system/sub cellular/macromolecular levels.
- Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
- Observe the effect of drugs on animals by simulated experiments
- Appreciate correlation of pharmacology with other bio medical sciences

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	1. General Pharmacology a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy. b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs .Enzyme induction, enzyme inhibition, kinetics of elimination	08	CO1 CO4 CO5
[2]	General Pharmacology a. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action. b. Adverse drug reactions. c. Drug interactions (pharmacokinetic and pharmacodynamic) d. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance	12	CO1 CO2 CO3 CO4 CO5

[3]	Pharmacology of drugs acting on peripheral nervous system a. Organization and function of ANS. b. Neurohumoral transmission-transmission and classification of neurotransmitters. c. Parasympathomimetic, Parasympatholytic, Sympathomimetics, sympatholytic. d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). e. Local anaesthetic agents. f. Drugs used in myasthenia gravis and glaucoma	10	CO1 CO2 CO3 CO4 CO5
[4]	Pharmacology of drugs acting on central nervous system a. Neurohumoral transmission in the C.N.S. special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine. b. General anaesthetics and pre-anaesthetics. c. Sedatives, hypnotics and centrally acting muscle relaxants. d. Anti-epileptics e. Alcohols and disulfiram.	08	CO1 CO2 CO3 CO4 CO5
[5]	Pharmacology of drugs acting on central nervous system a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manic and hallucinogens. b. Drugs used in Parkinson's disease and Alzheimer's disease. c. CNS stimulants and nootropics. d. Opioid analgesics and antagonists e. Drug addiction, drug abuse, tolerance and dependence.	07	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.3.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.
4. Bickley, L. S.; Bates, B. Bates' Guide to Physical Examination and History Taking.; Lippincott Williams & Wilkins: Philadelphia, 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To know about general idea of pharmacology subject, the contents of the subject, the basic about the drug and its action inside the body
CO2	Remember, Understand and Apply	To get knowledge about how to body react towards the drug and basic action and adverse effects produced by the drugs
CO3	Understand Apply and Evaluate	To understand about the system, disease and drug used in treatment of that type of disease
CO4	Understand and remember	To know about how disease occurs and drugs used in those diseases and drug interaction with others.
CO5	Remember, Understand, Apply and evaluate	To get knowledge about various agonist and antagonist and drugs dependence abuse and tolerance about certain drugs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	3	3	3	1	2	3	3	3	3	1
CO2	3	2	3	3	3	3	2	3	3	2	3	3	3	3	3	1
CO3	3	2	3	3	3	3	2	3	3	2	2	3	3	3	3	1
CO4	3	2	3	3	3	3	2	3	3	2	2	3	3	3	3	1
CO5	3	2	3	3	3	3	3	3	3	2	2	2	3	3	3	1
Avg	3	2	3	3	3	3	2.4	3	3	1.8	2.2	2.8	3	3	3	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACOGNOSY AND PHYTOCHEMISTRY -THEORY (BP405T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Objectives: Upon completion of the course, the student shall be able

- To know the techniques in the cultivation and production of crude drugs.
- To know the crude drugs, their uses and chemical nature.
- Know the evaluation techniques for the herbal drugs.
- To carry out the microscopic and morphological evaluation of crude drugs.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Pharmacognosy: (a) Definition, history, scope and development of Pharmacognosy (b) Sources of Drugs – Plants, Animals, Marine & Tissue culture (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins). Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero-taxonomical classification of drugs Quality control of Drugs of Natural Origin: Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.	10	CO2 CO5
[2]	Cultivation, Collection, Processing and storage of drugs of natural origin: Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants Conservation of medicinal plants	10	CO1
[3]	Plant tissue culture: Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines	07	CO4
[4]	Pharmacognosy in various systems of medicine: Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine. Introduction to secondary metabolites:	10	CO2 CO3 CO5

	Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins		
[5]	<p>Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs</p> <p>Plant Products: Fibers - Cotton, Jute, Hemp Hallucinogens, Teratogens, Natural allergens</p> <p>Primary metabolites: General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic uses and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:</p> <p>Carbohydrates: Acacia, Agar, Tragacanth, Honey</p> <p>Proteins and Enzymes : Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin).</p> <p>Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax .</p> <p>Marine Drugs: Novel medicinal agents from marine sources.</p>	08	CO2 CO5

C. TEXT BOOKS

1. Dr. Shukla P., Dr. Shashi, A. & Dr. Shukla P., A textbook of “Pharmacognosy & Phytochemistry-I” 1st Edition, Nirali Prakashan, 2019.
2. Kabra, A., Dr. Ashok PK. & Setia, S., A textbook of “Pharmacognosy & Phytochemistry-I”, Pee Vee Book, S. Vikas & Company (Medical Publishers) ,2019.

D. REFERENCE BOOKS

1. Deore SL., “Pharmacognosy & Phytochemistry-I-A Comprehensive Approach” 2nd edition, Pharma Med. Press, 2019.
2. Ali, M., “Pharmacognosy- Pharmacognosy & Phytochemistry-I”, Volume-I CBS Publishers & Distributors PVT. Ltd., 2018
3. Shah, B., & Seth, AK., “Textbook of Pharmacognosy & Phytochemistry” , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
4. Quadry, JS., “Textbook of Pharmacognosy (Theory & Practical)” 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
5. Rangari VD., “Pharmacognosy & Phytochemistry” Volume-I 3rd Edition, Career Publications, 2017.
6. Rangari VD., “Pharmacognosy & Phytochemistry” Volume-II 3rd Edition, Career Publications, 2017.
7. Jarald EE. & Jarald SE., “Textbook of Pharmacognosy & Phytochemistry” 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.
8. Neha Tyagi & Dr. Verma Santosh Kumar “A textbook of Pharmacognosy & Phytochemistry-I”, 1st Edition, BFC Publication, 2020.
9. Gokhale, SB., Dr. Kokate CK., Dr. Tatiya AV., Dr. Kalaskar MG., “Pharmacognosy & Phytochemistry-I” 1st Edition, Nirali Prakashan, 2019.
10. Ashutosh Kar, “Pharmacognosy & Phytochemistry-I “, 1st Edition, New Age International Private LTD. Publishers. 2020.
11. Dr. Das K., “Pharmacognosy & Phytochemistry-I” 1st Edition, Nirali Prakashan, 2019.
12. Kalia AN., Textbook of “Pharmacognosy & Phytochemistry-I” CBS Publishers & Distributors PVT. Ltd., 2021.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	Identify and analyse the techniques in the cultivation and production of crude drugs.
CO2	Remember and Understand Evaluate	Describe Pharmacognostic parameters & Pharmacognostic study of crude drug with their evaluation.
CO3	Understand and Apply	Explain & apply the basic principle of Indian systems of medicines.
CO4	Understand and apply	Discuss and apply the basic principle and techniques of Plant tissue culture.
CO5	Understand and apply	Discuss primary and secondary metabolites systematically from the source of their pharmaceutical and industrial application.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	-	2	-	2	2	3	2	3	2	2	2	1
CO2	3	2	2	2	-	2	2	1	2	1	2	3	2	3	2	1
CO3	3	2	2	1	-	2	3	2	2	1	2	3	2	3	3	1
CO4	3	2	2	2	-	2	2	1	2	1	2	3	2	2	3	1
CO5	3	2	2	2	-	2	-	2	2	1	2	3	2	2	2	1
Avg	3	2	2	1.8	-	2	1.4	1.6	2	1.4	2	3	2	2.4	2.4	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: MEDICINAL CHEMISTRY I-PRACTICAL (BP406P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

- understand the methods of preparation and properties of organic compounds
- explain the stereo chemical aspects of organic compounds and stereo chemical reactions
- know the medicinal uses and other applications of organic compounds

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Preparation of drugs/ intermediates 1,3-pyrazole 1,3-oxazole Benzimidazole Benztriazole 2,3- diphenyl quinoxaline Benzocaine Phenytoin Phenothiazine Barbiturate Assay of drugs Chlorpromazine Phenobarbitone Atropine Ibuprofen Aspirin Furosemide Determination of Partition coefficient for any two drugs	60	CO1 CO2 CO4 CO5

C. TEXT BOOKS (LATEST EDITION)

1. Raval H G, Practical organic Chemistry, First edition, Nirav & Roopal Prakashan, India, 2008

D. REFERENCE BOOKS (LATEST EDITION)

1. Mann, F. G.; Saunders, B. C. Practical Organic Chemistry; Pearson: New Delhi, 2009..
2. Arthur Israel Vogel; Furniss, B. S. Vogel's Textbook of Practical Organic Chemistry Including Qualitative Organic Analysis; London Longman Scientific & Technical [U.A, 1987.
3. Vishnoi, N. K. Advanced Practical Organic Chemistry.; Vikas Publishing House: Noida, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To determine the partition coefficient of some drugs
CO2	Understand and Apply	To carry out the synthesis of drugs
CO3	Understand and Evaluate	To perform the assay of drugs using various analytical methods
CO4	Understand and Apply	To synthesize intermediates using different chemical reaction
CO5	Understand and Apply	To purify synthesized compounds and determine their physical constants

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	1	1	1	-	1	1	-	3	3	1	2	1	0
CO2	3	1	1	1	1	1	1	1	1	1	3	3	2	3	1	1
CO3	3	1	1	1	1	1	-	1	1	-	3	3	1	1	1	1
CO4	3	1	1	1	1	1	-	1	1	1	3	3	2	2	1	1
CO5	3	1	1	1	1	1	1	1	1	1	3	3	1	2	1	2
Avg	3	1	1	1	1	1	0.4	1	1	0.6	3	3	1.4	2	1	1

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHYSICAL PHARMACEUTICS-II-PRACTICAL(BP407P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
- Know basics of the micromeritics, dispersed systems and colloidal dispersions

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Determination of particle size, particle size distribution using sieving method 2. Determination of particle size, particle size distribution using Microscopic method 3. Determination of bulk density, true density and porosity 4. Determine the angle of repose and influence of lubricant on angle of repose 5. Determination of viscosity of liquid using Ostwald's viscometer 6. Determination sedimentation volume with effect of different suspending agent 7. Determination sedimentation volume with effect of different concentration of 8. single suspending agent 9. Determination of viscosity of semisolid by using Brookfield viscometer 10. Determination of reaction rate constant first order. 11. Determination of reaction rate constant second order 12. Accelerated stability studies	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Sen, K. K., Dutta, S. K. A Laboratory Manual of Physical Pharmaceutics. India: PharmaMed Press. 2019.

D. REFERENCE BOOKS

1. Sinko, Patrick J., and Alfred N. Martin. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences. 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2006.
2. Parrott, E. L., Saski, W. Experimental Pharmaceutics. United States: Burgess Publishing Company. 1977
3. Carter, S. J. Cooper and Gunn's Tutorial Pharmacy. India: CBS Publishers & Distributors. 2021.
4. Ansel, H. C., Stoklosa, M. J. Pharmaceutical Calculations. United Kingdom: Lea &Febiger. 1986.
5. Gilbert S. Banker, Herbert Lieberman, Martin Rieger. Pharmaceutical Dosage Forms: Disperse Systems. United States: CRC Press. 2020.
6. Manavalan, R., Ramasamy, C. Physical Pharmaceutics. India: Pharma Med Press. 2017.
7. Subrahmanyam, C. V. S. Textbook of Physical Pharmaceutics. India: Vallabh Prakashan. 2000.
8. Jain, G., KrishenKhar, R., Ahmad, F. J. Theory and Practice of Physical Pharmacy - E-Book. India: Elsevier Health Sciences. 2011.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Evaluate	Understand and evaluate basic, derived and flow properties of powders and apply to prepare a stable formulation.
CO2	Understand and Evaluate	Understand and evaluate viscosity of fluids and formulations.
CO3	Remember and Analyse	Remember various type of suspending agent and analyse them to formulate a stable suspension.
CO4	Apply and Analyse	Apply principles of chemical kinetics in determination of rate constants as per the chemical reaction.
CO5	Understand and Analyse	Understand and analyse the shelf life of a formulation by accelerated stability studies.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	-	-	-	-	-	2	-	-	3	2	3	-	-
CO2	3	-	1	-	-	-	-	-	1	-	-	3	1	3	-	-
CO3	3	-	1	-	-	-	-	-	1	-	-	3	1	3	-	-
CO4	3	-	2	-	-	-	-	-	1	-	-	3	2	3	-	-
CO5	3	-	2	-	-	-	-	-	1	-	-	3	2	3	-	-
Avg	3	-	1.4	-	-	-	-	-	1.2	-	-	3	1.6	3	-	-

B. PHARM. SEMESTER – IV (BPH)
SUBJECT: PHARMACOLOGY I-PRACTICAL (B408 P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
--	--	4	4	2	35	10	5	-	50

A. COURSE OVERVIEW

Scope: It is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. It provides the basic knowledge required to understand the various disciplines of pharmacy.

Objectives: Upon completion of the course the student shall be able to

- Explain the gross morphology, structure and functions of various organs of the human body.
- Describe the various homeostatic mechanisms and their imbalances.
- Identify the various tissues and organs of different systems of human body.
- Perform the various experiments related to special senses and nervous system.
- Appreciate coordinated working pattern of different organs of each system

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. Introduction to experimental pharmacology. 2. Commonly used instruments in experimental pharmacology. 3. Study of common laboratory animals. 4. Maintenance of laboratory animals as per CPCSEA guidelines. 5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anaesthetics and euthanasia used for animal studies. 6. Study of different routes of drugs administration in mice/rats. 7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice. 8. Effect of drugs on ciliary motility of frog oesophagus 9. Effect of drugs on rabbit eye. 10. Effects of skeletal muscle relaxants using rota-rod apparatus. 11. Effect of drugs on locomotor activity using actophotometer. 12. Anticonvulsant effect of drugs by MES and PTZ method. 13. Study of stereotype and anti-catatonic activity of drugs on rats/mice. 14. Study of anxiolytic activity of drugs using rats/mice. 15. Study of local anaesthetics by different methods Microscopic study of epithelial and connective tissue 	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. Rang and Dale's Pharmacology, 9th ed.; Elsevier: Endinburgh, 2020.
2. Tripathi, K. D. Essentials of Medical Pharmacology; Jaypee Bros: New Delhi, 1988.
3. Brunton, L. L.; Hilal-Dandan, R.; Knollmann, B. C. Goodman & Gilman's the Pharmacological Basis of Therapeutics, 13th ed.; McGraw-Hill Education: New York, 2018.

D. REFERENCE BOOKS

1. Kulkarni, R. S. Index Theorems of Atiyah, Bott, Patodi and Curvature Invariants; Presses De L'université De Montreal: Montreal, 1975.
2. F Hoffmeister; G Stille. Handbook of Experimental Pharmacology. Vol. 55/2, Psychotropic Agents, Part 2, Anxiolytics, Gerontopsychopharmacological Agents, and Psychomotor Stimulants; Springer: Berlin, 1981.
3. Kapadia, S. R.; Chew, D.; Cura, F.; L'allier, P. L.; Roffi, M.; E Murat Tuzcu. Textbook of Interventional Cardiology: A Global Perspective; Jaypee: The Health Sciences Publisher: New Delhi, 2017.
4. Fundamentals of Experimental Pharmacology; Hilton & Company: Kolkata, 2015.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To know about general idea of pharmacology subject, the contents of the subject, the basic instrument used in pharmacology
CO2	Remember, Understand and Apply	To get knowledge about animals used in experimental pharmacology its detail, housing, feeding, dissection etc
CO3	Understand Apply and Evaluate	To understand about the drugs acting on the animals body part and instruments used to check the activity of the animal
CO4	Understand and remember	To know about how diseases are produced in the animals and drug used for those diseases.
CO5	Remember, Understand, Apply and evaluate	To get knowledge about which animals, which instrument and which kind of drug we can used to induce the disease and for treatment of those disease,

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	2	3	2	3	3	3	3	3	3	3	3	3
CO3	3	2	3	3	2	3	2	3	3	1	2	3	3	3	3	3
CO4	3	2	3	3	2	3	2	3	3	1	2	3	3	3	3	3
CO5	3	3	3	3	2	3	3	3	3	2	2	2	3	3	3	2
Avg	3	2.6	3	3	2	3	2.4	3	3	2	2.2	2.8	3	3	3	2.8

B. PHARM. SEMESTER – IV (BPH)**SUBJECT: PHARMACOGNOSY AND PHYTOCHEMISTRY I-PRACTICAL (BP409P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Objectives: Upon completion of the course, the student shall be able

- To know the techniques in the cultivation and production of crude drugs.
- To know the crude drugs, their uses and chemical nature.
- Know the evaluation techniques for the herbal drugs.
- To carry out the microscopic and morphological evaluation of crude drugs.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar 1. (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil. 2. Determination of stomatal number and stomatal index. 3. Determination of vein islet number, vein islet termination and palisade ratio. 4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer. 5. Determination of Fiber length and width 6. Determination of number of starch grains by Lycopodium spore method 7. Determination of Ash value. 8. Determination of Extractive values of crude drugs. 9. Determination of moisture content of crude drugs. 10. Determination of swelling index and foaming index.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Rana, M. & Kabra A., "Practical Manual - Pharmacognosy & Phytochemistry-I" Pee Vee Book, S. Vikas & Company (Medical Publishers), 2019.
2. Dr. Khandelwal, K.R., "Practical Pharmacognosy" 19th edition, Nirali Prakashan, 2008.

D. REFERENCE BOOKS

1. Kabra, A., Dr. Ashok P.K. & Setia, S., A textbook of "Pharmacognosy & Phytochemistry-I", Pee Vee Book, S. Vikas & Company (Medical Publishers), 2019.
2. Deore, S.L., "Pharmacognosy & Phytochemistry-I-A Comprehensive Approach" 2nd edition, Pharma Med. Press, 2019.
3. Ali, M., "Pharmacognosy- Pharmacognosy & Phytochemistry-I", Volume-I CBS Publishers & Distributors PVT. Ltd., 2018.

4. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry", 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
5. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
6. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
7. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
8. Jarald EE. & Jarald SE., "Textbook of Pharmacognosy & Phytochemistry" 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Identify and Analyse	Identify and Analyse unorganised and organized crude drugs by chemical tests.
CO2	Remember, Understand and Evaluate	Evaluation of Crude drug by qualitative and quantitative microscopic method.
CO3	Understand, Evaluate and Analyse	Discuss the evaluation and analyse Physicochemical parameters for crude drugs.
CO4	Understand, Remember and Apply	Describe the principle of different microscopic measurement techniques.
CO5	Apply and Analyse	Explain evaluation of crude drugs.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
CO2	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
CO3	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
CO4	3	3	2	3	-	1	-	1	1	1	3	2	2	3	2	1
CO5	3	3	2	3	-	2	-	1	2	1	3	2	2	3	2	1
Avg	3	3	2	3	-	1.8	-	1	1.8	1	3	2	2	3	2	1

B.PHARM. SEMESTER – V (BPH)
SUBJECT: MEDICINAL CHEMISTRY II -THEORY (BP501T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

- Understand the chemistry of drugs with respect to their pharmacological activity
- Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
- Know the Structural Activity Relationship of different class of drugs
- Study the chemical synthesis of selected drugs

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Classification, mechanism of action, uses, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted(*) of following class of drugs in all units.</p> <p>Antihistaminic agents: Histamine, receptors and their distribution in the human body</p> <p>H1-antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium</p> <p>H2-antagonists: Cimetidine*, Famotidine, Ranitidin</p> <p>Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole</p> <p>Anti-neoplastic agents:</p> <p>Alkylating agents: Mecllorethamine*, Cyclophosphamide, Melphalan</p> <p>Chlorambucil, Busulfan, Thiotepa</p> <p>Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine</p> <p>Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin</p> <p>Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate</p> <p>Miscellaneous: Cisplatin, Mitotane.</p>	10	CO1 CO2 CO3 CO4 CO5
[2]	<p>Anti-anginal:</p> <p>Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole</p> <p>Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem</p>	10	CO1 CO2 CO3 CO4

	hydrochloride, Nifedipine, Amlodipine, Felodipine, Nicardipine, Nimodipine Diuretics: Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride. Osmotic Diuretics: Mannitol Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.		CO5
[3]	Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcaïnide hydrochloride, Amiodarone, Sotalol Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan	10	CO1 CO2 CO3 CO4 CO5
[4]	Drugs acting on Endocrine system Nomenclature, Stereochemistry and metabolism of steroids Sex hormones: Testosterone, Nandrolone, Progestrones, Oestriol, Oestradiol, Oestrone, Diethyl stilbestrol Drugs for erectile dysfunction: Sildenafil, Tadalafil Oral contraceptives: Mifepristone, Norgestrel, Levonorgestrel Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole	08	CO1 CO2 CO3 CO4 CO5
[5]	Antidiabetic agents: Insulin and its preparations Sulfonylureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimepiride. Biguanides: Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acarbose, Voglibose. Local Anesthetics: SAR of Local anesthetics Benzoic Acid derivatives; Cocaine, Hexylcaine, Mepylcaine, Cyclomethycaine, Piperocaine Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine. Miscellaneous: Phenacaine, Dipreron, Dibucaine.*	07	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Alagarsamy, V. Textbook of Medicinal Chemistry, Volume I and Volume II, 3rd ed.; CBS Publishers, India, 2016
2. Kadam, S.S., Mahadik, K.R., Bothara, K.G. Principles of Medicinal Chemistry, Volume I and II, 20th ed.; Nirali Prakashan, India, 2010

D. REFERENCE BOOKS

1. Hansch, C., Semmes, P.G., Taylor, J.B. Comprehensive Medicinal Chemistry, Volume I to VI, 1st ed.; Elsevier, India, 2005
2. Abraham, D.J. Burger's Medicinal Chemistry and Drug Discovery, Volume I to VI, 6th ed.; Wiley-Interscience, New Jersey, 2003
3. Lemke, T.L., Williams, D.A. FOYE'S Principles of Medicinal Chemistry, 7th ed.; Lippincott Williams & Wilkins, Baltimore, 2013
4. Baele, J.M., Block J. H. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th ed.; Lippincott Williams & Wilkins; Baltimore, 2011
5. Lendnicher, D., Mitscher, L.A. The Organic Chemistry of Drug Synthesis, Volume I to VI, Wiley-Interscience, New Jersey, 2008
6. Johnson, D.S., Li, J.J. Art of Drug Synthesis, 1st ed.; Wiley-Interscience, New Jersey, 2007
7. Smith, J.H., Williams, H. Smith and Williamson's Introduction to the Principles of Drug Design and Action, 3rd ed; CRC Press, The Netherlands, 2005
8. Vardanyan, R., Hruby, V. Synthesis of Essential Drugs, Volume I & II, 1st ed.; Elsevier, The Netherlands, 2006

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To describe classification and chemistry of drugs
CO2	Understand and remember	To discuss mechanism of action of various drugs
CO3	Understand and remember	To explain drug metabolic pathways and adverse effects of drugs
CO4	Analysis	To explain Structural Activity Relationship of different class of drugs
CO5	Apply	To describe synthesis of selected drugs.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	1	-	-	-	-	-	-	3	2	3	1	1	-
CO2	3	-	2	2	-	-	-	-	-	-	3	2	3	1	2	-
CO3	3	-	1	1	-	-	-	-	-	-	3	2	3	1	2	-
CO4	3	-	2	1	-	-	-	-	-	-	3	2	3	1	1	-
CO5	3	3	3	2	3	-	-	-	-	3	3	2	3	3	2	3
Avg	3	0.6	1.8	1.4	0.6	-	-	-	-	0.6	3	2	3	1.4	1.6	0.6

B. PHARM. SEMESTER – V (BPH)
SUBJECT: INDUSTRIAL PHARMACY I-THEORY (BP502T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

Objectives: Upon completion of the course the student shall be able to

- Know the various pharmaceutical dosage forms and their manufacturing techniques.
- Know various considerations in development of pharmaceutical dosage forms
- Formulate solid, liquid and semisolid dosage forms and evaluate them for their quality

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Pre-formulation Studies: Introduction to pre-formulation, goals and objectives, study of physicochemical characteristics of drug substances. a. Physical properties: Physical form (crystal & amorphous), particle size, shape, flow properties, solubility profile (pKa, pH, partition coefficient), polymorphism b. Chemical Properties: Hydrolysis, oxidation, reduction, racemisation, polymerization BCS classification of drugs & its significant Application of pre-formulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.	07	CO1
[2]	Tablets: a. Introduction, ideal characteristics of tablets, classification of tablets. Excipients, Formulation of tablets, granulation methods, compression and processing problems, equipments and tablet tooling. b. Tablet coating: Types of coating, coating materials, formulation of coating composition, methods of coating, equipment employed and defects in coating. c. Quality control tests: In process and finished product tests Liquid orals: Formulation and manufacturing consideration of syrups and elixirs suspensions and emulsions; Filling and packaging; evaluation of liquid orals official in pharmacopoeia	10	CO2 CO3
[3]	Capsules: a. Hard gelatin capsules: Introduction, Production of hard gelatin capsule shells. size of capsules, Filling, finishing and special techniques of formulation of hard gelatin capsules, manufacturing defects. In process and final product quality control tests for capsules. b. soft gelatin capsules: Nature of shell and capsule content, size of capsules, importance of base adsorption and minim/gram factors, production, in process and final product quality control tests. Packing, storage and stability testing of soft gelatin capsules and their applications. Pellets: Introduction, formulation requirements, pelletization process, equipments for manufacture of pellets	08	CO2 CO3

[4]	Parenteral Products: a. Definition, types, advantages and limitations. Pre-formulation factors and essential requirements, vehicles, additives, importance of isotonicity b. Production procedure, production facilities and controls, aseptic processing c. Formulation of injections, sterile powders, large volume parenterals and lyophilized products. d. Containers and closures selection, filling and sealing of ampoules, vials and infusion fluids. Quality control tests of parenteral products. Ophthalmic Preparations: Introduction, formulation considerations; formulation of eye drops, eye ointments and eye lotions; methods of preparation; labelling, containers; evaluation of ophthalmic preparations	10	CO2 CO3
[5]	Cosmetics: Formulation and preparation of the following cosmetic preparations: lipsticks, shampoos, cold cream and vanishing cream, tooth pastes, hair dyes and sunscreens. Pharmaceutical Aerosols: Definition, propellants, containers, valves, types of aerosol systems; formulation and manufacture of aerosols; Evaluation of aerosols; Quality control and stability studies. Packaging Materials Science: Materials used for packaging of pharmaceutical products, factors influencing choice of containers, legal and official requirements for containers, stability aspects of packaging materials, quality control tests.	10	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.

D. REFERENCE BOOKS

1. Lieberman, H. A. Pharmaceutical Dosage Forms. Tablets, Vol. 1; New York, Ny Dekker, 1989.
2. Lieberman, H. A.; Lachmann, L.; Kenneth Edwards Avis. Pharmaceutical Dosage Forms : Parenteral Medications; Vol-1-3; M. Dekker: New York, 1984.
3. Lieberman, H. A.; Rieger, M. M.; Banker, G. S. Pharmaceutical Dosage Forms-- Disperse Systems. Volume 1- 3; Dekker: New York, 1998.
4. Banker, G. S.; Rhodes, C. T. Modern Pharmaceutics; Marcel Dekker: New York, 2002.
5. Beringer, P. Remington : The Science and Practice of Pharmacy.; Lippincott Williams & Wilkins: Philadelphia ; London, 2011.
6. Aulton, M. E. Pharmaceutics : The Science of Dosage Form Design; Churchill Livingstone: Edinburgh Etc., 2003.
7. Ansel, H. C. Introduction to Pharmaceutical Dosage Forms; Lea & Febiger: Philadelphia, 1985.
8. Rhodes, C. T.; Jens Thurø Carstensen. Drug Stability : Principles and Practices; Marcel Dekker: New York, 2000.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	To understand pre-formulation considerations in development of pharmaceutical dosage forms.
CO2	Remember, Understand and Evaluate	To get knowledge of various pharmaceutical dosage forms and their manufacturing techniques.
CO3	Understand Apply and Evaluate	To understand various quality control test for pharmaceutical dosage forms and apply it to maintain quality drug product.
CO4	Understand and Remember	To know packaging requirements and evaluate various packaging materials for pharmaceutical dosage forms.
CO5	Understand	To understand formulation and preparation of cosmetic products.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	1	-	1	1	-	2	3	3	3	2	1	1
CO2	3	3	3	3	1	2	1	1	3	1	3	3	3	1	1	1
CO3	3	1	3	3	1	3	1	1	1	-	3	3	3	2	2	2
CO4	3	1	3	3	1	3	1	1	3	-	3	3	3	1	2	2
CO5	3	3	2	3	1	2	1	1	3	2	3	3	3	1	1	1
Avg	3	2.2	3	3	1	2	1	1	2	1	3	3	3	1.4	1.4	1.4

B. PHARM. SEMESTER – V (BPH)
SUBJECT: PHARMACOLOGY-II–THEORY (BP503T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.

Objectives: Upon completion of this course the student should be able to

- Understand the mechanism of drug action and its relevance in the treatment of different diseases
- Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
- Demonstrate the various receptor actions using isolated tissue preparation
- Appreciate correlation of pharmacology with related medical sciences

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Pharmacology of drugs acting on cardio vascular system a. Introduction to hemodynamic and electrophysiology of heart. b. Drugs used in congestive heart failure c. Anti-hypertensive drugs. d. Anti-anginal drugs. e. Anti-arrhythmic drugs. f. Anti-hyperlipidaemia drugs.	10	CO1, CO2, CO4.
[2]	Pharmacology of drugs acting on cardio vascular system a. Drug used in the therapy of shock. b. Haematinics, coagulants and anticoagulants. c. Fibrinolytics and anti-platelet drugs d. Plasma volume expanders Pharmacology of drugs acting on urinary system a. Diuretics b. Anti-diuretics.	10	CO1, CO2, CO4.
[3]	Autacoids and related drugs a. Introduction to autacoids and classification b. Histamine, 5-HT and their antagonists. c. Prostaglandins, Thromboxane's and Leukotrienes. d. Angiotensin, Bradykinin and Substance P. e. Non-steroidal anti-inflammatory agents f. Anti-gout drugs g. Anti-rheumatic drugs	10	CO1, CO3, CO5.
[4]	Pharmacology of drugs acting on endocrine system a. Basic concepts in endocrine pharmacology. b. Anterior Pituitary hormones-analogues and their inhibitors. c. Thyroid hormones-analogues and their inhibitors.	08	CO1, CO3, CO4.

	d. Hormones regulating plasma calcium level-Parathormone, Calcitonin and Vitamin-D. e. Insulin, Oral Hypoglycaemic agents and glucagon. f. ACTH and corticosteroids.		
[5]	Pharmacology of drugs acting on endocrine system a. Androgens and Anabolic steroids. b. Estrogens, progesterone and oral contraceptives. c. Drugs acting on the uterus. Bioassay a. Principles and applications of bioassay. b. Types of bioassay c. Bioassay of insulin, oxytocin, vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5-HT.	07	CO3, CO4, CO5.

C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; Mcgraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; Knollmann B. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; Mcgraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Understand the mechanism of drug action and its relevance in the treatment of different diseases.
CO2	Understand and apply	Correlate the pathophysiology and mechanism of drug action of drugs and its application in treatment of the disease.
CO3	Create, Remember and Evaluate	Create the choice of medicine based on various receptor actions using isolated tissue preparation.
CO4	Understand and Remember	Appreciate correlation of pharmacology with related medical sciences.
CO5	Understand, analyse and Evaluate	Apply clinical skills in ethical practice in pharmacy practice.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	3	3	-	3	3	2	3	-	3	3	3	3	2	3
CO2	3	-	3	3	-	3	3	1	3	-	3	3	3	3	2	3
CO3	3	-	3	3	-	3	3	2	3	-	3	3	3	3	2	3
CO4	3	-	3	3	-	3	3	1	3	-	3	3	3	3	2	3
CO5	3	-	3	3	-	3	3	-	3	-	3	2	3	3	2	3
Avg	3	-	3	3	-	3	3	1.2	3	-	3	2.8	3	3	2	3

B. PHARM. SEMESTER – V (BPH)
SUBJECT: PHARMACOGNOSY & PHYTOCHEMISTRY-II -THEORY (BP504T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and Phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine

Objectives: Upon completion of the course, the student shall be able

- To know the modern extraction techniques, characterization and identification of the herbal drugs and Phytoconstituents.
- To understand the preparation and development of herbal formulation.
- To understand the herbal drug interactions.
- To carryout isolation and identification of phytoconstituents.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Metabolic pathways in higher plants and their determination a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway. b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.	07	CO1
[2]	General introduction, composition, chemistry & chemical classes, biological source, therapeutic uses and commercial applications of following secondary metabolites: Alkaloids: Vinca, Rauwolfia, Belladonna, Opium, Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander, Tannins: Catechu, Pterocarpus Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony Glycosides: Senna, Aloes, Bitter Almond Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids.	14	CO5
[3]	Isolation, Identification and Analysis of Phytoconstituents a) Terpenoids: Menthol, Citral, Artemisin b) Glycosides: Glycyrrhetic acid & Rutin c) Alkaloids: Atropine, Quinine, Reserpine, Caffeine d) Resins: Podophyllotoxin, Curcumin.	06	CO2 CO3
[4]	Industrial production, estimation and utilization of the following phytoconstituents: Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine.	10	CO4

[5]	Basics of Phytochemistry Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.	08	CO2
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C. TEXT BOOKS

1. Dr. Shukla P., Dr. Shashi, A. & Dr. Shukla P., "Pharmacognosy & Phytochemistry-II" NiraliPrakashan, 1st Edition, 2019.
2. Kabra, A., Dr. Ashok PK. & Setia, S., A textbook of "Pharmacognosy & Phytochemistry-II", Pee Vee, S. Vikas & Company Medical Publishers, 2019.

D. REFERENCE BOOKS

1. Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry", 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
2. Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
3. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
4. Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
5. Jarald EE. & Jarald SE., "Textbook of Pharmacognosy & Phytochemistry" 1st edition, CBS Publishers & Distributors PVT. Ltd., 2007.
6. Dr. Sudha T., Mrs. Rajeshwari, R., Dr. Ravikumar VR. & Dr. Nimbakar TP., Current trend in "Pharmacognosy & Phytochemistry-II" Part-2, PV Publication, 2019.
7. Dr. Das K., "Pharmacognosy & Phytochemistry-II" 1st Edition, NiraliPrakashan, 2019.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To describe various metabolic pathways and formation of different metabolites
CO2	Understand and apply	To explain conventional and modern extraction techniques for phytoconstituents and apply analytical techniques.
CO3	Apply and evaluate	To evaluate phytoconstituents by Isolation, identification and estimation.
CO4	Analyse	To analyse industrial production and estimate of important phytoconstituents.
CO5	Remember and understand	To discuss the chemistry and commercial applications of natural crude drugs.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	-	1	-	1	2	1	3	3	2	3	1	1
CO2	3	2	2	3	-	2	1	2	2	2	2	3	2	3	2	1
CO3	3	2	3	3	-	2	1	2	2	2	2	3	2	3	2	1
CO4	3	2	2	3	-	2	2	2	3	3	3	3	3	3	2	1
CO5	3	2	2	3	-	3	2	2	3	3	3	3	3	3	3	1
Avg	3	2	2	3	0	2	1.2	1.8	2.4	2.2	2.6	3	2.4	3	2	1

B.PHARM. SEMESTER – V (BPH)
SUBJECT: PHARMACEUTICAL JURISPRUDENCE–THEORY (BP505T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India.

Objectives: Upon completion of the course, the student shall be able to understand:

- The Pharmaceutical legislations and their implications in the development and marketing of Pharmaceuticals.
- Various Indian pharmaceutical Acts and Laws.
- The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
- The code of ethics during the pharmaceutical practice.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Drugs and Cosmetics Act, 1940 and its rules 1945: Objectives, Definitions, Legal definitions of schedules to the Act and Rules Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties. Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.	10	CO3 CO4
[2]	Drugs and Cosmetics Act, 1940 and its rules 1945. Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties. Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors.	10	CO3 CO4
[3]	Pharmacy Act –1948: Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties Medicinal and Toilet Preparation Act –1955: Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.	10	CO3 CO4 CO5

	Narcotic Drugs and Psychotropic substances Act-1985 and Rules: Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties.		
[4]	Study of Salient Features of Drugs and Magic Remedies Act and its rules: Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties. Prevention of Cruelty to animals Act-1960: Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties. National Pharmaceutical Pricing Authority: Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM).	08	CO3 CO4
[5]	Pharmaceutical Legislations – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee. Code of Pharmaceutical ethics: Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath Medical Termination of Pregnancy Act : Right to Information Act: Introduction to Intellectual Property Rights (IPR):	07	CO1 CO2 CO3

C. TEXT BOOKS

1. Dua, J. and Sharma, S., "Pharmaceutical Jurisprudence", S Vikas and Company, Pee vee publishers, India, 2019.
2. Jani, GK., "Pharmaceutical Jurisprudence, Forensic Pharmacy", Atul Prakashan, India, 2019

D. REFERENCE BOOKS

1. Jain, NK., "A text book of Forensic Pharmacy" Second edition-Reprint, Vallabh Prakashan, 2007.
2. Mithal, BM., "Text book of Forensic Pharmacy" first edition, Vallabh Prakashan, 1988.
3. Suresh, B., A text book of "Forensic Pharmacy" 20th edition, Birla publication PVT. LTD., 2019.
4. Government of India, Ministry of Health and Family Welfare, "Drugs and Cosmetics Act and Rules" 2016.
5. Dr. Agrawal, SP. And Dr. Khanna, R., "Pharmaceutical Jurisprudence And Ethics" 5th edition, Birla publication PVT. LTD., 2008.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Describe and apply the Pharmaceutical legislations in the development and marketing of pharmaceuticals.
CO2	Understand, Remember and Apply	Discuss the code of ethics during the pharmaceutical practice.
CO3	Understand and remember	Explain basic principle of Indian pharmaceutical Acts and Laws.
CO4	Understand and remember	Describe the concept of the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
CO5	Understand, Remember and Apply	Explain and apply Pharmacy act.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	-	2	2	3	2	2	-	3	3	2	1	3	1
CO2	3	1	2	-	2	2	3	2	2	-	3	3	2	1	3	1
CO3	3	2	2	-	2	2	3	2	2	-	3	3	2	2	3	1
CO4	3	2	2	-	2	2	3	2	2	-	3	3	2	2	3	1
CO5	3	2	2	-	2	2	3	2	2	-	3	3	2	2	3	1
Avg	3	1.6	2	-	2	2	3	2	2	-	3	3	2	1.6	3	1

B. PHARM. SEMESTER – V (BPH)
SUBJECT: INDUSTRIAL PHARMACY I-PRACTICAL (BP506P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: Course enables the student to understand and apply various manufacturing techniques to formulate different pharmaceutical dosage forms.

Objectives: Upon completion of the course the student shall be able to

- To design pre-formulation protocol and evaluation of various preformulation parameters for drugs.
- To prepare and evaluate different dosage forms like tablets, capsules, liquids, semisolids, sterile etc.
- To formulate cosmetic products.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Preformulation studies on paracetamol/aspirin/or any other drug 2. Preparation and evaluation of Paracetamol tablets 3. Preparation and evaluation of Aspirin tablets 4. Coating of tablets- film coating of tables/granules 5. Preparation and evaluation of Tetracycline capsules 6. Preparation of Calcium Gluconate injection 7. Preparation of Ascorbic Acid injection 8. Quality control test of (as per IP) marketed tablets and capsules 9. Preparation of Eye drops/ and Eye ointments 10. Preparation of Creams (cold / vanishing cream) 11. Evaluation of Glass containers (as per IP)	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Goudanavar, Prakash. Practical Manual for Industrial Pharmacy I: As per Syllabus Prescribed by PCI for B. Pharm v Sem; Orange Books Publication, 2020.
2. Patil, Ketan., Patil, Paresh., Patil, Narendra., Kshirsagar, Sandip. The Theory and Practical Book of Industrial Pharmacy-I; Ip Innovative Publication Pvt. Ltd: New Delhi, 2020.

D. REFERENCE BOOKS

1. Kohli, D. P. S.; Shah, D. H. Drug Formulations Manual; Business Horizons: New Delhi, 2012.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Apply and Create	To apply knowledge of preformulation in designing preformulation protocol and designing dosage forms.
CO2	Create and Evaluate	To prepare and evaluate tablet, capsules, of different APIs
CO3	Create and Evaluate	To prepare and evaluate sterile dosage form like injections and ophthalmic products.
CO4	Create	To prepare cosmetic products.
CO5	Evaluate	Evaluation of packaging materials for dosage forms as per pharmacopoeial standards.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	1	3	2	3	3	3	3	3	3	1
CO2	3	3	3	3	1	2	3	3	3	3	3	3	3	3	3	2
CO3	3	3	3	3	1	2	3	3	3	3	3	3	3	3	3	2
CO4	3	3	3	3	1	3	1	3	3	3	3	3	3	3	3	2
CO5	3	3	3	3	1	2	3	3	3	3	3	3	3	3	3	3
Avg	3	3	3	3	1.2	2.6	2.2	3	3	3	3	3	3	3	3	3

B.PHARM. SEMESTER – V (BPH)
SUBJECT: PHARMACOLOGY-II-PRACTICAL (BP507P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.

Objectives: Upon completion of this course the student should be able to

- Perform different types of bioassay.
- Isolate different organs/tissues from the laboratory animals by simulated experiments.
- Analyse various receptor actions using isolated tissue preparation.
- Evaluate and analyse different types of analgesic and anti-inflammatory drugs
- To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1) Introduction to in-vitro pharmacology and physiological salt solutions. 2) Effect of drugs on isolated frog heart. 3) Effect of drugs on blood pressure and heart rate of dog. 4) Study of diuretic activity of drugs using rats/mice. 5) DRC of acetylcholine using frog rectus abdominis muscle. 6) Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis-muscle and rat ileum respectively. 7) Bioassay of histamine using guinea pig ileum by matching method 8) Bioassay of oxytocin using rat uterine horn by interpolation method. 9) Bioassay of serotonin using rat fundus strip by three point bioassay. 10) Bioassay of acetylcholine using rat ileum/colon by four point bioassay. 11) Determination of PA ₂ value of prazosin using rat anococcygeus muscle (by Schilds plot method). 12) Determination of PD ₂ value using guinea pig ileum. 13) Effect of spasmogens and spasmolytic using rabbit jejunum. 14) Anti-inflammatory activity of drugs using carrageenan induced paw-oedema model. 15) Analgesic activity of drug using central and peripheral methods.	60	CO1, CO2, CO3, CO4, CO5.

C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; McGraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; Knollmann B. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; McGraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Perform, Apply and Quantify.	Perform different types of bioassay.
CO2	Understand and Isolate	Isolate different organs/tissues from the laboratory animals by simulated experiments.
CO3	Analyse	Analyse various receptor actions using isolated tissue preparation.
CO4	Analyse and Evaluate.	Evaluate and analyse different types of analgesic and anti-inflammatory drugs
CO5	Evaluate and analyse	To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	2	3	3	3	3	2	3	3	3	3	3	2	2	3	3
CO3	3	2	3	3	3	3	2	3	3	2	2	3	3	3	3	3
CO4	3	2	3	3	3	3	2	3	3	2	2	3	1	3	2	3
CO5	3	2	3	3	3	3	3	3	3	2	2	3	2	3	2	3
Avg	3	2	3	3	3	3	2.4	3	3	2.4	2.8	3	2.4	2.8	2.6	3

B. PHARM. SEMESTER – V (BPH)
SUBJECT: PHARMACOLOGY-II-PRACTICAL (BP507P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on different systems of body and in addition, emphasis on the basic concepts of bioassay.

Objectives: Upon completion of this course the student should be able to

- Understand the mechanism of drug action and its relevance in the treatment of different diseases
- Demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments
- Demonstrate the various receptor actions using isolated tissue preparation
- Appreciate correlation of pharmacology with related medical sciences

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	1) Introduction to in-vitro pharmacology and physiological salt solutions. 2) Effect of drugs on isolated frog heart. 3) Effect of drugs on blood pressure and heart rate of dog. 4) Study of diuretic activity of drugs using rats/mice. 5) DRC of acetylcholine using frog rectus abdominis muscle. 6) Effect of physostigmine and atropine on DRC of acetylcholine using frog rectus abdominis-muscle and rat ileum respectively. 7) Bioassay of histamine using guinea pig ileum by matching method 8) Bioassay of oxytocin using rat uterine horn by interpolation method. 9) Bioassay of serotonin using rat fundus strip by three point bioassay. 10) Bioassay of acetylcholine using rat ileum/colon by four point bioassay. 11) Determination of PA ₂ value of prazosin using rat anococcygeus muscle (by Schilds plot method). 12) Determination of PD ₂ value using guinea pig ileum. 13) Effect of spasmogens and spasmolytic using rabbit jejunum. 14) Anti-inflammatory activity of drugs using carrageenan induced paw-oedema model. 15) Analgesic activity of drug using central and peripheral methods.	45	CO1, CO2, CO3, CO4, CO5.

C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; McGraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; Knollmann B. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; McGraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Perform, Apply and Quantify.	Perform different types of bioassay.
CO2	Understand and Isolate	Isolate different organs/tissues from the laboratory animals by simulated experiments.
CO3	Analyse	Analyse various receptor actions using isolated tissue preparation.
CO4	Analyse and Evaluate.	Evaluate and analyse different types of analgesic and anti-inflammatory drugs
CO5	Evaluate and analyse	To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	3	-	-	3	3	3	-	-	3	3	3	3	3
CO2	3	-	3	3	-	-	3	3	3	-	-	3	2	2	3	3
CO3	3	-	3	3	-	-	3	3	3	-	-	3	3	3	3	3
CO4	3	-	3	3	-	-	3	3	3	-	-	3	1	3	2	3
CO5	3	1	3	3	-	-	3	3	3	-	-	3	2	3	2	3
Avg	3	0.4	3	3	-	-	3	3	3	-	-	3	2.4	2.8	2.6	3

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: MEDICINAL CHEMISTRY III -THEORY (BP601T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

Objectives: Upon completion of the course student shall be able to

- Understand the importance of drug design and different techniques of drug design.
- Understand the chemistry of drugs with respect to their biological activity.
- Know the metabolism, adverse effects and therapeutic value of drugs.
- Know the importance of SAR of drugs.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Classification, mechanism of action, uses, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*) of following class of drugs in all units. Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. β-Lactam antibiotics: Penicillin, Cephalosporins, β- Lactamase inhibitors, Monobactams Aminoglycosides: Streptomycin, Neomycin, Kanamycin Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline	10	CO1 CO2 CO3 CO4
[2]	Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. Macrolide: Erythromycin Clarithromycin, Azithromycin Miscellaneous: Chloramphenicol*, Clindamycin Prodrugs: Basic concepts and application of prodrugs design Antimalarials: Etiology of malaria Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovaquone	10	CO1 CO2 CO3 CO4 CO5
[3]	Anti-tubercular Agents	10	CO1

	<p>Synthetic anti tubercular agents: Isoniozid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.*</p> <p>Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycin, Capreomycin sulphate</p> <p>Urinary tract anti-infective agents</p> <p>Quinolones: SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin</p> <p>Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine</p> <p>Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirdine, Ribavirin, Saquinavir, Indinavir, Ritonavir</p>		CO2 CO3 CO4 CO5
[4]	<p>Antifungal agents:</p> <p>Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin.</p> <p>Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconazole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.</p> <p>Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine.</p> <p>Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.</p> <p>Sulphonamides and Sulfones Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine</p> <p>Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole</p> <p>Sulfones: Dapsone*</p>	08	CO1 CO2 CO3 CO4 CO5
[5]	<p>Introduction to Drug Design Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett's electronic parameter, Taft's steric parameter and Hansch analysis.</p> <p>Pharmacophore modeling and docking techniques.</p> <p>Combinatorial Chemistry: Concept and applications chemistry: solid phase and solution phase synthesis.</p>	07	CO1

C. TEXT BOOKS

1. Alagarsamy, V. Textbook of Medicinal Chemistry, Volume I and Volume II, 3rd ed.; CBS Publishers, India, 2016
2. Kadam, S.S., Mahadik, K.R., Bothara, K.G. Principles of Medicinal Chemistry, Volume I and II, 20th ed.; Nirali Prakashan, India, 2010

D. REFERENCE BOOKS

1. Hansch, C., Semmes, P.G., Taylor, J.B. Comprehensive Medicinal Chemistry, Volume I to VI, 1st ed.; Elsevier, India, 2005
2. Abraham, D.J. Burger's Medicinal Chemistry and Drug Discovery, Volume I to VI, 6th ed.; Wiley-Interscience, New Jersey, 2003
3. Lendnicher, D., Mitscher, L.A. The Organic Chemistry of Drug Synthesis, Volume I to VI, Wiley-Interscience, New Jersey, 2008
4. Johnson, D.S., Li, J.J. Art of Drug Synthesis, 1st ed.; Wiley-Interscience, New Jersey, 2007
5. Patrick, G.L. An Introduction to Medicinal Chemistry, 3rd ed.; Oxford University Press, Oxford, 2006
6. Silverman, R.B. The Organic Chemistry of Drug Design and Drug Action, 2nd ed.; Academic Press, Burlington, 2004
7. Lemke, T.L., Williams, D.A. FOYE'S Principles of Medicinal Chemistry, 7th ed.; Lippincott Williams & Wilkins, Baltimore, 2013
8. Baele, J.M., Block J. H. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th ed.; Lippincott Williams & Wilkins; Baltimore, 2011
9. Smith, J.H., Williams, H. Smith and Williamson's Introduction to the Principles of Drug Design and Action, 3rd ed; CRC Press, The Netherlands, 2005
10. Vardanyan, R., Hruby, V. Synthesis of Essential Drugs, Volume I & II, 1st ed.; Elsevier, The Netherlands, 2006

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To explain the fundamentals of drug design, different techniques of drug design and combinatorial chemistry
CO2	Understand and remember	To describe classification and chemistry of drugs
CO3	Understand and remember	To discuss action of drugs, their metabolism, adverse effects and therapeutic value of drugs
CO4	Analysis	To explain structural activity relationship of different class of drugs
CO5	Apply	To describe synthesis of selected drugs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	2	-	-	-	-	-	-	3	2	2	3	2	1
CO2	3	-	2	1	-	-	-	-	-	-	3	2	3	2	1	1
CO3	3	-	2	2	-	-	-	-	-	-	3	2	2	3	1	1
CO4	3	-	2	1	-	-	-	-	-	-	3	2	1	3	2	1
CO5	3	3	3	3	3	-	-	-	-	3	3	2	2	3	2	3
Avg	3	0.6	2	1.8	0.6	-	-	-	-	0.6	3	2	2	2.8	1.6	1.4

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: PHARMACOLOGY-III–THEORY (BP602T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and Chrono pharmacology.

Objectives: Upon completion of this course the student should be able to:

- understand the mechanism of drug action and its relevance in the treatment of different infectious diseases
- comprehend the principles of toxicology and treatment of various poisonings and
- appreciate correlation of pharmacology with related medical sciences

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Pharmacology of drugs acting on Respiratory system a. Anti-asthmatic drugs b. Drugs used in the management of COPD c. Expectorants and antitussives d. Nasal decongestants e. Respiratory stimulants Pharmacology of drugs acting on the Gastrointestinal Tract a. Antiulcer agents. b. Drugs for constipation and diarrhoea. c. Appetite stimulants and suppressants. d. Digestants and carminatives. e. Emetics and anti-emetics.	10	CO1, CO2, CO3.
[2]	Chemotherapy a. General principles of chemotherapy. b. Sulphonamides and cotrimoxazole. c. Antibiotics- Penicillin's, cephalosporin's, chloramphenicol, macrolides, quinolones and fluoroquinolones, tetracycline and aminoglycosides	10	CO1, CO2, CO3.
[3]	Chemotherapy a. Anti-tubercular agents b. Anti-leprotic agents c. Anti-fungal agents d. Antiviral drugs e. Anthelmintics f. Antimalarial drugs g. Anti-amoebic agents	10	CO1, CO2, CO3.
[4]	Chemotherapy Urinary tract infections and sexually transmitted diseases. Chemotherapy of malignancy.	08	CO4, CO5.

	Immunopharmacology a.Immunostimulants b. Immunosuppressant Protein drugs, monoclonal antibodies, target drugs to antigen, biosimilar.		
[5]	Principles of toxicology a. Definition and basic knowledge of acute, subacute and chronic toxicity. b.Definition and basic knowledge of genotoxicity, carcinogenicity, teratogenicity and mutagenicity c. General principles of treatment of poisoning. d.Clinical symptoms and management of barbiturates, morphine, organophosphorus compound and lead, mercury and arsenic poisoning. Chronopharmacology a.Definition of rhythm and cycles. b.Biological clock and their significance leading to chronotherapy.	07	CO4, CO5.

C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; Mcgraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; Knollmann B. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; Mcgraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's.*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.
10. N Udupa; Gupta, P. D. *Concepts in Chronopharmacology*; Shyam Prakashan: Jaipur, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
C01	Understand and Apply	Understand the mechanism of drug action and its relevance in the treatment of different infectious diseases.
C02	Understand and Apply	Understand the resistance mechanism of drug action in the treatment of different infectious diseases.
C03	Remember, Evaluate and Apply	Select the drug, its necessity, frequency, duration, prophylaxis and test for cure of the treatment of infectious diseases.
C04	Understand, Remember and Apply	Appreciate correlation of pharmacology with related medical sciences and Chrono-pharmacology.
C05	Understand, Evaluate and analyse	Comprehend the principles of toxicology and treatment of various poisonings.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	-	3	3	3	2	3	1	3	1	3	3	-	3	3	3
C02	3	-	3	3	3	1	3	1	3	3	2	3	-	3	3	3
C03	3	1	3	3	2	2	3	2	3	2	2	3	-	3	3	3
C04	3	1	3	3	3	1	3	3	3	3	3	3	-	3	3	3
C05	3	1	3	3	3	2	3	1	3	1	3	3	-	3	3	3
Avg	3	0.6	3	3	2.8	1.6	3	1.6	3	2.2	2.6	3	-	3	3	3

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: HERBAL DRUG TECHNOLOGY–THEORY (BP603T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

Objectives: Upon completion of this course the student should be able to:

- Understand raw material as source of herbal drugs from cultivation to herbal drug product
- Know the WHO and ICH guidelines for evaluation of herbal drugs
- Know the herbal cosmetics, natural sweeteners, nutraceuticals
- Appreciate patenting of herbal drugs, GMP.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Herbs as raw materials Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation. Source of Herbs, Selection, identification and authentication of herbal materials Processing of herbal raw material Biodynamic Agriculture Good agricultural practices in cultivation of medicinal plants including Organic farming. Pest and Pest management in medicinal plants: Biopesticides/Bioinsecticides. Indian Systems of Medicine a) Basic principles involved in Ayurveda, Siddha, Unani and Homeopathy b) Preparation and standardization of Ayurvedic formulations viz Aristas and Asavas, Ghutika, Churna, Lehya and Bhasma.	11	CO1 CO5
[2]	Nutraceuticals General aspects, Market, growth, scope and types of products available in the market. Health benefits and role of Nutraceuticals in ailments like Diabetes, CVS diseases, Cancer, Irritable bowel syndrome and various Gastro intestinal diseases. Study of following herbs as health food: Alfalfa, Chicory, Ginger, Fenugreek, Garlic, Honey, Amla, Ginseng, Ashwagandha, Spirulina Herbal-Drug and Herb-Food Interactions: General introduction to interaction and classification. Study of following drugs and their possible side effects and interactions: Hypercium, kava-kava, Ginkobiloba, Ginseng, Garlic, Pepper & Ephedra.	07	CO3
[3]	Herbal Cosmetics Sources and description of raw materials of herbal origin used via, fixed oils, waxes, gums colours, perfumes, protective agents, bleaching agents, antioxidants in products such as skin care, hair care and oral hygiene products. Herbal excipients:	10	CO3 CO5

	Herbal Excipients – Significance of substances of natural origin as excipients – colorants, sweeteners, binders, diluents, viscosity builders, disintegrants, flavors & perfumes. Herbal formulations : Conventional herbal formulations like syrups, mixtures and tablets and Novel dosage forms like phytosomes		
[4]	Evaluation of Drugs WHO & ICH guidelines for the assessment of herbal drugs Stability testing of herbal drugs. Patenting and Regulatory requirements of natural products: a) Definition of the terms: Patent, IPR, Farmers right, Breeder's right, Bioprospecting and Biopiracy b) Patenting aspects of Traditional Knowledge and Natural Products. Case study of Curcuma & Neem. Regulatory Issues - Regulations in India (ASU DTAB, ASU DCC), Regulation of manufacture of ASU drugs - Schedule Z of Drugs & Cosmetics Act for ASU drugs.	10	CO2 CO4
[5]	General Introduction to Herbal Industry Herbal drugs industry: Present scope and future prospects. A brief account of plant based industries and institutions involved in work on medicinal and aromatic plants in India. Schedule T–Good Manufacturing Practice of Indian systems of medicine Components of GMP (Schedule–T) and its objectives, Infrastructural requirements, working space, storage area, machinery and equipments, standard operating procedures, health and hygiene, documentation and records.	07	CO3 CO4

C. TEXT BOOKS

1. Dr. Arora, P. & Dr. Arora, V., A text book of “Herbal Drug Technology” Pee Vee Books, S. Vikas & Company (Medical Publishers) ,2019.
2. Dr. Lodhi, S., Dr. Usman, R. Md ., Dr. Deshmukh Ta., Darvekar, VM. & Dr. Kori ML., “Herbal Drug Technology”, 1st Edition, Nirali Prakashan, 2019.

D. REFERENCE BOOKS

1. Dr. Mukherjee, PK. & Dr. Verpoorte, R., “GMP for Botanicals” 1st Edition, Business Horizons Pharmaceutical Publishers, 2003.
2. Dr. Mukherjee, PK.”Quality Control of Herbal Drugs: An Approach to Evaluation of botanicals” 1st Edition reprint, Elsevier Science Publication, 2017.
3. Agrawal, SS. & Paridhavi M., “Herbal Drug Technology” 2nd edition, Orient Blackswan , 2012.
4. Shah, B., & Seth, AK., “Textbook of Pharmacognosy & Phytochemistry” , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
5. Rangari VD., “Pharmacognosy & Phytochemistry” Volume-I 3rd Edition, Career Publications, 2017.
6. Rangari VD., “Pharmacognosy & Phytochemistry” Volume-II 3rd Edition, Career Publications, 2017.
7. Quadry, JS., “Textbook of Pharmacognosy (Theory & Practical)” 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.
8. Dr. Shinde, VM. & Mrs. Bodas-yadav, KS., “Herbal Drug Technology”, 2nd edition, Nirali Prakashan, 2020.
9. Dr. Tiwari V., “Herbal Drug Technology”, 1st edition, Nirali Prakashan, 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	Describe concept of raw material as source of herbal drugs from cultivation for herbal drug production.
CO2	Understand, Remember and Apply	Application of WHO and ICH guidelines for standardisation of herbal drugs.
CO3	Understand and Remember	Explain the concept of herbal medicines, Herbal cosmetics and nutraceuticals and herbal industry.
CO4	Understand and Apply	Describe Good manufacturing practice, Patenting and Regulatory requirements of natural products.
CO5	Understand and Analyse	Detail description and analysis of various ayurvedic formulations.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	-	2	2	1	2	1	3	3	2	2	-	1
CO2	3	2	2	2	-	2	3	1	2	1	3	3	2	2	3	1
CO3	3	2	2	2	-	2	2	1	3	1	3	3	2	2	-	1
CO4	3	2	2	2	-	2	3	1	3	1	3	3	2	2	3	1
CO5	3	2	2	2	-	2	2	1	2	1	3	3	2	2	3	1
Avg	3	2	2	2	-	2	2.4	1	2.4	1	3	3	2	2	1.8	1

B. PHARM. SEMESTER – VI (BPH)**SUBJECT: BIOPHARMACEUTICS AND PHARMACOKINETICS-THEORY (BP604T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart knowledge and skills of Biopharmaceutics and pharmacokinetics and their applications in pharmaceutical development, design of dose and dosage regimen and in solving the problems arising therein.

Objectives: Upon completion of the course student shall be able to:

- Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
- Use of plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
- To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
- Understand various pharmacokinetic parameters, their significance & applications.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Biopharmaceutics Absorption; Mechanisms of drug absorption through GIT, factors influencing drug absorption through GIT, absorption of drug from Non-per oral extra-vascular routes. Distribution Tissue permeability of drugs, binding of drugs, apparent, volume of drug distribution, plasma and tissue protein binding of drugs, factors affecting protein-drug binding. Kinetics of protein binding, Clinical significance of protein binding of drugs	10	CO1
[2]	Elimination: Drug metabolism and basic understanding metabolic pathways renal excretion of drugs, factors affecting renal excretion of drugs, renal clearance, Non-renal routes of drug excretion of drugs Bioavailability and Bioequivalence: Definition and Objectives of bioavailability, absolute and relative bioavailability, measurement of bioavailability, <i>in-vitro</i> drug dissolution models, <i>in-vitro-in-vivo</i> correlations, bioequivalence studies, methods to enhance the dissolution rates and bioavailability of poorly soluble drugs.	10	CO1 CO5
[3]	Pharmacokinetics: Definition and introduction to Pharmacokinetics, Compartment models, Non-compartment models, physiological models, One compartment open model. (a). Intravenous Injection (Bolus) (b). Intravenous infusion and (c) Extra vascular administrations. Pharmacokinetics parameters - KE , $t_{1/2}$, V_d , AUC , K_a , Cl_t and CLR - definitions methods of eliminations, understanding of their significance and application.	08	CO1 CO2 CO5
[4]	Multicompartment models: Two compartment open model. IV bolus Kinetics of multiple dosing, steady state drug levels, calculation of loading and maintenance doses and their significance in clinical settings.	8	CO2 CO4
[5]	Nonlinear Pharmacokinetics:	7	CO2

	a. Introduction, b. Factors causing Non-linearity. c. Michaelis-menton method of estimating parameters, Explanation with example of drugs.		CO4
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C. TEXT BOOKS

1. Brahankar, D. M.; Jaiswal, S. B. *Biopharmaceutics and Pharmacokinetics : A Treatise*; Vallabh Prakashan: Delhi, 2014.

D. REFERENCE BOOKS

1. Abdou, H. M. Dissolution, Bioavailability and Bioequivalence; Mack Publishing Company: Easton, 1989.
2. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics; Lea & Febiger: Philadelphia, 1984.
3. Gibaldi, M.; Perrier, D. Pharmacokinetics; Infroma Healthcare: New York, 2007.
4. Notari, R. E. Biopharmaceutics and Pharmacokinetics : An Introduction; M. Dekker: New York, 1975.
5. Notari, R. E. Biopharmaceutics and Clinical Pharmacokinetics : An Introduction; M. Dekker: New York, 1987.
6. Remington, J. P.; Gennaro, A. R. Remington's Pharmaceutical Sciences; Mack Pub. Co: Easton, Pa., 1990.
7. Rowland, M.; Tozer, T. N. Clinical Pharmacokinetics and Pharmacodynamics : Concepts and Applications; Wolters Kluwer-Lippincott William & Wilkins: Philadelphia, 2011.
8. Shargel, L.; Yu, A. B. C. Applied Biopharmaceutics & Pharmacokinetics; Mcgraw-Hill Education: Singapore, 2016.
9. Gibaldi M and Prescott L, Hand Book of Clinical Pharmacokinetics, ADIS Health Science Press, 1989
10. Swarbrick, Biopharmaceutics, Lea & Febiger, U.S., 1971

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember and Understand	Understand the basic concepts in biopharmaceutics and pharmacokinetics and their significance.
CO2	Understand and Apply	To understand and apply plasma drug concentration-time data to calculate the pharmacokinetic parameters to describe the kinetics of drug absorption, distribution, metabolism, excretion, elimination.
CO3	Understand	To understand the concepts of bioavailability and bioequivalence of drug products and their significance.
CO4	Understand and Remember	To understand various pharmacokinetic parameters and their significance.
CO5	Apply and evaluate	To apply the IVIVC co-relation for different dosage forms.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	1	2	1	2	2	3	3	3	3	2	2
CO2	3	2	3	3	1	2	-	2	2	1	2	3	3	3	2	2
CO3	3	2	2	3	2	2	2	2	-	1	3	3	3	3	2	2
CO4	3	2	2	3	1	1	-	3	-	2	3	3	2	2	2	2
CO5	3	3	3	3	2	1	2	3	2	2	2	3	3	3	1	2
Avg	3	2.2	2.6	3	1.6	1.4	1.2	2.2	1.2	1.6	2.6	3	2.8	2.8	1.8	2

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: PHARMACEUTICAL BIOTECHNOLOGY-THEORY (BP605T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course enables the student to learn biotechnology, long promise to revolutionize the biological sciences and technology. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. Biotechnology has already produced transgenic crops and animals and the future promises a lot more. It is basically a research-based subject.

Objectives: Upon completion of the course the student shall be able to understand Enzymes, Genetic engineering and fermentation technology and importance of biotechnology in industry.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. b) Enzyme Biotechnology- Methods of enzyme immobilization and applications. c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries. d) Brief introduction to Protein Engineering. e) Use of microbes in industry. Production of Enzymes- General consideration Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. f) Basic principles of genetic engineering.	10	CO1
[2]	a) Study of cloning vectors, restriction endonucleases and DNA ligase. b) Recombinant DNA technology. Application of genetic engineering in medicine. c) Application of r DNA technology and genetic engineering in the production of: i) Interferon ii) Vaccines- hepatitis- B iii) Hormones- Insulin. d) Brief introduction to PCR	10	CO2 CO3
[3]	Types of immunity- humoral immunity, cellular immunity a) Structure of Immunoglobulins b) Structure and Function of MHC c) Hypersensitivity reactions, Immune stimulation and Immune suppressions. d) General method of the preparation of bacterial vaccines, toxoids, viral vaccines, antitoxins, serum-immune blood derivatives and other products relative to immunity. e) Storage conditions and stability of official vaccines f) Hybridoma technology- Production, Purification and Applications	10	CO5
[4]	a) Immunoblotting techniques- ELISA, Western blotting, Southern blotting. b) Genetic organization of Eukaryotes and Prokaryotes	08	CO2 CO5

	c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. d) Introduction to Microbial biotransformation and applications. e) Mutation: Types of mutation/mutants.		
[5]	a) Fermentation methods and general requirements, study of media, equipment, sterilization methods, aeration process, stirring. b) Large scale production fermenter design and its various controls. c) Study of the production of - penicillin, citric acid, Vitamin B12, Glutamic acid, Griseofulvin, d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma substitutes.	07	CO4

C. TEXT BOOKS

1. Primrose, S. B. *Molecular Biotechnology*; Blackwell Scientific Publications: Oxford ; Boston, 2001.
2. Stanbury, P. F.; Whitaker, A.; Hall, S. J. *Principles of Fermentation Technology*; 2017.

D. REFERENCE BOOKS

1. Glick, B. R.; Patten, C. L. *Molecular Biotechnology: Principles and Applications of Recombinant DNA*; Asm Press: Washington, Dc, 2017.
2. Kindt, T. J.; Goldsby, R. A.; Anne, B. *Kuby Immunology*; W.H. Freeman and Company: New York, 2007.
3. Goding, J. W. *Monoclonal Antibodies: Principles and Practice: Production and Application of Monoclonal Antibodies in Cell Biology, Biochemistry and Immunology*; Academic Press: London, 1996.
4. Walker, J. M.; Gingold, E. B. *Molecular Biology and Biotechnology*; Royal Society of Chemistry: London, 1993.
5. Zaborsky, O. R. *Immobilized Enzymes*; Krieger: Malabar, Fla., 1984.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember and Understand	To Understand the importance of Immobilized enzymes in Pharmaceutical Industries.
CO2	Remember and Understand	To learn genetic engineering applications in relation to production of pharmaceuticals
CO3	Understand and Apply	To learn Importance of Monoclonal antibodies in Industries
CO4	Understand and Remember	To learn the use of microorganisms in fermentation technology
CO5	Understand	To learn antigen-antibody reaction and immunity of Human system

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
C01	2	—	1	3	—	-	1	1	1	3	3	3	3	3	2	3
C02	2	—	2	3	—	1	1	1	2	3	3	2	3	3	3	3
C03	2	—	2	3	—	-	1	1	2	3	3	3	3	3	3	3
C04	2	—	2	3	—	2	1	1	2	3	3	3	3	3	2	3
C05	2	—	2	2	—	2	2	1	1	2	2	1	2	3	1	1
Avg	2	—	1.8	2.8	—	1	1.2	1	1.6	2.8	2.8	2.4	2.8	3	2.2	2.6

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: INSTRUMENTAL METHODS OF ANALYSIS - THEORY (BP606T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.

Objectives: Upon completion of the course student shall be able to:

- understand the cGMP aspects in a pharmaceutical industry
- appreciate the importance of documentation
- understand the scope of quality certifications applicable to pharmaceutical industries
- understand the responsibilities of QA & QC departments

B. COURSE CONTENT

NO	TOPIC	L Hrs)	COs
[1]	Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP Total Quality Management (TQM): Definition, elements, philosophies ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines Quality by design (QbD): Definition, overview, elements of QbD program, tools ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration NABL accreditation: Principles and procedures	10	CO1 CO3
[2]	Organization and personnel: Personnel responsibilities, training, hygiene and personal records. Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination. Equipments and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.	10	CO1 CO3 CO4
[3]	Quality Control: Quality control test for containers, rubber closures and secondary packing materials. Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities	10	CO3 CO4
[4]	Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal. Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.	08	CO2
[5]	Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and	07	CO5

	scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation. Warehousing: Good warehousing practice, materials management		
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C. TEXT BOOKS

1. P P Sharma. *How to Practice GMPs*, 6th ed.; vandana publications Pvt. Ltd.: Delhi, 2010.
2. Hirsch, A. F. *Good Laboratory Practice Regulations*; M. Dekker: New York ; Basel, 1989.

D. REFERENCE BOOKS

1. Weinberg, S. *Good Laboratory Practice Regulations*; M. Dekker: New York, 1995.
2. World Health Organization. *Quality Assurance of Pharmaceuticals. 2: A Compendium of Guidelines and Related Materials*; 1999.
3. World Health Organization. Pharmaceuticals Programme. The International pharmacopoeia = Pharmacopoeia Internationalis. Vol. 4, Tests, methods and general requirements: quality specifications for pharmaceutical substances, excipients and dosage forms
4. ICH Official web site: ICH <http://www.ich.org/>.
5. ISO. ISO 14000 Environmental management <https://www.iso.org/iso-14001-environmental-management.html>.
6. Ghosh S K; Maitra K. *A Guide to Total Quality Management*, 4th ed.; Oxford Publishing House, 2005.
7. S K Ghosh. *Introduction to ISO 9000 and Total Quality Management*, 4th ed.; Oxford Publishing House, 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the cGMP, GLP and ICH aspects in a pharmaceutical industry
CO2	Understand Apply and Evaluate	To understand and appreciate the importance of QbD and documentation
CO3	Understand and remember	To understand the scope of quality certifications applicable to pharmaceutical industries
CO4	Understand and remember	To understand the responsibilities of QA & QC departments
CO5	Understand Apply and Evaluate	To learn the aspects of calibration, validation and Material management

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	-	-	3	3	2	2	-	3	3	3	1	2	3
CO2	3	2	2	2	-	3	3	2	2	-	3	3	3	1	2	3
CO3	3	2	1	-	-	3	3	2	2	2	3	3	3	1	2	3
CO4	3	2	1	-	2	3	3	2	2	-	3	3	3	1	2	3
CO5	3	2	1	-	-	2	2	2	2	2	3	3	3	1	2	2
Avg	3	2	1.2	0.4	0.4	2.8	2.8	2	2	0.8	3	3	3	1	2	2.8

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: MEDICINAL CHEMISTRY III -PRACTICAL (BP607P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	-	05	10	50

A. COURSE OVERVIEW

Medicinal Chemistry III practical subject imparts practical knowledge regarding synthesis and analysis of drugs by various methods via experiments in laboratory. The subject also focuses on chemical structure, reaction and mechanism drawing experiment using various offline and online tools. Experiments involving prediction of various physicochemical properties-drug likeness properties would help to understand important aspect of drug design.

Objectives: Upon completion of the course student shall be able to

- Use ChemDraw for chemical structure and reaction drawing
- Synthesize and purify organic compounds
- Perform analysis of drugs using various analytical methods

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Preparation of drugs and intermediates 1 Sulphanilamide 2 7-Hydroxy, 4-methyl coumarin 3 Chlorobutanol 4 Triphenyl imidazole 5 Tolbutamide 6 Hexamine Assay of drugs 1 Isonicotinic acid hydrazide 2 Chloroquine 3 Metronidazole 4 Dapsone 5 Chlorpheniramine maleate 6 Benzyl penicillin Preparation of medicinally important compounds or intermediates by Microwave irradiation technique Drawing structures and reactions using chem draw Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeness screening (Lipinski's RO5)	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Kar, A. Advanced Practical Medicinal Chemistry, 3rd ed.; New Age International Publishers, India, 2020
2. Vogel, A.I., Tatchell, A.R., Furniss, B.S., Smith, P.W.G. Text book of practical organic chemistry, 5th ed.; Longman Scientific and Technical; New York, 2011

C. REFERENCE BOOKS

1. Lendnicher, D., Mitscher, L.A. The Organic Chemistry of Drug Synthesis, Volume I to VI, Wiley-Interscience, New Jersey, 2008
2. Mann, F.G., Saunders, B.G., Practical Organic Chemistry, 4th ed.; Pearson, India, 2009

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Apply, analysis and evaluate	To assess the drug-likeness properties of drugs using various online tools
CO2	Understand and apply	To draw chemical structure, reaction and mechanism drawing using offline and online tools
CO3	Apply	To synthesize some drugs and intermediates by conventional synthesis
CO4	Apply	To perform synthesis of selected drugs by microwave assisted organic synthesis technique
CO5	Apply and evaluate	To carry out analysis of various drugs

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	2	3	1	-	-	-	-	-	3	2	2	3	2	1
CO2	2	1	1	3	-	-	-	-	-	-	3	1	2	1	1	1
CO3	3	2	3	3	1	-	-	-	-	3	3	3	3	2	2	3
CO4	3	2	3	3	1	-	-	-	-	3	3	3	3	2	2	3
CO5	3	2	3	3	1	-	-	-	-	3	3	3	3	2	2	1
Avg	2.8	1.4	2.4	3	0.8	-	-	-	-	1.2	3	2.4	2.6	2	1.8	1.8

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: PHARMACOLOGY-III–PRACTICAL (BP608P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject is intended to impart the fundamental knowledge on various aspects (classification, mechanism of action, therapeutic effects, clinical uses, side effects and contraindications) of drugs acting on respiratory and gastrointestinal system, infectious diseases, immuno-pharmacology and in addition, emphasis on the principles of toxicology and Chrono pharmacology.

Objectives: Upon completion of this course the student should be able to:

- Evaluate different types of toxicity studies.
- Apply different types of statistical analysis in different pharmacological experiments.
- Analyse and evaluate various receptor actions using isolated tissue preparation.
- Create the observation data and correlate them using statistical analysis.
- To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1) Dose calculation in pharmacological experiments. 2) Anti-allergic activity by mast-cell stabilization assay. 3) Study of anti-ulcer activity of a drug using pylorus ligand (SHAY) rat model and NSAIDS induced ulcer model. 4) Study of effect of drugs on gastrointestinal motility. 5) Effect of agonist and antagonists on guinea pig ileum. 6) Estimation of serum biochemical parameters by using semi- auto analyser. 7) Effect of saline purgative on frog intestine. 8) Insulin hypoglycaemic effect in rabbit. 9) Test for pyrogens (rabbit method). 10) Determination of acute oral toxicity (LD50) of a drug from a given data. 11) Determination of acute skin irritation / corrosion of a test substance. 12) Determination of acute eye irritation /corrosion of a test substance. 13) Calculation of pharmacokinetic parameters from a given data. 14) Biostatistics methods in experimental pharmacology (student's t test, ANOVA) 15) Biostatistics methods in experimental pharmacology (Chi square test, Wilcoxon Signed Rank test)	60	CO1, CO2, CO3, CO4, CO5.

C. TEXT BOOKS

1. Tripathi, K. D. *Essentials of Medical Pharmacology*; Jaypee Brothers Medical Publishers: New Delhi, 2019.

D. REFERENCE BOOKS

1. Ritter, J.; Flower, R. J.; Henderson, G.; Yoon Kong Loke; Rang, H. P. *Rang and Dale's Pharmacology*, 9th ed.; Elsevier: Endinburgh, 2020.
2. Katzung, B. G. *Basic & Clinical Pharmacology*, 14th ed.; McGraw-Hill Education, Copyright: New York I 11 Pozostałych, 2018.
3. Louis Sanford Goodman; Gilman, A.; Brunton, L. L.; Chabner, B. A.; Knollmann B. C. *Goodman & Gilman's the Pharmacological Basis of Therapeutics*; McGraw-Hill Medical: New York, 2011.
4. Al, E. *Applied Therapeutics: The Clinical Use of Drugs*; Wolters Kluwer Health - Lippincott Williams & Wilkins, Cop: Philadelphia, 2013.
5. *Lippincott's Illustrated Reviews Bundle Lippincott's Illustrated Reviews: Biochemistry, 4th Ed + Lippincott's Illustrated Reviews, Pharmacology, North American Edition, 4th Ed + Lippincott's*; Lippincott Williams & Wilkins, 2009.
6. Hl Sharma; Kk Sharma. *Principles of Pharmacology*; Paras: New Delhi, 2011.
7. Craig, C. R.; Stitzel, R. E. *Modern Pharmacology with Clinical Applications*; Lippincott Williams & Wilkins: Philadelphia, 2004.
8. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
9. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.
10. N Udupa; Gupta, P. D. *Concepts in Chronopharmacology*; Shyam Prakashan: Jaipur, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember and Evaluate.	Evaluate different types of toxicity studies.
CO2	Apply and Analyse	Apply different types of statistical analysis in different pharmacological experiments.
CO3	Analyse an Evaluate.	Analyse and evaluate various receptor actions using isolated tissue preparation.
CO4	Create and Correlate	Create the observation data and correlate them using statistical analysis.
CO5	Evaluate and analyse	To evaluate the drugs on different organs/tissues from the laboratory animals by in vivo/in vitro analysis.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3	2	3	3	3
CO3	3	2	3	3	3	3	2	3	3	2	2	3	3	3	3	3
CO4	3	2	3	3	3	3	2	3	3	2	2	3	2	3	3	3
CO5	3	3	3	3	3	3	3	3	3	2	2	3	3	3	2	3
Avg	3	2.4	3	3	3	3	2.4	3	3	2.4	2.2	3	2.6	3	2.8	3

B. PHARM. SEMESTER – VI (BPH)
SUBJECT: HERBAL DRUG TECHNOLOGY - PRACTICAL (BP609P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	4	4	2	35	10	05	-	50

A. COURSE OVERVIEW

Scope: This subject gives the student the knowledge of basic understanding of herbal drug industry, the quality of raw material, guidelines for quality of herbal drugs, herbal cosmetics, natural sweeteners, nutraceutical etc. The subject also emphasizes on Good Manufacturing Practices (GMP), patenting and regulatory issues of herbal drugs

Objectives: Upon completion of this course the student should be able to:

- Understand raw material as source of herbal drugs from cultivation to herbal drug product
- Know the WHO and ICH guidelines for evaluation of herbal drugs
- Know the herbal cosmetics, natural sweeteners, nutraceuticals
- Appreciate patenting of herbal drugs, GMP.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. To perform preliminary phytochemical screening of crude drugs. 2. Determination of the alcohol content of Asava and Arista 3. Evaluation of excipients of natural origin 4. Incorporation of prepared and standardized extract in cosmetic formulations like creams, lotions and shampoos and their evaluation. 5. Incorporation of prepared and standardized extract in formulations like syrups, mixtures and tablets and their evaluation as per Pharmacopoeia requirements. 6. Monograph analysis of herbal drugs from recent Pharmacopoeias 7. Determination of Aldehyde content. 8. Determination of Phenol content 9. Determination of total alkaloids.	60	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Dr. Usman, R. Md., Darvhekar, VM., Dr.Akhila, S. &Dr. Kumar, V., A practical Book of “Herbal Drug Technology” 1st edition, NiraliPrakashan, 2019.
2. Dr. Lodhi, S. A practical Book fo “Herbal Drug Technology” Pee Vee Books, S. Vikas & Company (Medical Publishers) ,2020.
- 3.

D. REFERENCE BOOKS

1. Dr.Khadabadi, SS., Dr.Deore, SL. & Mr. Baviskar, BA., “Experimental Phytopharmacognosy” A comprehensive Guide, 1st edition, Nirali Prakashan, 2011.
2. Dr. Mukherjee, PK. &Dr.Verpoorte, R., “GMP for Botanicals” 1st Edition, Business Horizons Pharmaceutical Publishers, 2003.
3. Dr. Mukherjee, PK.”Quality Control of Herbal Drugs: An Approach to Evaluation of botanicals” 1st Edition reprint, Elsevier Science Publication, 2017.

- Agrawal, SS. & Paridhavi M., "Herbal Drug Technology" 2nd edition, Orient Blackswan , 2012.
- Shah, B., & Seth, AK., "Textbook of Pharmacognosy & Phytochemistry" , 2nd Edition, CBS Publishers & Distributors PVT. Ltd., 2017.
- Rangari VD., "Pharmacognosy & Phytochemistry" Volume-I 3rd Edition, Career Publications, 2017.
- Rangari VD., "Pharmacognosy & Phytochemistry" Volume-II 3rd Edition, Career Publications, 2017.
- Quadry, JS., "Textbook of Pharmacognosy (Theory & Practical)" 17th Edition, CBS Publishers & Distributors PVT. Ltd., 2020.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	Analysis of Natural excipients.
CO2	create and standardise	Preparation and standardisation of herbal Products, herbal cosmetics and Ayurvedic formulations.
CO3	understand and apply	Description and application of phytochemical screening of crude drugs.
CO4	Understand and Analysis	Monograph Analysis of herbal drugs as per the Pharmacopoeial standard.
CO5	Understand and Analysis	To perform Quantitative analysis of phytoconstituents present in crude drugs.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	-	2	2	1	2	1	3	3	3	3	2	-
CO2	3	2	2	3	-	2	2	1	2	1	3	3	3	3	1	-
CO3	3	2	2	3	-	2	2	1	2	1	3	3	3	3	1	-
CO4	3	2	2	3	-	2	2	1	2	1	3	3	3	3	2	-
CO5	3	2	2	3	-	2	2	1	2	1	3	3	3	3	2	-
Avg	3	2	2	3	-	2	2	1	2	1	3	3	3	3	1.6	-

B. PHARM. SEMESTER – VII (BPH)
SUBJECT: INSTRUMENTAL METHODS OF ANALYSIS - THEORY (BP701T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

Objectives: Upon completion of the course the student shall be able to

- Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
- Understand the chromatographic separation and analysis of drugs.
- Perform quantitative & qualitative analysis of drugs using various analytical instruments.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	UV Visible spectroscopy Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode. Applications - Spectrophotometric titrations, Single component and multi component analysis Fluorimetry Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications	10	CO1 CO2 CO5
[2]	IR spectroscopy Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications Flame Photometry -Principle, interferences, instrumentation and applications Atomic absorption spectroscopy - Principle, interferences, instrumentation and applications Nepheloturbidometry - Principle, instrumentation and applications	10	CO1 CO2 CO5
[3]	Introduction to chromatography Adsorption and partition column chromatography -Methodology, advantages, disadvantages and applications. Thin layer chromatography - Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications. Paper chromatography -Introduction, methodology, development techniques, advantages, disadvantages and applications Electrophoresis – Introduction, factors affecting electrophoretic mobility,	10	CO3 CO4 CO5

	Techniques of paper, gel, capillary electrophoresis, applications		
[4]	Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications High performance liquid chromatography (HPLC) -Introduction, theory, instrumentation, advantages and applications.	08	CO3 CO4 CO5
[5]	Ion exchange chromatography - Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications Gel chromatography - Introduction, theory, instrumentation and applications Affinity chromatography - Introduction, theory, instrumentation and applications	07	CO3 CO4 CO5

C. TEXT BOOKS

1. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis*.; Pearson: New Delhi, 2009.
2. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..

D. REFERENCE BOOKS

1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds*.; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
8. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
9. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.
10. Garratt, D. C. *The Quantitative Analysis of Drugs : Assisted by L. Brealey Etc.*; Chapman & Hall: London, 1964.
11. Finar, I. L. *Organic Chemistry*.; Pearson Education, (9Th Impression: Delhi, 2011.
12. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand the interaction of matter with electromagnetic radiations
CO2	Understand Apply and Evaluate	To apply the fundamentals of spectroscopy in drug analysis
CO3	Understand	To understand the chromatographic separation fundamentals
CO4	Understand Apply and Evaluate	To apply the fundamentals of various chromatographic techniques in drug analysis
CO5	Understand Apply and Evaluate	To learn quantitative & qualitative analysis of drugs using various analytical instruments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	1	-	1	-	1	-	-	3	3	3	1	1	-
CO2	3	2	3	2	-	2	1	1	2	-	3	3	3	2	2	1
CO3	3	-	1	1	-	1	-	1	-	-	3	3	3	1	1	-
CO4	3	2	3	2	-	2	1	1	2	-	3	3	3	2	2	1
CO5	3	2	1	1	-	2	1	1	1	-	3	3	3	2	2	1
Avg	3	1.2	1.8	1.4	-	1.6	0.6	1	1	-	3	3	3	1.6	1.6	0.6

B. PHARM. SEMESTER – VII (BPH)
SUBJECT: INDUSTRIAL PHARMACY II -THEORY (BP702T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory to market

Objectives: Upon completion of the course the student shall be able to

- Know the process of pilot plant and scale up of pharmaceutical dosage forms
- Understand the process of technology transfer from lab scale to commercial batch
- Know different Laws and Acts that regulate pharmaceutical industry
- Understand the approval process and regulatory requirements for drug products

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Pilot plant scale up techniques: General considerations - including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology	10	CO1
[2]	Technology development and transfer: WHO guidelines for Technology Transfer(TT): Terminology, Technology transfer protocol, Quality risk management, Transfer from R & D to production (Process, packaging and cleaning), Granularity of TT Process (API, excipients, finished products, packaging materials) Documentation, Premises and equipments, qualification and validation, quality control, analytical method transfer, Approved regulatory bodies and agencies, Commercialization - practical aspects and problems (case studies), TT agencies in India - APCTD, NRDC, TIFAC, BCIL, TBSE / SIDBI; TT related documentation - confidentiality agreement, licensing, MoUs, legal issues	10	CO2
[3]	Regulatory affairs: Introduction, Historical overview of Regulatory Affairs, Regulatory authorities, Role of Regulatory affairs department, Responsibility of Regulatory Affairs Professionals Regulatory requirements for drug approval: Drug Development Teams, Non-Clinical Drug Development, Pharmacology, Drug Metabolism and Toxicology, General considerations of Investigational New Drug (IND) Application, Investigator's Brochure (IB) and New Drug Application (NDA), Clinical research / BE studies, Clinical Research Protocols, Biostatistics in Pharmaceutical Product Development, Data Presentation for FDA Submissions, Management of Clinical Studies.	10	CO3 CO4
[4]	Quality management systems: Quality management & Certifications: Concept of Quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality systems standards, ISO 14000, NABL, GLP	08	CO5
[5]	Indian Regulatory Requirements: Central Drug Standard Control	07	CO3

	Organization (CDSCO) and State Licensing Authority: Organization, Responsibilities, Certificate of Pharmaceutical Product (COPP), Regulatory requirements and approval procedures for New Drugs.		CO4
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C. TEXT BOOKS

1. B Nagarani. Industrial pharmacy-II. Blue Rose Publishers, New Delhi 2021.

D. REFERENCE BOOKS

1. Regulatory Affairs from Wikipedia, the free encyclopedia modified on 7th April available at http://en.wikipedia.org/wiki/Regulatory_Affairs.
2. International Regulatory Affairs Updates, 2005. available at <http://www.iraup.com/about.php>
3. Douglas J Pisano and David S. Mantus. Text book of FDA Regulatory Affairs A Guide for Prescription Drugs, Medical Devices, and Biologics' Second Edition.
4. Regulatory Affairs brought by learning plus, inc. available at <http://www.cgmp.com/ra.htm>.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Understand and apply process of pilot plant and scale up of pharmaceutical dosage forms
CO2	Understand and remember	Understand and remember process of technology transfer from lab scale to commercial batch
CO3	Remember and apply	Remember and apply different Laws and Acts that regulate pharmaceutical industry
CO4	Understand, Remember and apply	Understand, Remember and apply approval process and regulatory requirements for drug products
CO5	Understand, apply and evaluate	Understand, apply and evaluate various aspects of quality and quality management

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	1	-	-	-	-	-	-	-	3	3	1	-	-
CO2	3	1	2	1	-	-	-	-	-	-	-	3	3	3	-	-
CO3	3	-	1	-	-	-	2	-	-	-	-	3	3	-	-	-
CO4	3	1	1	-	-	-	2	-	-	-	-	3	3	-	-	-
CO5	3	3	2	-	3	-	1	-	-	-	2	3	3	-	3	-
Avg	3	1.4	1.4	0.4	0.6	-	1	-	-	-	0.4	3	3	0.8	0.6	-

B. PHARM. SEMESTER – VII (BPH)
SUBJECT: PHARMACY PRACTICE -THEORY (BP703T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: In the changing scenario of pharmacy practice in India, for successful practice of Hospital Pharmacy, the students are required to learn various skills like drug distribution, drug information, and therapeutic drug monitoring for improved patient care. In community pharmacy, students will be learning various skills such as dispensing of drugs, responding to minor ailments by providing suitable safe medication, patient counselling for improved patient care in the community set up.

Objectives: Upon completion of the course the student shall be able to

- know various drug distribution methods in a hospital
- appreciate the pharmacy stores management and inventory control
- monitor drug therapy of patient through medication chart review and clinical review
- obtain medication history interview and counsel the patients
- identify drug related problems
- detect and assess adverse drug reactions
- interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
- know pharmaceutical care services
- do patient counselling in community pharmacy
- appreciate the concept of Rational drug therapy

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>a) Hospital and it's organization Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions.</p> <p>b) Hospital pharmacy and its organization Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.</p> <p>c) Adverse drug reaction Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.</p> <p>d) Community Pharmacy Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.</p>	10	CO1 CO2

[2]	<p>a) Drug distribution system in a hospital Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs.</p> <p>b) Hospital formulary Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.</p> <p>c) Therapeutic drug monitoring Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.</p> <p>d) Medication adherence Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.</p> <p>e) Patient medication history interview Need for the patient medication history interview, medication interview forms.</p> <p>f) Community pharmacy management Financial, materials, staff, and infrastructure requirements.</p>	10	CO2
[3]	<p>a) Pharmacy and therapeutic committee Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.</p> <p>b) Drug information services Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.</p> <p>c) Patient counselling Definition of patient counselling; steps involved in patient counselling, and Special cases that require the pharmacist</p> <p>d) Education and training program in the hospital Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education.</p> <p>e) Prescribed medication order and communication skills Prescribed medication order- interpretation and legal requirements, Communication skills- communication with prescribers and patients.</p>	10	CO1 CO2 CO3
[4]	<p>a) Budget preparation and implementation Budget preparation and implementation</p> <p>b) Clinical Pharmacy Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.</p> <p>c) Over the counter (OTC) sales Introduction and sale of over the counter, and Rational use of common over the counter medications.</p>	8	CO4
[5]	<p>a) Drug store management and inventory control Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure,</p>	7	CO4 CO5

	<p>purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure</p> <p>b) Investigational use of drugs Description, principals involved, classification, control, identification, role of hospital pharmacist, advisory committee.</p> <p>c) Interpretation of Clinical Laboratory Tests Blood chemistry, hematology, and urinalysis</p>		
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C. TEXT BOOKS

1. Tipnis Bajaj. Hospital Pharmacy, 1st ed. Maharashtra: Career Publications; 2008.
2. Merchant S.H. and Dr. J.S.Quadry. *A textbook of hospital pharmacy*, 4th ed. Ahmadabad: B.S. Shah Prakakshan; 2001.

D. REFERENCE BOOKS & JOURNALS

1. Parthasarathi G, Karin Nyfort-Hansen, Milap C Nahata. *A textbook of Clinical Pharmacy Practice- essential concepts and skills*, 1st ed. Chennai: Orient Longman Private Limited; 2004.
2. William E. Hassan. *Hospital pharmacy*, 5th ed. Philadelphia: Lea & Febiger; 1986.
3. Tipnis Bajaj. *Hospital Pharmacy*, 1st ed. Maharashtra: Career Publications; 2008.
4. Scott LT. *Basic skills in interpreting laboratory data*, 4th ed. American Society of Health System Pharmacists Inc; 2009.
5. Parmar N.S. *Health Education and Community Pharmacy*, 18th ed. India: CBS Publishers & Distributers; 2008.

JOURNALS

1. Therapeutic drug monitoring. ISSN: 0163-4356(<https://journals.lww.com/drug-monitoring/pages/default.aspx>)
2. Journal of pharmacy practice. ISSN: 0974-8326 (<https://ijopp.org/>)
3. American journal of health system pharmacy. ISSN: 1535-2900 (online) (<https://academic.oup.com/ajhp>)
4. Pharmacy times (Monthly magazine) (<https://www.pharmacytimes.com/>)

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	To understand the structure of healthcare system like hospital and community pharmacy and analyze adverse drug reactions
CO2	Remember, Understand and Evaluate	To get knowledge of various procedures carried out in the hospital and pharmacy and management of the pharmacy
CO3	Understand and remember	To know various committees and training programs in the hospitals and understand about communication skills
CO4	Understand and Remember	To understand basic clinical pharmacy practice and to know about financial management
CO5	Understand and evaluate	To understand the managerial practices of the drug store and know about interpretation of various biochemical laboratory tests

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	3	1	3	1	2	3	2	1	3	3	3	1	3
CO2	3	1	1	3	3	3	1	2	3	1	2	3	2	1	1	3
CO3	3	3	3	1	3	3	3	3	3	1	3	3	2	1	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3	2
Avg	3	2.2	2.2	2.6	2.6	3	2.2	2.6	3	1.6	2.4	3	2.6	2.2	2.2	2.6

B. PHARM. SEMESTER – VII (BPH)
SUBJECT: NOVEL DRUG DELIVERY SYSTEMS -THEORY (BP704T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge on the area of novel drug delivery systems.

Objectives: Upon completion of the course student shall be able

- To understand various approaches for development of novel drug delivery systems.
- To understand the criteria for selection of drugs and polymers for the development of novel drug delivery systems, their formulation and evaluation

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.	10	CO4 CO2
[2]	Microencapsulation: Definition, advantages and disadvantages, microspheres/microcapsules, microparticles, methods of microencapsulation, applications Mucosal Drug Delivery system: Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implants and osmotic pump	10	CO1 CO3 CO5
[3]	Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers	10	CO1 CO3 CO5
[4]	Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications	08	CO3 CO5
[5]	Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications	07	CO3 CO5

C. TEXT BOOKS

1. Jain, N. K. *Controlled and Novel Drug Delivery*; CBS Publishers & Distributors: New Delhi, India, 1997.
2. Vyas, S. P.; Khar, R. K. *Controlled Drug Delivery -Concepts and Advances*; Vallabh Prakashan: New Delhi, 2002.

D. REFERENCE BOOKS

1. Chien, Y. W. *Novel Drug Delivery Systems, Second Edition*, 2nd ed.; CRC Press: Boca Raton, FL, 1991.
2. Robinson, J. R.; Lee, V. H. *Controlled Drug Delivery Systems*; Marcel Dekker, Inc: New York, 1992.
3. *Encyclopedia of Controlled Drug Delivery, 2 Volume Set*; Mathiowitz, E., Ed.; John Wiley & Sons: Nashville, TN, 1999.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand various approaches for development of novel drug delivery systems
CO2	Understand	To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems
CO3	learn	Learn Aspects related to formulation and evaluation of various novel drug delivery systems
CO4	Understand and remember	Explain the principles and technology used in the design of sustained release and controlled release drug delivery systems
CO5	Analyse	Analyse various evaluation parameters for oral, parenteral, topical etc. drug delivery systems

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	-	2	-	2	2	3	2	3	3	3	3	2
CO2	3	2	2	3	-	2	-	2	3	2	1	2	3	3	3	1
CO3	3	3	3	3	-	2	-	2	3	3	2	2	3	3	3	2
CO4	3	2	3	2	-	2	-	2	3	2	2	3	3	3	2	2
CO5	3	3	3	3	-	2	-	2	2	1	1	2	3	3	3	1
Avg	3	2.6	2.6	2.6	-	2	-	2	2.6	2.2	1.6	2.4	3	3	2.8	1.6

B. PHARM. SEMESTER – VII (BPH)
SUBJECT: INSTRUMENTAL METHODS OF ANALYSIS - PRACTICAL (BP705P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM		Total
-	-	4	4	2	35	10	5		50

A. COURSE OVERVIEW

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

Objectives: Upon completion of the course the student shall be able to

- Understand spectroscopy and chromatographic techniques and their applications in drug analysis
- Perform quantitative & qualitative analysis of drugs using various analytical instruments.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds Estimation of dextrose by colorimetry Estimation of sulfanilamide by colorimetry Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy Assay of paracetamol by UV- Spectrophotometry Estimation of quinine sulfate by fluorimetry Study of quenching of fluorescence	30	CO1 CO2 CO5
[2]	Determination of sodium by flame photometry Determination of potassium by flame photometry Determination of chlorides and sulphates by nephelo turbidometry Separation of amino acids by paper chromatography Separation of sugars by thin layer chromatography Separation of plant pigments by column chromatography Demonstration experiment on HPLC Demonstration experiment on Gas Chromatography	30	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. *Practical book of instrumental methods of analysis – Final Year BPharm – Semester 7*, first.; Abhishek Tiwari, Ed.; Nirali Prakashan, 2020.
2. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

D. REFERENCE BOOKS

1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds*.; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.

4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distributors: New Delhi, 2005.
8. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
9. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.
10. Garratt, D. C. *The Quantitative Analysis of Drugs : Assisted by L. Brealey Etc.*; Chapman & Hall: London, 1964.
11. Finar, I. L. *Organic Chemistry.*; Pearson Education, (9Th Impression: Delhi, 2011.
12. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982.
13. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis.*; Pearson: New Delhi, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the fundamentals of spectroscopy in drug analysis
CO2	Understand Apply and Evaluate	To apply the fundamentals of spectroscopy in qualitative and quantitative drug analysis
CO3	Understand and remember	To understand the fundamentals of chromatography in drug analysis
CO4	Understand Apply and Evaluate	To apply the fundamentals of chromatography in qualitative and quantitative drug analysis
CO5	Understand Apply and Evaluate	To understand working and handling of various analytical instruments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	1	1	-	1	-	1	-	-	3	3	3	1	1	-
CO2	3	3	3	2	-	2	1	1	2	-	3	3	3	2	2	1
CO3	3	-	1	1	-	1	-	1	-	-	3	3	3	1	1	-
CO4	3	3	3	2	-	2	1	1	2	-	3	3	3	2	2	1
CO5	3	3	-	-	-	2	1	1	1	-	3	3	3	2	2	1
Avg	3	1.8	1.6	1.2	-	1.6	0.6	1	1	-	3	3	3	1.6	1.6	0.6

B. PHARM. SEMESTER – VII (BPH)
SUBJECT: PRACTICE SCHOOL (BP706PS)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM		Total
-	-	12	6	6	125	-	25		150

A. COURSE OVERVIEW

In the VII semester, every candidate shall undergo practice school for a period of 150 hours evenly distributed throughout the semester. The student shall opt any one of the domains for practice school declared by the program committee from time to time.

At the end of the practice school, every student shall submit a printed report (in triplicate) on the practice school he/she attended (not more than 25 pages). Along with the exams of semester VII, the report submitted by the student, knowledge and skills acquired by the student through practice school shall be evaluated by the subject experts at college Level and grade point shall be awarded.

B. PHARM. SEMESTER – VIII (BPH)**SUBJECT: BIOSTATISTICS AND RESEARCH METHODOLOGY -THEORY (BP801T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: To understand the applications of Biostatistics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non-Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analysing the statistical data using Excel.

Objectives: Upon completion of the course the student shall be able to

- Know the operation of M.S. Excel, SPSS, R and MINITAB®, DoE (Design of Experiment)
- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction: Statistics, Biostatistics, Frequency distribution Measures of central tendency: Mean, Median, Mode- Pharmaceutical examples Measures of dispersion: Dispersion, Range, standard deviation, Pharmaceutical problems Correlation: Definition, Karl Pearson's coefficient of correlation, Multiple correlation - Pharmaceuticals examples	10	CO1 CO2
[2]	Regression: Curve fitting by the method of least squares, fitting the lines $y = a + bx$ and $x = a + by$, Multiple regression, standard error of regression– Pharmaceutical Examples Probability: Definition of probability, Binomial distribution, Normal distribution, Poisson's distribution, properties - problems Sample, Population, large sample, small sample, Null hypothesis, alternative hypothesis, sampling, essence of sampling, types of sampling, Error-I type, Error-II type, Standard error of mean (SEM) - Pharmaceutical examples Parametric test: t-test (Sample, Pooled or Unpaired and Paired), ANOVA, (One way and Two way), Least Significance difference	10	CO1 CO2
[3]	Non-Parametric tests: Wilcoxon Rank Sum Test, Mann-Whitney U test, Kruskal-Wallis test, Friedman Test. Introduction to Research: Need for research, Need for design of Experiments, Experiential Design Technique, plagiarism Graphs: Histogram, Pie Chart, Cubic Graph, response surface plot, Counter Plot graph Designing the methodology: Sample size determination and Power of a study, Report writing and presentation of data, Protocol, Cohorts studies, Observational studies, Experimental studies, Designing clinical trial, various phases.	10	CO2 CO3 CO4

[4]	Blocking and confounding system for Two-level factorials Regression modeling: Hypothesis testing in Simple and Multiple regression models. Introduction to Practical components of Industrial and Clinical Trials Problems: Statistical Analysis Using Excel, SPSS, MINITAB®, DESIGN OF EXPERIMENTS, R - Online Statistical Software's to Industrial and Clinical trial approach	08	CO2 CO3 CO5
[5]	Design and Analysis of experiments: Factorial Design: Definition, 22, 23 design. Advantage of factorial design Response Surface methodology: Central composite design, Historical design, Optimization Techniques	07	CO4 CO5

C. TEXT BOOKS

1. Bolton, Stanford. Pharmaceutical statistics: Practical and clinical applications; 2nd Ed; Marcel Dekker Inc: New York, 1997
2. Panneerselvam, R. Design and Analysis of Experiments; PHI: India, 2012

D. REFERENCE BOOKS

1. Gupta, SC. Fundamentals of Statistics; 7th Ed; Himalaya Publishing House: India, 2018
2. Montgomery, DC. Design and Analysis of Experiments; 10th Ed (student edition); John Wiley & Sons, 2019

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To understand statistical techniques and apply to solve statistical problem
CO2	Remember, Understand and Apply	To understand various hypothesis testing techniques and application to pharmaceutical experiments.
CO3	Understand	To learn research methodology for pharmaceutical experiments
CO4	Understand and Remember	To understand optimization and design of experiments (DoE) for pharmaceutical experiments.
CO5	Understand and Apply	To know operation and application of different statistical software for statistical optimization of experiments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	-	3	3	-	-	2	-	1	-	3	3	3	2	3	2
CO2	3	-	3	3	-	-	2	-	1	-	3	3	3	2	1	2
CO3	3	-	3	3	-	-	3	-	3	-	3	3	3	2	3	2
CO4	3	-	3	3	-	-	2	-	2	-	3	3	3	2	2	2
CO5	3	-	3	3	-	-	1	-	3	-	3	3	3	2	1	2
Avg	3	-	3	3	-	-	2		2	-	3	3	3	2	2	2

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: SOCIAL AND PREVENTIVE PHARMACY (BP802T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Objectives: After the successful completion of this course, the student shall be able to:

- Acquire high consciousness/realization of current issues related to health and Pharmaceutical problems within the country and worldwide.
- Have a critical way of thinking based on current healthcare development.
- Evaluate alternative ways of solving problems related to health and pharmaceutical issues.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Concept of health and disease: Definition, concepts and evaluation of public health. Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick. b. Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention. c. Sociology and health: Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health d. Hygiene and health: personal hygiene and health care; avoidable habits	10	CO1 CO2
[2]	Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chikungunya, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse	10	CO2
[3]	National health programs, its objectives, functioning and outcome of the following: HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.	10	CO3 CO4 CO5
[4]	National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program	08	CO3 CO4 CO5
[5]	Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school.	07	CO3 CO4 CO5

C. TEXT BOOKS

1. Prabhakara, G. N. Short Textbook of Preventive and Social Medicine; Jaypee Brothers Medical Publishers: Bengaluru ; St. Louis (USA), 2010.
2. Rabindra, R.; Jaypee Brothers (Jaypeedigital. Mahajan & Gupta Textbook of Preventive and Social Medicine; Jaypee Brothers Medical Publisher (P) Ltd, 2013.

D. REFERENCE BOOKS & JOURNAL

1. Jain, V. Review of Preventive and Social Medicine (Including Biostatistics); 6th Edn. Jaypee Publication, New Delhi, 2014.
2. Lalita, H. D.; Dhananjaya, H. A. Essentials of Community Medicine—A Practical Approach; 2nd Edn. Jaypee Publications, New Delhi, 2012.
3. Park, K. Park's Textbook of Preventive and Social Medicine; 21st Edn. Bhanot Publishers: India, 2015.
4. Adepu, R. Community Pharmacy Practice; PharmaMed Press/BSP Books, Telangana, India, 2022.

JOURNAL:

1. Research in Social and Administrative Pharmacy, Elsevier, Ireland
(<https://www.sciencedirect.com/journal/research-in-social-and-administrative-pharmacy>)

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	To understand basic concept of health and effect of various social, mental and hygienic aspects on health
CO2	Remember, Understand and Evaluate	To get knowledge of various communicable and non-communicable diseases and its preventive measures
CO3	Understand and Evaluate Apply	To get knowledge about various state and central government health programs on various health problems
CO4	Understand and remember	To know government efforts on various critical health issues
CO5	Understand and remember	To know about health infrastructure and role of government in the development of infrastructure as well as importance of hygiene

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	3	3	3	3	3	3	3	3	3	2	3	3	3	3
CO2	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	2	1	2	1	3	3	3	3	3	1	2	3	3	2	2	3
CO4	2	1	2	1	3	3	3	3	3	1	2	1	3	2	2	3
CO5	3	1	2	1	3	3	3	3	3	1	2	2	3	2	2	3
Avg	2.6	1	2.4	1.8	3	3	3	3	3	1.8	2.4	2.2	3	2.4	2.4	3

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: PHARMA MARKETING MANAGEMENT (Theory) (BP803ET)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The pharmaceutical industry not only needs highly qualified researchers, chemists and, technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry. The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.

Objectives: The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Marketing: Definition, general concepts and scope of marketing; Distinction between marketing & selling; Marketing environment; Industry and competitive analysis; Analyzing consumer buying behavior; industrial buying behavior. Pharmaceutical market: Quantitative and qualitative aspects; size and composition of the market; demographic descriptions and socio-psychological characteristics of the consumer; market segmentation & targeting. Consumer profile; Motivation and prescribing habits of the physician; patients' choice of physician and retail pharmacist. Analyzing the Market; Role of market research.	10	CO1
[2]	Product decision: Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; New product decisions; Product branding, packaging and labeling decisions, Product management in pharmaceutical industry.	08	CO2
[3]	Promotion: Methods, determinants of promotional mix, promotional budget; An overview of personal selling, advertising, direct mail, journals, sampling, retailing, medical exhibition, public relations, online promotional techniques for OTC Products.	07	CO3
[4]	Pharmaceutical marketing channels: Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management. Professional sales representative (PSR): Duties of PSR, purpose of detailing, selection and training, supervising, norms for customer calls, motivating, evaluating, compensation and future prospects of the PSR.	10	CO4
[5]	Pricing: Meaning, importance, objectives, determinants of price; pricing methods	10	CO5

	and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority). Emerging concepts in marketing: Vertical & Horizontal Marketing; Rural Marketing; Consumerism; Industrial Marketing; Global Marketing.		
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C. TEXT BOOKS:

1. Patil, PA. & Thakare, HN., "Text book of Pharmaceutical marketing management" 1st edition, White Falcon Publishing, 2020.
2. Dr. Bhambere, DS., Dr. Ahirrao, SP., Dr. Kankate, RS. & Dr. Laddha UD., "Pharma Marketing Management", 1st edition, Bhumi Publishing 2021.

D. REFERENCE BOOKS:

1. Walker, OC., Boy, H. & Larreche, JC., "Marketing Strategy- Planning and Implementation", 1st edition, Tata MC Graw Hill Education, New Delhi., 1999.
2. Grewal, D., & Levy, M., "Marketing", Indian Edition, Tata MC Graw Hill India. 2017.
3. Kumar A. & Meenakshi N. "Marketing Management", 3rd edition, Vikas Publishing House Pvt. Ltd., India., 2017.
4. Saxena, R., "Marketing Management", 6th edition, Tata MC Graw-Hill, 2019.
5. Ramaswamy, US & Nanakamari, S., "Marketing Managemnt" 5th edition, MC Graw Hill Education, New Delhi, 2017.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	Describe the concept of pharmaceutical marketing in research area.
CO2	Create and Apply	Create and apply the idea of new product development in pharmaceutical Industry.
CO3	Understand, Remember and Analyse	Discuss the components of promotion of pharmaceutical products.
CO4	Remember, apply, understand and Evaluate	Explain pharmaceutical marketing channels. To evaluate the responsibility of professional sales representative.
CO5	Identify, Apply & Evaluate	Discuss responsibilities of pricing authorities in India.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	3	2	-	2	2	-	2	3	3	2	3	-
CO2	3	2	2	2	-	2	-	2	2	-	2	3	3	2	2	-
CO3	3	2	2	2	3	2	-	2	2	-	2	3	3	2	3	-
CO4	3	2	2	2	3	2	-	2	2	-	2	3	3	2	3	-
CO5	3	2	2	2	-	2	-	2	2	-	2	3	3	2	2	-
Avg	3	2	2	2	1.8	2	-	2	2	-	2	3	3	2	2.6	-

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: PHARMACEUTICAL REGULATORY SCIENCE - THEORY (BP804T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.

Objectives: Upon completion of the subject student shall be able to;

- Know about the process of drug discovery and development
- Know the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
- Know the regulatory approval process and their registration in Indian and international markets

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	New Drug Discovery and development Stages of drug discovery, Drug development process, pre-clinical studies, non-clinical activities, clinical studies, Innovator and generics, Concept of generics, Generic drug product development.	10	CO1
[2]	Regulatory Approval Process Approval processes and timelines involved in Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA). Changes to an approved NDA / ANDA. Regulatory authorities and agencies Overview of regulatory authorities of India, United States, European Union, Australia, Japan, Canada (Organization structure and types of applications)	10	CO2 CO3 CO4
[3]	Registration of Indian drug product in overseas market Procedure for export of pharmaceutical products, Technical documentation, Drug Master Files (DMF), Common Technical Document (CTD), electronic Common Technical Document (eCTD), ASEAN Common Technical Document (ACTD) research.	10	CO3
[4]	Clinical trials Developing clinical trial protocols, Institutional Review Board / Independent Ethics committee - formation and working procedures, Informed consent process and procedures, GCP obligations of Investigators, sponsors & Monitors, Managing and Monitoring clinical trials, Pharmacovigilance - safety monitoring in clinical trials	08	CO5
[5]	Regulatory Concepts Basic terminology, guidance, guidelines, regulations, Laws and Acts, Orange book, Federal Register, Code of Federal Regulatory, Purple book	07	CO5

C. TEXT BOOKS

1. Itkar, S.; Vyawahare, N. S. *Drug Regulatory Affaira*, Kindle.; Nirali Prakashan, 2019.
2. Berry, I. R.; Martin, R. P. *The Pharmaceutical Regulatory Process*; Informa Healthcare: New York, 2008.

D. REFERENCE BOOKS

1. Guarino, R. A. *New Drug Approval Process*; Informa Healthcare, Cop: New York, 2009.
2. Weinberg, S. *Guidebook for Drug Regulatory Submissions*; Wiley: Hoboken, N.J., 2009.
3. Pisano, D. J. *FDA Regulatory Affairs : A Guide for Prescription Drugs, Medical Devices, and Biologics*; Informa Healthcare Usa: New York, 2008.
4. Kanfer, I.; Shargel, L. *Generic Drug Product Development : Solid Oral Dosage Forms*; Marcel Dekker: New York, 2005.
5. Rozovsky, F. A.; Adams, R. K. *Clinical Trials and Human Research : A Practical Guide to Regulatory Compliance*; Jossey-Bass: San Francisco, 2003.
6. Gallin, J. I.; Ognibene, F. P.; Laura Lee Johnson. *Principles and Practice of Clinical Research*; Elsevier/Academic Press: London ; San Diego, Ca, 2018.
7. Ng, R. *Drugs : From Discovery to Approval*; Wiley-Blackwell: Chichester, 2009.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand the process of drug discovery and development
CO2	Understand and remember	To understand the regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
CO3	Understand and remember	To understand the regulatory approval process and their registration in international markets
CO4	Understand and remember	To understand the regulatory approval process and their registration in Indian markets
CO5	Understand remember and Apply	To Understand the regulatory concepts and clinical trial aspects

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	1	2	2	3	3	-	3	3	3	2	3	3
CO2	3	-	-	-	-	1	2	3	2	-	3	3	3	1	2	2
CO3	3	-	-	1	-	1	2	3	2	-	3	3	3	1	2	2
CO4	3	-	-	1	-	1	2	3	2	-	3	3	3	1	2	2
CO5	3	2	2	2	1	2	2	3	3	-	3	3	3	2	3	3
Avg	3	0.8	0.8	1.2	0.4	1.4	2	3	2.4	-	3	3	3	1.4	2.4	2.4

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: PHARMACOVIGILANCE (BP805ET)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions. The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Objectives: At completion of this paper it is expected that students will be able to (know, do, and appreciate):

- Why drug safety monitoring is important?
- History and development of pharmacovigilance
- National and international scenario of pharmacovigilance
- Dictionaries, coding and terminologies used in pharmacovigilance
- Detection of new adverse drug reactions and their assessment
- International standards for classification of diseases and drugs
- Adverse drug reaction reporting systems and communication in pharmacovigilance
- Methods to generate safety data during pre-clinical, clinical and post approval phases of drugs' life cycle
- Drug safety evaluation in paediatrics, geriatrics, pregnancy and lactation
- Pharmacovigilance Program of India (PvPI) requirement for ADR reporting in India
- ICH guidelines for ICSR, PSUR, expedited reporting, pharmacovigilance planning
- CIOMS requirements for ADR reporting
- Writing case narratives of adverse events and their quality.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Pharmacovigilance <ul style="list-style-type: none"> • History and development of Pharmacovigilance • Importance of safety monitoring of Medicine • WHO international drug monitoring programme • Pharmacovigilance Program of India(PvPI) Introduction to adverse drug reactions <ul style="list-style-type: none"> • Definitions and classification of ADRs • Detection and reporting • Methods in Causality assessment • Severity and seriousness assessment • Predictability and preventability assessment • Management of adverse drug reactions Basic terminologies used in pharmacovigilance	10	CO1 CO2

	<ul style="list-style-type: none"> Terminologies of adverse medication related events Regulatory terminologies 		
[2]	Drug and disease classification <ul style="list-style-type: none"> Anatomical, therapeutic and chemical classification of drugs International classification of diseases Daily defined doses International Non-proprietary Names for drugs Drug dictionaries and coding in pharmacovigilance <ul style="list-style-type: none"> WHO adverse reaction terminologies MedDRA and Standardised MedDRA queries WHO drug dictionary Eudravigilance medicinal product dictionary Information resources in pharmacovigilance <ul style="list-style-type: none"> Basic drug information resources Specialised resources for ADRs Establishing pharmacovigilance programme <ul style="list-style-type: none"> Establishing in a hospital Establishment & operation of drug safety department in industry Contract Research Organisations (CROs) Establishing a national programme 	10	CO2
[3]	Vaccine safety surveillance <ul style="list-style-type: none"> Vaccine Pharmacovigilance Vaccination failure Adverse events following immunization Pharmacovigilance methods <ul style="list-style-type: none"> Passive surveillance – Spontaneous reports and case series Stimulated reporting Active surveillance – Sentinel sites, drug event monitoring and registries Comparative observational studies – Cross sectional study, case control study and cohort study Targeted clinical investigations Communication in pharmacovigilance <ul style="list-style-type: none"> Effective communication in Pharmacovigilance Communication in Drug Safety Crisis management Communicating with Regulatory Agencies, Business Partners, Healthcare facilities & Media 	10	CO2 CO3
[4]	Safety data generation <ul style="list-style-type: none"> Pre-clinical phase Clinical phase Post approval phase (PMS) ICH Guidelines for Pharmacovigilance <ul style="list-style-type: none"> Organization and objectives of ICH Expedited reporting Individual case safety reports Periodic safety update reports Post approval expedited reporting Pharmacovigilance planning Good clinical practice in pharmacovigilance studies 	08	CO4
[5]	Pharmacogenomics of adverse drug reactions <ul style="list-style-type: none"> Genetics related ADR with example focusing PK parameters. 	07	CO5

	Drug safety evaluation in special population <ul style="list-style-type: none"> • Paediatrics • Pregnancy and lactation • Geriatrics CIOMS <ul style="list-style-type: none"> • CIOMS Working Groups • CIOMS Form CDSCO (India) and Pharmacovigilance <ul style="list-style-type: none"> • D&C Act and Schedule Y • Differences in Indian and global pharmacovigilance requirements 		
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C. TEXT BOOKS

1. Gupta, S. K.; India. Textbook of Pharmacovigilance; Jaypee Brothers Medical Publishers: New Delhi, 2011.
2. Mohanta, G. P.; Manna, P. K. Text book of Pharmacovigilance: concept and practice; PharmaMed Press: Hyderabad, India, 2016.

D. REFERENCE BOOKS & WEBSITES

1. Cobert, B. L.; Biron, P. Practical Drug Safety from A to Z; Sudbury, Mass Jones and Bartlett, 2009.
2. Andrews, E. B.; Moore, N. Mann's Pharmacovigilance; John Wiley & Sons Inc: Chichester, West Sussex, Uk, 2014.
3. Stephens, M. D. B.; Talbot, J. C.C.; Waller, P. Stephens' Detection of New Adverse Drug Reactions; Wiley: Chichester; Hoboken, NJ, 2004.
4. Waller, P.; Harrison-Woolrych, M. An Introduction to Pharmacovigilance; Wiley Blackwell/John Wiley & Sons Inc: Chichester, West Sussex, Uk ; Hoboken, Nj, 2017.
5. Cobert, B. Cobert's Manual of Drug Safety and Pharmacovigilance; Jones And Bartlett Publishers: 1997, 2011.
6. Strom, B. L. Textbook of Pharmacoepidemiology.; Wiley-Blackwell: S.L., 2022.
7. Parthasarathi, G.; Nyfort-Hansen, K.; Nahata, M. C.; Elliott, R. A.; George, J.; Nation, R. L.; Rayner, C. R. A Text Book of Clinical Pharmacy Practice: Essential Concepts and Skills; Orient Longman Ltd: Hyderabad, 2004.
8. National Formulary of India
9. <http://www.whoumc.org/DynPage.aspx?id=105825&mn1=7347&mn2=7259&mn3=7297>
10. <https://www.ich.org/>
11. <http://www.cioms.ch/>
12. <http://cdsco.nic.in/>
13. http://www.who.int/vaccine_safety/en/
14. http://www.ipc.gov.in/PvPI/pv_home.html

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	To know about basic aspects of Pharmacovigilance and Adverse Drug Reactions
CO2	Remember, Understand and Evaluate	To understand various terminologies related to drugs, coding and Adverse Drug Reactions and to know about organization of pharmacovigilance programs
CO3	Understand Apply and Evaluate	To get knowledge about various methods and communication techniques in Pharmacovigilance
CO4	Understand and remember	To know about various ICH guidelines related to Pharmacovigilance
CO5	Understand and remember	To understand basics of Pharmacogenomics and to know the rules and regulations related to Pharmacovigilance in India

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	3	2	3	3	3	3	3	3	3	2	2
CO2	3	3	2	3	3	3	1	3	3	1	3	3	3	3	3	2
CO3	3	3	3	3	3	3	1	3	3	1	3	3	3	3	3	2
CO4	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	1	3	3	3	3	3	3	3	3	3	2	3
Avg	3	2.6	2.8	3	2.4	3	2	3	3	2.2	3	3	3	3	2.6	2.4

B. PHARM. SEMESTER – VIII (BPH)**SUBJECT: QUALITY CONTROL AND STANDARDIZATION OF HERBALS – THEORY (BP806ET)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	--	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: In this subject the student learns about the various methods and guidelines for evaluation and standardization of herbs and herbal drugs. The subject also provides an opportunity for the student to learn cGMP, GAP and GLP in traditional system of medicines.

Objectives: Upon completion of the subject student shall be able to;

- know WHO guidelines for quality control of herbal drugs
- know Quality assurance in herbal drug industry
- know the regulatory approval process and their registration in Indian and international markets
- appreciate EU and ICH guidelines for quality control of herbal drugs

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Basic tests for drugs – Pharmaceutical substances, Medicinal plants materials and dosage forms WHO guidelines for quality control of herbal drugs. Evaluation of commercial crude drugs intended for use	10	CO1
[2]	Quality assurance in herbal drug industry of cGMP, GAP, GMP and GLP in traditional system of medicine. WHO Guidelines on current good manufacturing Practices (cGMP) for Herbal Medicines WHO Guidelines on GACP for Medicinal Plants.	10	CO2
[3]	EU and ICH guidelines for quality control of herbal drugs. Research Guidelines for Evaluating the Safety and Efficacy of Herbal Medicines	10	CO3 CO4
[4]	Stability testing of herbal medicines. Application of various chromatographic techniques in standardization of herbal products. Preparation of documents for new drug application and export registration GMP requirements and Drugs & Cosmetics Act provisions.	08	CO5
[5]	Regulatory requirements for herbal medicines. WHO guidelines on safety monitoring of herbal medicines in pharmacovigilance systems Comparison of various Herbal Pharmacopoeias. Role of chemical and biological markers in standardization of herbal products	07	CO4 CO5

B. TEXT BOOKS

1. Dr. Pankaj Pradhan and Dr. Dillip Kumar Jena, "Quality Control and Standardization of Herbals", Thakur Publication PVT. LTD., Lucknow, 2021.
2. Dr. Antara Choudhury, "Quality control and standardization of herbals", Nirali Prakashan, India, 2021.

C. REFERENCE BOOKS

1. Mukherjee, P.W. Quality Control of Herbal Drugs: An Approach to Evaluation of Botanicals. Business Horizons Publishers, New Delhi, India, 2002.
2. Shinde M.V., Dhalwal K., Potdar K., Mahadik K. Application of quality control principles to herbal drugs. International Journal of Phytomedicine 1(2009); p. 4-8.
3. WHO Quality Control Methods for Medicinal Plant Materials, World Health Organization, Geneva, 1998.
4. WHO Guidelines for the Appropriate Use of Herbal Medicines. WHO Regional Publications, Western Pacific Series No 3, WHO Regional office for the Western Pacific, Manila, 1998.
5. WHO The International Pharmacopeia, Vol. 2: Quality Specifications, 3rd edn. World Health Organization, Geneva, 1981.
6. WHO Quality Control Methods for Medicinal Plant Materials. World Health Organization, Geneva, 1999.
7. WHO Global Atlas of Traditional, Complementary and Alternative Medicine. 2 vol. set. Vol. 1 contains text and Vol. 2, maps. World Health Organization, Geneva, 2005.
8. WHO Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. World Health Organization, Geneva, 2004.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and evaluate	To evaluate crude drugs as per WHO guidelines.
CO2	Understand and apply	Discuss Quality assurance and techniques in herbal drug industry and herbal products.
CO3	Remember and evaluate	EU and ICH guidelines for quality control of herbal drugs and for Evaluating the Safety and Efficacy of Herbal Medicines.
CO4	Understand, remember and apply	Explain Regulatory requirements for herbal medicines.
CO5	Create and apply	To prepare documents for new drug application and apply GMP requirements and Drugs & Cosmetics Act provisions.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	0	1	3	1	2	1	2	3	3	3	2	2
CO2	3	2	2	3	0	2	2	2	2	2	3	3	3	3	2	2
CO3	3	2	3	3	1	2	3	2	2	2	2	3	2	3	2	2
CO4	3	2	2	3	2	2	2	2	2	3	3	3	3	3	2	2
CO5	3	2	2	3	2	3	2	2	2	2	2	3	3	3	3	2
Avg	3	2	2	3	1	2	2.4	1.8	2	2	2.4	3	2.8	3	2.2	2

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: COMPUTER AIDED DRUG DESIGN-THEORY (BP807ET)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.

Objectives: Upon completion of the course, the student shall be able to understand

- Design and discovery of lead molecules
- The role of drug design in drug discovery process
- The concept of QSAR and docking
- Various strategies to develop new drug like molecules.
- The design of new drug molecules using molecular modelling software

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Drug Discovery and Development Stages of drug discovery and development Lead discovery and Analog Based Drug Design Rational approaches to lead discovery based on traditional medicine, Random screening, Non-random screening, serendipitous drug discovery, lead discovery based on drug metabolism, lead discovery based on clinical observation. Analog Based Drug Design: Bioisosterism, Classification, Bioisosteric replacement. Any three case studies	10	CO1
[2]	Quantitative Structure Activity Relationship (QSAR) SAR versus QSAR, History and development of QSAR, Types of physicochemical parameters, experimental and theoretical approaches for the determination of physicochemical parameters such as Partition coefficient, Hammett's substituent constant and Tafts steric constant. Hansch analysis, Free Wilson analysis, 3D-QSAR approaches like COMFA and COMSIA	10	CO1 CO2
[3]	Molecular Modeling and virtual screening techniques Virtual Screening techniques: Drug likeness screening, Concept of pharmacophore mapping and pharmacophore-based Screening, Molecular docking: Rigid docking, flexible docking, manual docking, Docking based screening. De novo drug design.	10	CO1 CO2 CO3
[4]	Informatics & Methods in drug design Introduction to Bioinformatics, chemoinformatics. ADME databases, chemical, biochemical and pharmaceutical databases	08	CO1 CO4
[5]	Molecular Modeling: Introduction to molecular mechanics and quantum mechanics. Energy Minimization methods and Conformational Analysis, global conformational minima determination.	07	CO1 CO5

C. TEXT BOOKS

1. Mehta, S.K., Singh, R.K. A Text Book of Computer Aided Drug Design, 1st ed.; S. Vikas and Company, India, 2018
2. Siddiqui, A.A, Kumar, H., Khisal S. Computer-Aided Drug Design. 1st ed.; CBS Publishers, India, 2019

D. REFERENCE BOOKS

1. Hansch, C., Semmes, P.G., Taylor, J.B. Comprehensive Medicinal Chemistry, Volume I to VI, 1st ed.; Elsevier, India, 2005
2. Abraham, D.J. Burger's Medicinal Chemistry and Drug Discovery, Volume I to VI, 6th ed.; Wiley-Interscience, New Jersey, 2003
3. Patrick, G.L. An Introduction to Medicinal Chemistry, 3rd ed.; Oxford University Press, Oxford, 2006
4. Silverman, R.B. The Organic Chemistry of Drug Design and Drug Action, 2nd ed.; Academic Press, Burlington, 2004
5. Singh D.B. Computer-Aided Drug Design, 1st ed.; Springer, Singapore, 2020
6. Lemke, T.L., Williams, D.A. FOYE'S Principles of Medicinal Chemistry, 7th ed.; Lippincott Williams & Wilkins, Baltimore, 2013
7. Baele, J.M., Block J. H. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, 12th ed.; Lippincott Williams & Wilkins; Baltimore, 2011
8. Smith, J.H., Williams, H. Smith and Williamson's Introduction to the Principles of Drug Design and Action, 3rd ed; CRC Press, The Netherlands, 2005
9. Patrick, G.L. An Introduction to Medicinal Chemistry, 3rd ed.; Oxford University Press, Oxford, 2006

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To explain the process of drug discovery to development and different approaches of drug design and discovery
CO2	Understand and remember	To describe importance of Quantitative Structure Activity Relationship (QSAR) and various methods of QSAR in rational drug design
CO3	Understand and apply	To explain structure-based and ligand-based virtual screening approaches of drug design
CO4	Understand and apply	To discuss principles of bioinformatics and cheminformatics and their role in drug design and discovery
CO5	Understand and apply	To understand role of molecular modelling techniques in computer-aided drug design

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	-	-	3	-	-	-	-	-	-	3	2	3	3	1	-
C02	3	-	-	3	-	-	-	-	-	-	3	2	3	3	1	-
C03	3	-	2	3	-	-	-	-	-	-	3	2	3	3	1	-
C04	3	-	2	3	-	-	-	-	-	-	3	2	3	3	1	-
C05	3	-	1	3	-	-	-	-	-	-	3	2	3	3	1	-
Avg	3	-	1	3	-	-	-	-	-	-	3	2	3	3	1	-

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: CELL AND MOLECULAR BIOLOGY (B808ET)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	---	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Cell biology is a branch of biology that studies cells – their physiological properties, their structure, the organelles they contain, interactions with their environment, their life cycle, division, death and cell function. This is done both on a microscopic and molecular level. Cell biology research encompasses both the great diversity of single-celled organisms like bacteria and protozoa, as well as the many specialized cells in multi-cellular organisms such as humans, plants, and sponges

Objectives: Upon completion of the course the student shall be able to

- Summarize cell and molecular biology history.
- Summarize cellular functioning and composition.
- Describe the chemical foundations of cell biology.
- Summarize the DNA properties of cell biology.
- Describe protein structure and function.
- Describe cellular membrane structure and function.
- Describe basic molecular genetic mechanisms.
- Summarize the Cell Cycle

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a) Cell And Molecular Biology: Definitions Theory and Basics and Applications. b) Cell And Molecular Biology: History and Summation. c) Properties Of Cells and Cell Membrane. d) Prokaryotic Versus Eukaryotic e) Cellular Reproduction f) Chemical Foundations – An Introduction and Reactions (Types)	10	CO1
[2]	a) DNA and the Flow of Molecular Information b) DNA Functioning c) DNA and RNA d) Types of RNA e) Transcription and Translation	10	CO2
[3]	a) Proteins: Defined and Amino Acids b) Protein Structure c) Regularities in Protein Pathways d) Cellular Processes e) Positive Control and significance of Protein Synthesis	10	CO1 CO2 CO3
[4]	a) Science of Genetics b) Transgenics and Genomic Analysis c) Cell Cycle analysis d) Mitosis and Meiosis e) Cellular Activities and Checkpoints	08	CO1 CO2 CO3 CO4 CO5

[5]	a) Cell Signals: Introduction b) Receptors for Cell Signals c) Signalling Pathways: Overview d) Misregulation of Signalling Pathways e) Protein-Kinases: Functioning	07	CO1 CO2 CO3 CO4 CO5
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C. TEXT BOOKS

1. Cooper, J. W.; Gunn, C.; Sidney James Carter. Cooper and Gunn's Tutorial Pharmacy; Cbs Publishers: Editorial: New Delhi, 2005.
2. Hondermarck, H. Proteomics : Biomedical and Pharmaceutical Applications; Kluwer Academic Publishers: Dordrecht ; Boston, 2004.

D. REFERENCE BOOKS

1. Pelczar, M. J.; Chan, E. C. S.; Kreig, N. R. Laboratory Exercises in Microbiology; Mcgraw-Hill: New York, 1986.
3. Glick, B. R.; Thompson, J. E. Methods in Plant Molecular Biology and Biotechnology; Crc Press: Boca Raton, 1993.
4. Samuel Cate Prescott; Dunn, C. G.; Reed, G. Industrial Microbiology; Macmillan: New York, 1982.
5. Rose, A. H. Industrial Microbiology; Butterworths: London, 1961.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To know about the basics of cell, types of cells its basic functions, the structure and all the details
CO2	Remember, Understand and Apply	To get knowledge about DNA, RNA, Structure, function, translation and transcription
CO3	Understand Apply and Evaluate and remember	To understand about the protein structure, its synthesis and its regulations
CO4	Understand	To get knowledge about genomics, genomics analysis, cell cycle analysis, mitosis and Meiosis
CO5	Remember	To understand about cell signals, receptors for cell signals its functioning and misregulation

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	2	3	1	3	3	3	3	3	2	2	3	3	3	3
CO2	2	2	2	3	2	3	2	3	3	3	3	2	3	3	3	3
CO3	3	2	3	3	2	3	2	3	3	2	2	3	3	3	3	2
CO4	3	2	3	3	2	3	2	3	3	2	2	2	3	3	3	3
CO5	3	2	2	3	2	3	3	3	3	2	2	2	3	3	3	2
Avg	2.6	1.8	2.4	3	1.8	3	2.4	3	3	2.4	2.2	2.2	3	3	3	2.6

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: COSMETIC SCIENCE- THEORY (BP809ET)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope

This course is designed to impart knowledge and skills necessary for the fundamental need for cosmetic and cosmeceutical products.

Objectives

Upon completion of the course, the students shall be able to understand

- Key ingredients used in cosmetics and cosmeceuticals.
- Key building blocks for various formulations.
- Current technologies in the market
- Various key ingredients and basic science to develop cosmetics and cosmeceuticals
- Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Classification of cosmetic and cosmeceutical products, Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs Cosmetic excipients: Surfactants, rheologymodifiers, humectants, emollients, preservatives. Classification and application Skin: Basic structure and function of skin. Hair: Basic structure of hair. Hair growth cycle. Oral Cavity: Common problem associated with teeth and gums.	10	CO1 CO2 CO3
[2]	Principles of formulation and building blocks of skin care products: Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmeceuticals. Antiperspirants & deodorants- Actives & mechanism of action. Principles of formulation and building blocks of Hair care products: Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. Hair oils. Chemistry and formulation of Para-phenylene diamine based hair dye. Principles of formulation and building blocks of oral care products: Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.	10	CO1 CO2 CO3 CO4
[3]	Sun protection, Classification of Sunscreens and SPF. Role of herbs in cosmetics: Skin Care: Aloe and turmeric Hair care: Henna and amla. Oral care: Neem and clove Analytical cosmetics: BIS specification and analytical methods for shampoo, skincream and toothpaste.	10	CO1 CO5

[4]	Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties Soaps, and syndet bars. Evolution and skin benefits.	8	CO5 CO4
[5]	Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis. Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants- Actives and mechanism of action	7	CO4 CO5

C. TEXT BOOKS

1. Sharma, P. P.; Vandana Publications. *Cosmetics : Formulation, Manufacturing & Quality Control*; Vandana Publications: Delhi, 2018.
2. Nanda S and Khar R, Text book of cosmeticology Tata Publishers.

D. REFERENCE BOOKS

1. Ralph Gordon Harry; Wilkinson, J. B.; Moore, R. J. *Cosmetología de Harry*; Díaz De Santos: España, 1990.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Analyse	To understand and remember the key ingredients used in cosmetics and cosmeceuticals
CO2	Remember	To remember the Key building blocks for various formulations.
CO3	Understand and remember	To apply current technologies in the market.
CO4	Understand and Remember	To understand various key ingredients and basic science to develop cosmetics and cosmeceuticals
CO5	understand and evaluate	To apply the scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	2	-	1	1	2	2	1	3	3	2	3	1	2
CO2	3	1	1	2	-	1	-	2	2	-	2	3	2	1	1	2
CO3	3	2	3	3	2	2	2	3	3	-	3	3	3	1	3	3
CO4	3	2	3	3	2	-	-	2	3	2	2	3	3	3	3	2
CO5	3	2	3	3	1	2	-	2	3	2	3	3	3	3	3	2
Avg	3	1.6	2.2	2.6	1	1.2	0.6	2.2	2.6	1	2.6	3	2.6	2.2	2.2	2.2

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: PHARMACOLOGICAL SCREENING METHODS (BP810ET)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart the basic knowledge of preclinical studies in experimental animals including design, conduct and interpretations of results.

Objectives: Upon completion of the course the student shall be able to

- Appreciate the applications of various commonly used laboratory animals.
- Appreciate and demonstrate the various screening methods used in pre-clinical research.
- Appreciate and demonstrate the importance of biostatistics and research methodology.
- Design and execute a research hypothesis independently.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Laboratory Animals: Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals, Common lab animals: Description and applications of different species and strains of animals. Popular transgenic and mutant animals. Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.	8	CO1, CO4, CO5.
[2]	Preclinical screening models a. Introduction: Dose selection, calculation and conversions, preparation of drug solution/suspensions, grouping of animals and importance of sham negative and positive control groups. Rationale for selection of animal species and sex for the study. b. Study of screening animal models for Diuretics, nootropics, anti-Parkinson's, anti-asthmatics, Preclinical screening models :for CNS activity-analgesic, antipyretic, anti-inflammatory, general anaesthetics, sedative and hypnotics, antipsychotic, antidepressant, antiepileptic, anti-parkinsonism, Alzheimer's disease	12	CO2, CO3, CO4.
[3]	Pre-clinical screening models: for ANS activity, sympathomimetic, sympatholytic, parasympathomimetics, parasympatholytics, skeletal muscle relaxants, drugs acting on eye, local anaesthetics.	10	CO2, CO3, CO4.
[4]	Preclinical screening models: for CVS activity-antihypertensive, diuretics, antiarrhythmic, antidyslipidemic, anti-aggregatory, coagulants, and anticoagulants Preclinical screening models for other important drugs like antiulcer, antidiabetic, anticancer and anti-asthmatics.	10	CO2, CO3, CO4.
[5]	Research methodology and Bio-statistics Selection of research topic, review of literature, research hypothesis and study design Pre-clinical data analysis and interpretation using Students't' test and One-way ANOVA. Graphical representation of data	05	CO3.

C. TEXT BOOKS

1. Hans Gerhard Vogel. *Drug Discovery and Evaluation: Pharmacological Assays; Including a CD-ROM*; Springer: Berlin, 2002.

D. REFERENCE BOOKS

1. *Fundamentals of Experimental Pharmacology*; Hilton & Company: Kolkata, 2015.
2. Kulkarni, S. *Handbook of Experimental Pharmacology*, 3rd Edition. Vallabh Prakashan: Delhi, 2005.
3. Home: Committee for the Purpose of Control and Supervision of Experiments on Animals <http://cpcsea.nic.in> (accessed 2022 -04 -04).
4. Gupta, S. *Drug Screening Methods*; Sk Gupta, 2016.
5. Sundar, S.; Richard, J. *An Introduction to Biostatistics: A Manual for Students in Health Sciences*; Prentice/Hall Of India: New Delhi, 1996.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	Appreciate the applications of various commonly used laboratory animals.
	Understand, analyse and evaluate	Understand, analyse and evaluate new and existing drugs in various screening methods used in preclinical research
CO3	Apply and Remember	Apply and Remember importance of biostatistics and research methodology
CO4	Create, hypothesis and apply	Design and execute a research hypothesis independently.
CO5	Understand and apply	Understand and maintain guidelines of CPCSEA and OECD.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	2	3	3	3	1	3	3	3	3	3	3	3
CO2	3	2	3	3	2	2	3	2	2	2	3	3	2	3	3	3
CO3	3	2	3	3	1	2	3	2	1	3	3	3	2	3	3	3
CO4	3	3	3	3	1	3	3	3	2	3	3	3	3	3	3	3
CO5	3	2	3	3	1	3	3	2	0	3	3	3	3	3	3	3
Avg	3	2.2	3	3	1.4	2.6	3	2.4	1.2	2.8	3	3	2.6	3	3	3

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: ADVANCED INSTRUMENTATION TECHNIQUES - THEORY (BP811T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.

Objectives: Upon completion of the course the student shall be able to

- understand the advanced instruments used and its applications in drug analysis
- understand the chromatographic separation and analysis of drugs.
- understand the calibration of various analytical instruments
- know analysis of drugs using various analytical instruments.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Nuclear Magnetic Resonance spectroscopy Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications Mass Spectrometry- Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications s	10	CO1 CO2 CO5
[2]	Thermal Methods of Analysis: Principles, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) X-Ray Diffraction Methods: Origin of X-rays, basic aspects of crystals, X- ray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.	10	CO2 CO5
[3]	Calibration and validation- as per ICH and USFDA guidelines Calibration of following Instruments Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC	10	CO4 CO5
[4]	Radio immune assay: Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay Extraction techniques: General principle and procedure involved in the solid phase extraction and liquid-liquid extraction	08	CO1
[5]	Hyphenated techniques- LC-MS/MS, GC-MS/MS, HPTLC-MS.	07	CO1 CO2 CO3 CO5

C. TEXT BOOKS

1. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis*.; Pearson: New Delhi, 2009.
2. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..

D. REFERENCE BOOKS

1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds*.; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
8. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
9. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.
10. Garratt, D. C. *The Quantitative Analysis of Drugs : Assisted by L. Brealey Etc.*; Chapman & Hall: London, 1964.
11. Finar, I. L. *Organic Chemistry*.; Pearson Education, (9Th Impression: Delhi, 2011.
12. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand the advanced instruments used and its applications in drug analysis
CO2	Understand Apply and Evaluate	To apply the fundamentals of spectroscopy in drug analysis
CO3	Understand	To understand the chromatographic separation fundamentals and analysis of drugs
CO4	Understand and Apply	To understand the calibration of various analytical instruments
CO5	Understand Apply and Evaluate	To learn quantitative & qualitative analysis of drugs using various analytical instruments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	3	-	2	1	1	2	-	3	3	3	2	2	1
CO2	3	2	3	2	-	2	1	1	2	-	3	3	3	2	2	1
CO3	3	-	1	-	-	1	-	1	-	-	3	3	3	1	1	-
CO4	3	2	3	2	-	2	1	1	2	-	3	3	3	2	2	1
CO5	3	2	1	1	-	2	1	1	1	-	3	3	3	2	2	1
Avg	3	1.4	2	1.6	-	1.8	0.8	1	1.4	-	3	3	3	1.8	1.8	0.8

B. PHARM. SEMESTER – VIII (BPH)**SUBJECT: DIETARY SUPPLEMENTS AND NUTRACEUTICALS – THEORY (BP812ET)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	--	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject covers foundational topic that are important for understanding the need and requirements of dietary supplements among different groups in the population.

Objective: This module aims to provide an understanding of the concepts behind the theoretical applications of dietary supplements. By the end of the course, students should be able to:

- Understand the need of supplements by the different group of people to maintain healthy life.
- Understand the outcome of deficiencies in dietary supplements.
- Appreciate the components in dietary supplements and the application.
- Appreciate the regulatory and commercial aspects of dietary supplements including health claims.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Definitions of Functional foods, Nutraceuticals and Dietary supplements. Classification of Nutraceuticals, Health problems and diseases that can be prevented or cured by Nutraceuticals i.e., weight control, diabetes, cancer, heart disease, stress, osteoarthritis, hypertension etc. b. Public health nutrition, maternal and child nutrition, nutrition and ageing, nutrition education in community. c. Source, Name of marker compounds and their chemical nature, Medicinal uses and health benefits of following used as nutraceuticals/functional foods: Spirulina, Soyabean, Ginseng, Garlic, Broccoli, Gingko, Flaxseeds	7	CO1 CO5
[2]	Phytochemicals as nutraceuticals: Occurrence and characteristic features (chemical nature medicinal benefits) of following a) Carotenoids- α and β -Carotene, Lycopene, Xanthophylls, leutin b) Sulfides: Diallyl sulfides, Allyl trisulfide. c) Polyphenolics: Resveratrol d) Flavonoids- Rutin, Naringin, Quercetin, Anthocyanidins, catechins, Flavones e) Prebiotics / Probiotics.: Fructo oligosaccharides, Lacto bacillum f) Phyto estrogens : Isoflavones, daidzein, Geobustan, lignans g) Tocopherols h) Proteins, vitamins, minerals, cereal, vegetables and beverages as functional foods: oats, wheat bran, rice bran, sea foods, coffee, tea and the like.	15	CO1 CO3
[3]	a) Introduction to free radicals: Free radicals, reactive oxygen species, production of free radicals in cells, damaging reactions of free radicals	07	CO1 CO2

	on lipids, proteins, Carbohydrates, nucleic acids. b) Dietary fibres and complex carbohydrates as functional food ingredients.		CO3
[4]	a) Free radicals in Diabetes mellitus, Inflammation, Ischemic reperfusion injury, Cancer, Atherosclerosis, Free radicals in brain metabolism and pathology, kidney damage, muscle damage. Free radicals involvement in other disorders. Free radicals theory of ageing. b) Antioxidants: Endogenous antioxidants – enzymatic and nonenzymatic antioxidant defence, Superoxide dismutase, catalase, Glutathione peroxidase, Glutathione Vitamin C, Vitamin E, α - Lipoic acid, melatonin, Synthetic antioxidants: Butylated hydroxy Toluene, Butylated hydroxy Anisole. c) Functional foods for chronic disease prevention	10	CO1 CO2 CO3
[5]	a) Effect of processing, storage and interactions of various environmental factors on the potential of nutraceuticals. b) Regulatory Aspects; FSSAI, FDA, FPO, MPO, AGMARK. HACCP and GMPs on Food Safety. Adulteration of foods. c) Pharmacopoeial Specifications for dietary supplements and nutraceuticals.	06	CO4 CO5

C. TEXT BOOKS

1. Dr. Tapan Behl, Dr. Sukhbir Singh, & Dr. Neelam Sharma Dietary Supplements & Nutraceuticals, R. Narain Publishers & Distributors, Agra, 2021.

D. REFERENCE BOOKS

1. K.T Agusti and P. Faizal, Role of dietary fibres and nutraceuticals in preventing diseases, B S Publication, 2019.
2. Cooper. K.A, Advanced Nutritional Therapies, Thomas Nelson Inc publisher, 1997.
3. Jean Carper The Food Pharmacy, Simon & Schuster publisher, UK Ltd., 2000.
4. James F. Balch and Phyllis A. Balch, Prescription for Nutritional Healing, 2nd Edn., Avery Publishing Group, NY, 1997.
5. G. Gibson and C.williams Editors 2000 Functional foods Woodhead Publ. Co. London.
6. Goldberg, I. Functional Foods, Chapman and Hall, New York, 1994
7. Labuza, T.P. Functional Foods and Dietary Supplements: Safety, Good Manufacturing Practice (GMPs) and Shelf-Life Testing in Essentials of Functional Foods M.K. Sachmidl and T.P. Labuza eds. Aspen Press, 2000.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	Discuss the need and requirements of supplements by the different group of people to maintain healthy life.
CO2	Understand and evaluate	Describe the outcome of deficiencies in dietary supplements and evaluate it.
CO3	Remember and analyse	To analyse the components in dietary supplements and the application.
CO4	Apply	To apply regulatory and commercial aspects of dietary supplements including health claims.
CO5	Create	Explain nutrition education.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
C01	3	3	2	2	2	2	1	3	2	3	2	3	3	3	2	2
C02	3	3	2	2	2	2	1	3	2	2	3	3	3	3	2	2
C03	3	2	3	2	2	2	1	3	2	2	2	3	2	3	2	2
C04	3	2	3	2	2	2	2	3	2	3	3	3	3	3	2	2
C05	3	2	2	2	2	2	1	3	2	2	2	3	3	3	3	2
Avg	3	2.4	2.4	2	2	2	1.2	3	2	2.4	2.4	3	2.8	3	2.2	2

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: PHARMACEUTICAL PRODUCT DEVELOPMENT (BP813ET)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge on pharmaceutical product development

Objectives: Upon completion of the course student shall be able

- Understand regulation related to pharmaceutical product development
- Understand selection and application of excipients in pharmaceutical formulations
- Understand QbD & optimization and its application in pharmaceutical product development
- Understand selection and quality control testing of packaging materials for pharmaceutical product development

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to pharmaceutical product development, objectives, regulations related to preformulation, formulation development, stability assessment, manufacturing and quality control testing of different types of dosage forms	10	CO1
[2]	An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories i. Solvents and solubilizers ii. Cyclodextrins and their applications iii. Non - ionic surfactants and their applications iv. Polyethylene glycols and sorbitols v. Suspending and emulsifying agents vi. Semi solid excipients	10	CO2 CO3
[3]	An advanced study of Pharmaceutical Excipients in pharmaceutical product development with a special reference to the following categories i. Tablet and capsule excipients ii. Directly compressible vehicles iii. Coat materials iv. Excipients in parenteral and aerosols products v. Excipients for formulation of NDDS Selection and application of excipients in pharmaceutical formulations with specific industrial applications	10	CO2 CO3
[4]	Optimization techniques in pharmaceutical product development. A study of various optimization techniques for pharmaceutical product development with specific examples. Optimization by factorial designs and their applications. A study of QbD and its application in pharmaceutical product development.	08	CO1 CO4
[5]	Selection and quality control testing of packaging materials for pharmaceutical product development- regulatory considerations.	07	CO5

C. TEXT BOOKS

-

D. REFERENCE BOOKS

1. Bolton, S.; Bon, C. *Pharmaceutical Statistics : Practical and Clinical Applications*; Informa Healthcare Usa: New York, 2010.
2. Swarbrick, J. *Encyclopedia of Pharmaceutical Technology*; Marcel Dekker: New York, Ny, 2004.
3. Lachman, L.; Liebermann, H. A. *The Theory and Practice of Industrial Pharmacy*; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.
4. Lieberman, H. A. *Pharmaceutical Dosage Forms Tablets, Vol. 1-3*; New York, Dekker, 1990.
5. Lieberman, H. A.; Rieger, M. M.; Banker, G. S. *Pharmaceutical Dosage Forms-- Disperse Systems. Volume 1-2*; Dekker: New York, 1998.
6. Avis, K. E.; Lieberman, H. A.; Lachman, L. *Pharmaceutical Dosage Forms: Parenteral Medications VOL 1-3*; M. Dekker: New York, 1992.
7. Remington, J. P.; Gennaro, A. R. *Remington's Pharmaceutical Sciences*; Mack Pub. Co: Easton, Pa., 1990.
8. Ansel, H. C.; Allen, L. V.; Popovich, N. G. *Pharmaceutical Dosage Forms and Drug Delivery Systems*; Philadelphia, Pa Lippincott-Williams & Wilkins, 1999.
9. Vyas, S. P.; Khar, R. K. *Targeted & Controlled Drug Delivery : Novel Carrier Systems*; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2010.
10. Aulton, M. E.; Taylor, K. *Aulton's Pharmaceutics : The Design and Manufacture of Medicines*, 5th ed.; Elsevier: London, 2018.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand regulation related to pharmaceutical product development
CO2	Study	Study of Pharmaceutical Excipients in pharmaceutical product development
CO3	Understand	Understand selection and application of excipients in pharmaceutical formulations
CO4	Understand and Remember	Understand QbD & optimization and its application in pharmaceutical product development
CO5	Understand and analyse	Understand selection and quality control testing of packaging materials for pharmaceutical product development

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	1	2	3	2	2	3	2	3	2	2	3	3
CO2	3	2	2	3	1	2	1	2	3	2	2	3	3	3	3	2
CO3	3	1	3	3	1	2	1	2	3	3	2	2	3	3	3	2
CO4	3	2	3	3	1	2	1	2	3	2	2	3	3	3	2	2
CO5	3	3	3	3	1	2	2	2	2	2	2	2	3	3	3	1
Avg	3	2	2.6	3	1	2	1.6	2	2.6	2.4	2	2.6	2.8	2.8	2.8	2

B. PHARM. SEMESTER – VIII (BPH)
SUBJECT: PROJECT WORK (BP813PW)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	12	6	6	150	-	-	-	150

A. COURSE OVERVIEW

All the students shall undertake a project under the supervision of a teacher and submit a report. The area of the project shall directly relate any one of the elective subjects opted by the student in semester VIII. The project shall be carried out in group not exceeding 5 in number. The project report shall be submitted in triplicate (typed & bound copy not less than 25 pages).

The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). Students shall be evaluated in groups for four hours (i.e., about half an hour for a group of five students).

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Master of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table – 2: Course of study for M. Pharm. (Pharmaceutics)

Course Code	Course	Credit Hours	Credit Points	Hrs./week	Marks
Semester I					
MPH101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPH102T	Drug Delivery System	4	4	4	100
MPH103T	Modern Pharmaceutics	4	4	4	100
MPH104T	Regulatory Affair	4	4	4	100
MPH105P	Pharmaceutics Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPH201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	4	4	4	100
MPH202T	Advanced Biopharmaceutics & Pharmacokinetics	4	4	4	100
MPH203T	Computer Aided Drug Delivery System	4	4	4	100
MPH204T	Cosmetic and Cosmeceuticals	4	4	4	100
MPH205P	Pharmaceutics Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Master of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table – 6: Course of study for M. Pharm. (Pharmaceutical Quality Assurance)

Course Code	Course	Credit Hours	Credit Points	Hrs./week	Marks
Semester I					
MQA101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MQA102T	Quality Management System	4	4	4	100
MQA103T	Quality Control and Quality Assurance	4	4	4	100
MQA104T	Product Development and Technology Transfer	4	4	4	100
MQA105P	Pharmaceutical Quality Assurance Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MQA201T	Hazards and Safety Management	4	4	4	100
MQA202T	Pharmaceutical Validation	4	4	4	100
MQA203T	Audits and Regulatory Compliance	4	4	4	100
MQA204T	Pharmaceutical Manufacturing Technology	4	4	4	100
MQA205P	Pharmaceutical Quality Assurance Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650

M. PHARM. SEMESTER – I (MPH)**SUBJECT: MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES – THEORY (MPH101T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	--	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives: After completion of course student is able to know about

- Chemicals and excipients
- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier -Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation. c. Spectrofluorimetric: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	11	CO1 CO2 CO5
[2]	NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³ C NMR. Applications of NMR spectroscopy	11	CO1 CO2 CO5
[3]	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	11	CO1 CO2 CO5
[4]	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: <ul style="list-style-type: none">• Thin Layer chromatography• Paper Chromatography	11	CO3 CO4 CO5

	<ul style="list-style-type: none"> ● Ion exchange chromatography ● Column chromatography ● Gas chromatography ● High Performance Liquid chromatography ● Affinity chromatography 		
[5]	<p>a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following:</p> <p>a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing</p> <p>b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.</p>	11	CO5
[6]	Immunological assays : RIA (Radio immuno assay), ELISA, Bioluminescence assays.	05	CO5

C. TEXT BOOKS

1. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..
2. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis*.; Pearson: New Delhi, 2009.

D. REFERENCE BOOKS

1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds*.; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
8. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
9. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.
10. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the fundamentals of various spectroscopic techniques
CO2	Understand Apply and Evaluate	To apply the fundamentals of spectroscopy in single and combination drug analysis
CO3	Understand and remember	To understand the chromatographic separation fundamentals
CO4	Understand Apply and Evaluate	To apply the fundamentals of various chromatographic techniques in single and combination drug analysis
CO5	Understand Apply and Evaluate	To learn theoretical and practical aspects of various analytical instruments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO2	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO3	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO4	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO5	3	2	1	1	-	2	1	1	1	-	3	3	1	1	-
Avg	3	1.2	1.8	1.4	-	1.6	0.6	1	1	-	3	2.6	0.6	0.6	-

M. PHARM. SEMESTER – I (MPH)
SUBJECT: DRUG DELIVERY SYSTEMS (MPH102T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

Objectives: Upon completion of the course, student shall be able to understand

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of delivering system
- The formulation and evaluation of Novel drug delivery systems

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Sustained Release (SR) and Controlled Release (CR) formulations: Introduction & basic concepts, advantages/ disadvantages, factors influencing, Physicochemical & biological approaches for SR/CR formulation, Mechanism of Drug Delivery from SR/CR formulation. Polymers: introduction, definition, classification, properties and application Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, And Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy.	10	CO5 CO2
[2]	Rate Controlled Drug Delivery Systems: Principles & Fundamentals, Types, Activation; Modulated Drug Delivery Systems; Mechanically activated, pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems Feedback regulated Drug Delivery Systems; Principles & Fundamentals.	10	CO5 CO2
[3]	Gastro-Retentive Drug Delivery Systems: Principle, concepts advantages and disadvantages, Modulation of GI transit time approaches to extend GI transit. Buccal Drug Delivery Systems: Principle of muco adhesion, advantages and disadvantages, Mechanism of drug permeation, Methods of formulation and its evaluations.	10	CO1 CO3 CO4
[4]	Ocular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers.	06	CO1 CO3 CO4
[5]	Transdermal Drug Delivery Systems: Structure of skin and barriers, Penetration enhancers, Transdermal Drug Delivery Systems, Formulation and evaluation.	10	CO1 CO3 CO4
[6]	Protein and Peptide Delivery: Barriers for protein delivery. Formulation and Evaluation of delivery systems of proteins and other macromolecules.	08	CO1 CO3 CO4
[7]	Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines.	06	CO1 CO3 CO4

C. TEXT BOOKS

1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002

D. REFERENCE BOOKS

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York, Chichester/Weinheim

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand the various approaches for development of novel drug delivery system
CO2	Learn	To learn the criteria for selection of drugs and polymers for the development of delivery system
CO3	Learn	To learn the formulation and evaluation of Novel drug delivery systems.
CO4	Analyse	Analyse various evaluation parameters for oral, parenteral, topical etc. drug delivery systems
CO5	Understand and analyse	Explain the principles and technology used in the design of sustained release and controlled release drug delivery systems

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	2	-	2	2	3	1	3	3	2	2
CO2	3	2	2	2	-	3	-	2	2	2	2	2	3	2	2
CO3	3	2	3	3	-	2	-	3	2	2	3	3	3	2	2
CO4	3	2	3	3	-	2	-	2	2	2	2	3	3	3	3
CO5	3	2	2	2	-	2	-	3	2	3	3	3	3	2	3
Avg	3	2	2.4	2.4	-	2.2	-	2.4	2	2.4	2.2	2.8	3	2.2	2.4

M. PHARM. SEMESTER – I (MPH)
SUBJECT: MODERN PHARMACEUTICS (MPH103T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course designed to impart advanced knowledge and skills required to learn various aspects and concepts at pharmaceutical industries.

Objectives: Upon completion of the course, student shall be able to understand

- The elements of preformulation studies.
- The Active Pharmaceutical Ingredients and Generic drug Product development
- Industrial Management and GMP Considerations.
- Optimization Techniques & Pilot Plant Scale Up Techniques
- Stability Testing, sterilization process & packaging of dosage forms.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Preformation Concepts – Drug Excipient interactions - different methods, kinetics of stability, Stability testing. Theories of dispersion and pharmaceutical Dispersion (Emulsion and Suspension, SMEDDS) preparation and stability Large and small volume parental – physiological and formulation consideration, Manufacturing and evaluation. b. Optimization techniques in Pharmaceutical Formulation: Concept and parameters of optimization, Optimization techniques in pharmaceutical formulation and processing. Statistical design, Response surface method, Contour designs, Factorial designs and application in formulation	20	CO1 CO4
[2]	Validation: Introduction to Pharmaceutical Validation, Scope & merits of Validation, Validation and calibration of Master plan, ICH & WHO guidelines for calibration and validation of equipments, Validation of specific dosage form, Types of validation. Government regulation, Manufacturing Process Model, URS, DQ, IQ, OQ & P.Q. of facilities.	10	CO2 CO3
[3]	cGMP & Industrial Management: Objectives and policies of current good manufacturing practices, layout of buildings, services, equipments and their maintenance Production management: Production organization, , materials management, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control, industrial and personal relationship. Concept of Total Quality Management.	10	CO2 CO3
[4]	Compression and compaction: Physics of tablet compression, compression, consolidation, effect of friction, distribution of forces, compaction profiles.	10	CO5
[5]	Study of Solubility parameters, Diffusion parameters, Dissolution parameters and Pharmacokinetic parameters, Heckle plots, Similarity factors – f2 and f1, Higuchi and Peppas plot, Linearity Concept of significance, Standard deviation, Chi square test, students T-test, ANOVA test.	10	CO5

C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013

D. REFERENCE BOOKS

1. Lieberman, H. A. *Pharmaceutical Dosage Forms Tablets, Vol. 1-3*; New York, Dekker, 1990.
2. Lieberman, H. A.; Rieger, M. M.; Banker, G. S. *Pharmaceutical Dosage Forms-- Disperse Systems. Volume 1-2*; Dekker: New York, 1998.
3. Avis, K. E.; Lieberman, H. A.; Lachman, L. *Pharmaceutical Dosage Forms: Parenteral Medications VOL 1-3*; M. Dekker: New York, 1992.
4. Banker, G. S.; Rhodes, C. T. *Modern Pharmaceutics*; Dekker: New York, 1996.
5. Remington, J. P.; Gennaro, A. R. *Remington's Pharmaceutical Sciences*; Mack Pub. Co: Easton, Pa., 1990.
6. Bean, H. S.; Carless, J. E.; Arnold Heyworth Beckett. *Advances in Pharmaceutical Sciences*; Academic Press: London, 1964.
7. Sinko, P. J.; Martin, A. N. *Martin's Physical Pharmacy Pharmaceutical Sciences: Physical Chemical Principles in the Pharmaceutical Sciences.*; Lippincott Williams & Wilkins: Philadelphia, 2006.
8. Arthur Owen Bentley; Ernest Alexander Rawlins. *Bentley's Textbook of Pharmaceutics.*; All India Traveller Book Seller: New Delhi, 2002.
9. Willig, S. H. *Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control from Manufacturer to Consumer*; Marcel Dekker, Inc: New York, N.Y., 2001.
10. Kohli, D. P. S.; Shah, D. H. *Drug Formulations Manual*; Business Horizons: New Delhi, 2012.
11. Sharma, P.P. *How to practice GMPs*. Vandana publication, 2001.
12. Berry, I. R.; Nash, R. A. *Pharmaceutical Process Validation*; Marcel Dekker: New York, 1993.
13. James Robert Evans. *Applied Production and Operations Management*; Info Access & Distribution: Singapore, 1994.
14. Swarbrick, J. *Encyclopedia of Pharmaceutical Technology*; Marcel Dekker: New York, Ny, 2004.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Learn	Learn the elements of preformulation studies.
CO2	Understand	Understand validations of processes and equipments used in Pharmaceutical Industry
CO3	Learn	Learn Industrial Management and GMP Considerations.
CO4	Understand and Remember	Understand and remember Optimization Techniques & Statistical designs
CO5	Understand and analyse	Understand physics of tablet compression and analyse dissolution & diffusion parameters

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	2	-	2	2	2	1	3	2	1	1
CO2	3	2	2	3	-	2	-	2	2	3	2	3	3	3	2
CO3	3	1	2	2	-	3	-	3	2	3	2	3	3	3	2
CO4	3	2	3	3	-	2	-	2	2	2	3	3	2	3	3
CO5	3	3	3	3	-	2	-	2	2	2	2	3	1	3	3
Avg	3	2	2.4	2.6	-	2.2	-	2.2	2	2.4	2	3	2.2	2.6	2.2

M. PHARM. SEMESTER – I (MPH)
SUBJECT: REGULATORY AFFAIRS - THEORY (MPH104T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	--	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course designed to impart advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in different countries, different phases of clinical trials and submitting regulatory documents: filing process of IND, NDA and ANDA

Objectives: Upon completion of the course, it is expected that the students will be able to understand

- The Concepts of innovator and generic drugs, drug development process
- The Regulatory guidance's and guidelines for filing and approval process
- Preparation of Dossiers and their submission to regulatory agencies in different countries
- Post approval regulatory requirements for actives and drug products
- Submission of global documents in CTD/ eCTD formats
- Clinical trials requirements for approvals for conducting clinical trials
- Pharmacovigilance and process of monitoring in clinical trials.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Documentation in Pharmaceutical industry: Master formula record, DMF (Drug Master File), distribution records. Generic drugs product development Introduction , Hatch- Waxman act and amendments, CFR (CODE OF FEDERAL REGULATION) ,drug product performance, in-vitro, ANDA regulatory approval process, NDA approval process, BE and drug product assessment, in –vivo, scale up process approval changes, post marketing surveillance, outsourcing BA and BE to CRO. b. Regulatory requirement for product approval: API, biologics, novel, therapies obtaining NDA, ANDA for generic drugs ways and means of US registration for foreign drugs	15	CO1 CO2 CO3 CO4
[2]	CMC, post approval regulatory affairs. Regulation for combination products and medical devices.CTD and ECTD format, industry and FDA liaison. ICH - Guidelines of ICH-Q, S E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries.	15	CO2 CO3
[3]	Non clinical drug development: Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier, dossier (IMPD) and investigator brochure (IB).	15	CO2 CO5
[4]	Clinical trials: Developing clinical trial protocols. Institutional review board/ independent ethics committee Formulation and working procedures informed Consent process and procedures. HIPAA- new, requirement to clinical study process, • pharmacovigilance safety monitoring in clinical trials.	15	CO2 CO5

C. TEXT BOOKS

1. Berry, I. R.; Martin, R. P. *The Pharmaceutical Regulatory Process*; Informa Healthcare: New York, 2008.
2. Guarino, R. A. *New Drug Approval Process*; Informa Healthcare, Cop: New York, 2009.

D. REFERENCE BOOKS

1. Kanfer, I.; Shargel, L. *Generic Drug Product Development : Solid Oral Dosage Forms*; Marcel Dekker: New York, 2005.
2. Weinberg, S. *Guidebook for Drug Regulatory Submissions*; Wiley: Hoboken, N.J., 2009.
3. Pisano, D. J. *FDA Regulatory Affairs : A Guide for Prescription Drugs, Medical Devices, and Biologics*; Informa Healthcare Usa: New York, 2008.
4. Rozovsky, F. A.; Adams, R. K. *Clinical Trials and Human Research : A Practical Guide to Regulatory Compliance*; Jossey-Bass: San Francisco, 2003.
5. Administration, A. G. D. of H. T. G. TGA basics <http://www.tga.gov.au/tga-basics>
6. Your gateway to the European Union http://europa.eu/index_en.htm.
7. ICH Official web site : ICH <http://www.ich.org/>.
8. Commissioner, O. of the. U.S. Food and Drug Administration <http://www.fda.gov/>.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the Concepts of innovator and generic drugs, drug development process
CO2	Understand and Apply	To understand the Regulatory guidance and guidelines for filing and approval process
CO3	Understand and remember	To understand Preparation of Dossiers and their submission to regulatory agencies in different countries in CTD/ eCTD formats
CO4	Understand and remember	To understand Post approval regulatory requirements for actives and drug products
CO5	Understand and remember	To acquire knowledge about Non-clinical development, Clinical trials requirements, Pharmacovigilance and process of monitoring in clinical trials.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	2	2	3	3	-	3	-	3	2	-
CO2	3	-	-	-	-	2	2	3	2	-	3	-	3	2	-
CO3	3	-	-	-	1	2	2	3	2	-	3	-	3	2	-
CO4	3	-	-	-	-	2	2	3	3	-	3	-	3	-	-
CO5	3	2	1	1	1	2	2	3	3	-	3	-	1	2	1
Avg	3	0.4	0.2	0.2	0.4	2	2	3	2.6	-	3	-	2.6	1.6	0.2

M. PHARM. SEMESTER – I (MPH)
SUBJECT: PHARMACEUTICS PRACTICAL – I (MPH105P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	12	12	6	100	30	20	-	150

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge and skills on analytical techniques and development of various NDDS dosage forms

Objectives: objectives of the course is to make students able to

- Understand, learn and application of various spectrophotometric and chromatographic analytical methods in analysis of drugs and drug products.
- Application of preformulation concepts in Preparation, characterization and evaluation of conventional and novel drug delivery systems

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Analysis of pharmacopoeial compounds and their formulations by UV Vis-spectrophotometer 1. Simultaneous estimation of multi component containing formulations by UV spectrophotometry 2. Experiments based on HPLC 3. Experiments based on Gas Chromatography 4. Estimation of riboflavin/quinine sulphate by fluorimetry 5. Estimation of sodium/potassium by flame photometry	90	CO1 CO2
[2]	1. To perform In-vitro dissolution profile of CR/ SR marketed formulation 2. Formulation and evaluation of sustained release matrix tablets 3. Formulation and evaluation osmotically controlled DDS 4. Preparation and evaluation of Floating DDS- hydro dynamically balanced DDS 5. Formulation and evaluation of Muco adhesive tablets. 6. Formulation and evaluation of trans dermal patches. 7. To carry out preformulation studies of tablets. 8. To study the effect of compressional force on tablets disintegration time. 9. To study Micromeritic properties of powders and granulation. 10. To study the effect of particle size on dissolution of a tablet. 11. To study the effect of binders on dissolution of a tablet. 12. To plot Heckal plot, Higuchi and peppas plot and determine similarity factors.	90	CO2 CO3 CO4 CO5

C. TEXT BOOKS

D. REFERENCE BOOKS

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Assessment	Assessment of the drug/s using various spectroscopic and chromatographic techniques
CO2	Learn	Handling and operations of various analytical instruments
CO3	understand	Preparation and evaluation of modified release drug delivery systems
CO4	Understand and Remember	To understand effect of various excipients and process parameters on various dosage forms
CO5	Understand and apply	application of the various model dependent and model independent approaches for the assessment of dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	1	2	1	2	2	2	1	3	1	1	1
CO2	3	3	2	2	2	3	2	3	2	3	2	3	2	2	2
CO3	3	3	3	2	2	2	1	3	2	3	2	3	3	2	2
CO4	3	3	3	3	1	2	1	2	2	2	3	3	3	3	3
CO5	3	3	3	3	1	2	1	2	2	3	2	3	3	3	3
Avg	3	3	2.6	2.6	1.4	2.2	1.2	2.4	2	2.6	2	3	2.4	2.2	2.2

M. PHARM. SEMESTER – II (MPH)
SUBJECT: MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY & TARGETED DDS) (NTDS) (MPH201T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

Objectives: Upon completion of the course, student shall be able to understand

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of delivering system
- The formulation and evaluation of novel drug delivery systems

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Targeted Drug Delivery Systems: Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery.	12	CO5
[2]	Targeting Methods: introduction preparation and evaluation. Nano Particles & Liposomes: Types, preparation and evaluation.	12	CO5 CO3
[3]	Micro Capsules / Micro Spheres: Types, preparation and evaluation, Monoclonal Antibodies; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes.	12	CO2 CO3
[4]	Pulmonary Drug Delivery Systems : Aerosols, propellents, Containers Types, preparation and evaluation, Intra Nasal Route Delivery systems; Types, preparation and evaluation.	12	CO1 CO2
[5]	Nucleic acid based therapeutic delivery system : Gene therapy, introduction (ex-vivo & in-vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and nonviral gene transfer). Liposomal gene delivery systems. Biodistribution and Pharmacokinetics. knowledge of therapeutic antisense molecules and aptamers as drugs of future.	12	CO4

C. TEXT BOOKS

1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002

D. REFERENCE BOOKS

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York, Chichester/Weinheim

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand the various approaches for development of novel drug delivery systems.
CO2	Learn	To learn the criteria for selection of drugs and polymers for the development of NDDS
CO3	Understand	To understand the concepts of formulation and evaluation of Nano carrier-based drug delivery systems.
CO4	learn	To learn the nucleic acid-based drug delivery systems.
CO5	Understand and analyse	To understand concepts and methods of targeted drug delivery systems.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	2	-	2	2	3	1	3	3	2	2
CO2	3	3	3	3	-	2	-	2	2	2	1	2	3	2	2
CO3	3	2	3	2	-	2	-	3	2	2	3	2	3	2	3
CO4	3	2	2	2	-	2	-	2	2	2	3	2	3	3	2
CO5	3	2	2	2	-	2	-	3	2	3	3	3	3	2	3
Avg	3	2.2	2.4	2.2	-	2	-	2.4	2	2.4	2.2	2.4	3	2.2	2.4

M. PHARM. SEMESTER – II (MPH)**SUBJECT: ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS (MPH202T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge and skills necessary for dose calculations, dose adjustments and to apply biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of biopharmaceutics and pharmacokinetics are provided to help the students to clarify the concepts.

Objectives: Upon completion of this course it is expected that students will be able understand,

- The basic concepts in biopharmaceutics and pharmacokinetics. The use raw data and derive the pharmacokinetic models and parameters the best describe the process of drug absorption, distribution, metabolism and elimination.
- The critical evaluation of biopharmaceutic studies involving drug product equivalency.
- The design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.
- The potential clinical pharmacokinetic problems and application o basics of pharmacokinetic

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Drug Absorption from the Gastrointestinal Tract: Gastrointestinal tract, Mechanism of drug absorption, Factors affecting drug absorption, pH–partition theory of drug absorption. Formulation and physicochemical factors: Dissolution rate, Dissolution process, Noyes–Whitney equation and drug dissolution, Factors affecting the dissolution rate. Gastrointestinal absorption: role of the dosage form: Solution (elixir, syrup and solution) as a dosage form, Suspension as a dosage form, Capsule as a dosage form, Tablet as a dosage form, Dissolution methods ,Formulation and processing factors, Correlation of in vivo data with in vitro dissolution data. Transport model: Permeability-Solubility-Charge State and the pH Partition Hypothesis, Properties of the Gastrointestinal Tract (GIT), pH Microclimate Intracellular pH Environment, Tight-Junction Complex.	12	CO1 CO2
[2]	Biopharmaceutic considerations in drug product design and In Vitro Drug Product Performance: Introduction, biopharmaceutic factors affecting drug bioavailability, rate-limiting steps in drug absorption, physicochemical nature of the drug formulation factors affecting drug product performance, in vitro: dissolution and drug release testing, compendial methods of dissolution, alternative methods of dissolution testing, meeting dissolution requirements, problems of variable control in dissolution testing performance of drug products. In vitro–in vivo correlation, dissolution profile comparisons, drug product stability, considerations in the design of a drug product.	12	CO1 CO2
[3]	Pharmacokinetics: Basic considerations, pharmacokinetic models, compartment modeling: one compartment model- IV bolus, IV infusion,	12	CO3

	extra-vascular. Multi compartment model: two compartment - model in brief, non-linear pharmacokinetics: cause of non-linearity, Michaelis – Menten equation, estimation of k _{max} and v _{max} . Drug interactions: introduction, the effect of protein binding interactions, the effect of tissue-binding interactions, cytochrome p450-based drug interactions, drug interactions linked to transporters.		
[4]	Drug Product Performance, In Vivo: Bioavailability and Bioequivalence: drug product performance, purpose of bioavailability studies, relative and absolute availability. Methods for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, crossover study designs, evaluation of the data, bioequivalence example, study submission and drug review process. Biopharmaceutics classification system, methods. Permeability: In-vitro, in-situ and In-vivo methods. Generic biologics (biosimilar drug products), clinical significance of bioequivalence studies, special concerns in bioavailability and bioequivalence studies, generic substitution.	12	CO4
[5]	Application of Pharmacokinetics: Modified-Release Drug Products, Targeted Drug Delivery Systems and Biotechnological Products. Introduction to Pharmacokinetics and pharmacodynamic, drug interactions. Pharmacokinetics and pharmacodynamics of biotechnology drugs. Introduction, Proteins and peptides, Monoclonal antibodies, Oligonucleotides, Vaccines (immunotherapy), Gene therapies.	12	CO5

C. TEXT BOOKS

1. Jaiswal, Sunil B., and Brahmankar, D. M.. Biopharmaceutics and Pharmacokinetics: A Treatise. India, Vallabh Prakashan, 2005.

D. REFERENCE BOOKS

1. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics. India: Pharmamed Press. 2005.
2. Yu, Andrew B.C., and Shargel, Leon. Applied Biopharmaceutics & Pharmacokinetics, Seventh Edition. Singapore, McGraw-Hill Education, 2015.
3. Gibaldi, Milo, and Perrier, Donald. Pharmacokinetics., 2nd edition, Marcel Dekker Inc., New York, 1982
4. Swarbrick. J. Current Concepts in the Pharmaceutical Sciences: Biopharmaceutics. United States: Lea & Febiger. 1970.
5. Malcolm Rowland and Thom N. Tozer. Clinical Pharmacokinetics, Concepts and Applications. 3rd edition. Lea and Febiger, Philadelphia, 1995
6. Abdou. H.M, Dissolution, Bioavailability and Bioequivalence, Mack Publishing Company, Pennsylvania 1989
7. Robert. E. Notari. Biopharmaceutics and Clinical Pharmacokinetics, An Introduction, 4th edition, Marcel Dekker Inc, New York and Basel, 1987.
8. John. G Wagner and M. Pamarowski. Biopharmaceutics and Relevant Pharmacokinetics, 1st edition, Drug Intelligence Publications, Hamilton, Illinois, 1971.
9. James Swarbrick, James. G. Boylan. Encyclopedia of Pharmaceutical Technology, Vol 13, Marcel Dekker Inc, New York, 1996.
10. Sunil S Jambhekar and Philip J Breen. Basic Pharmacokinetics, 1st edition, pharmaceutical press, RPS Publishing, 2009.
11. Alex Avdeef. Absorption and Drug Development- Solubility, Permeability, and Charge State, John Wiley & Sons, Inc, 2003.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand basic concepts and factors affecting of absorption of drugs form GIT and bioavailability.
CO2	Understand and Apply	Understand and apply biopharmaceutic considerations and in-vitro dissolution in drug product design.
CO3	Understand and Utilize	Understand and utilize the pharmacokinetic models for the determination of pharmacokinetic parameters.
CO4	Understand, Analyze and Evaluate	Understand and analyze the bioavailability of a drug and evaluate the bioequivalence between drug products.
CO5	Remember and Understand	Remember and Understand applications of biopharmaceutics and apply in designing dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	1	2	1	1	3	2	2	3	2	3	2
CO2	3	2	3	2	1	3	2	2	2	2	3	3	3	3	2
CO3	2	1	2	3	1	2	2	2	1	1	2	2	3	3	3
CO4	3	2	2	2	1	2	1	1	3	2	3	3	2	3	2
CO5	3	2	3	3	1	2	2	2	2	2	2	3	3	3	2
Avg	2.8	1.6	2.4	2.4	1	2.2	1.6	1.6	2.2	1.8	2.4	2.8	2.6	3	2.2

M. PHARM. SEMESTER – II (MPH)
SUBJECT: COMPUTER AIDED DRUG DEVELOPMENT (MPH203T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge and skills necessary for computer Applications in pharmaceutical research and development who want to understand the application of computers across the entire drug research and development process. Basic theoretical discussions of the principles of more integrated and coherent use of computerized information (informatics) in the drug development process are provided to help the students to clarify the concepts.

Objectives: Upon completion of this course it is expected that students will be able to understand,

- History of Computers in Pharmaceutical Research and Development
- Computational Modeling of Drug Disposition
- Computers in Preclinical Development
- Optimization Techniques in Pharmaceutical Formulation
- Computers in Market Analysis
- Computers in Clinical Development
- Artificial Intelligence (AI) and Robotics
- Computational fluid dynamics (CFD)

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Computers in Pharmaceutical Research and Development: A General Overview: History of Computers in Pharmaceutical Research and Development. Statistical modeling in Pharmaceutical research and development: Descriptive versus Mechanistic Modeling, Statistical Parameters, Estimation, Confidence Regions, Nonlinearity at the Optimum, Sensitivity Analysis, Optimal Design, Population Modeling b. Quality-by-Design in Pharmaceutical Development: Introduction, ICH Q8 guideline, Regulatory and industry views on QbD, Scientifically based QbD - examples of application.	12	CO1 CO2
[2]	Computational Modeling of Drug Disposition: Introduction, Modeling Techniques: Drug Absorption, Solubility, Intestinal Permeation, Drug Distribution, Drug Excretion, Active Transport; P-gp, BCRP, Nucleoside Transporters, hPEPT1, ASBT, OCT, OATP, BBB-Choline Transporter.	12	CO3 CO4
[3]	Computer-aided formulation development: Concept of optimization, Optimization parameters, Factorial design, Optimization technology & Screening design. Computers in Pharmaceutical Formulation: Development of pharmaceutical emulsions, microemulsion drug carriers Legal Protection of Innovative Uses of Computers in R&D, The Ethics of Computing in Pharmaceutical Research, Computers in Market analysis	12	CO1 CO2

[4]	a. Computer-aided biopharmaceutical characterization: Gastrointestinal absorption simulation. Introduction, Theoretical background, Model construction, Parameter sensitivity analysis, Virtual trial, Fed vs. fasted state, In vitro dissolution and in-vitro-in-vivo correlation, Biowaiver considerations b. Computer Simulations in Pharmacokinetics and Pharmacodynamics: Introduction, Computer Simulation: Whole Organism, Isolated Tissues, Organs, Cell, Proteins and Genes. c. Computers in Clinical Development: Clinical Data Collection and Management, Regulation of Computer Systems	12	CO3 CO4
[5]	Artificial Intelligence (AI), Robotics and Computational fluid dynamics: General overview, Pharmaceutical Automation, Pharmaceutical applications, Advantages and Disadvantages. Current Challenges and Future Directions.	12	CO5

C. TEXT BOOKS

1. Ekins, S. Computer Applications in Pharmaceutical Research and Development
Ekins/Computer Applications in Pharmaceutical Research and Development; Hoboken, Nj, USA John Wiley & Sons, Inc, 2006.

D. REFERENCE BOOKS

1. Jelena Djuris. Computer-Aided Applications in Pharmaceutical Technology; Woodhead Publishing: Oxford, 2013.
2. Swarbrick, J. Encyclopaedia of Pharmaceutical Technology; Vol 1-3; Marcel Dekker: New York, Ny, 2004.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To know role of computers and application of statistical modeling in pharmaceutical research.
CO2	Understand and Apply	To understand application of QbD and optimization techniques in pharmaceutical product development.
CO3	Understand	To know computational modeling techniques of drug disposition and biopharmaceutical process.
CO4	Understand and Remember	To know and understand application of computers modeling techniques in pharmacokinetic and pharmacodynamic of drugs.
CO5	Understand and Remember	To understand artificial intelligence in development of drug product.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	3	-	-	-	-	2	-	3	-	3	0	3
CO2	3	2	3	3	-	-	3	3	2	-	3	-	3	1	3
CO3	3	2	2	3	-	-	3	3	3	-	3	-	3	3	3
CO4	3	2	2	3	-	-	3	3	3	-	3	2	3	3	3
CO5	3	1	2	3	-	-	3	2	2	-	3	3	3	0	3
Avg	3	1.6	2	3	-	-	2.4	2.2	2.4	-	3	1	3	1.4	3

M. PHARM. SEMESTER – II (MPH)
SUBJECT: COSMETIC AND COSMECEUTICALS (MPH204T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge and skills necessary for the fundamental need for cosmetic and cosmeceutical products.

Objectives: Upon completion of the course the student shall be able to

- Key ingredients used in cosmetics and cosmeceuticals.
- Key building blocks for various formulations.
- Current technologies in the market
- Various key ingredients and basic science to develop cosmetics and cosmeceuticals.
- Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Cosmetics – Regulatory : Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labeling of cosmetics Regulatory provisions relating to import of cosmetics., Misbranded and spurious cosmetics. Regulatory provisions relating to manufacture of cosmetics – Conditions for obtaining license, prohibition of manufacture and sale of certain cosmetics, loan license, offences and penalties.	12	CO3
[2]	Cosmetics - Biological aspects : Structure of skin relating to problems like dry skin, acne, pigmentation, prickly heat, wrinkles and body odor. Structure of hair and hair growth cycle. Common problems associated with oral cavity. Cleansing and care needs for face, eye lids, lips, hands, feet, nail, scalp, neck, body and under-arm.	12	CO1 CO4 CO5
[3]	Formulation Building blocks: Building blocks for different product formulations of cosmetics/cosmeceuticals. Surfactants – Classification and application. Emollients, rheological additives: classification and application. Antimicrobial used as preservatives, their merits and demerits. Factors affecting microbial preservative efficacy. Building blocks for formulation of a moisturizing cream, vanishing cream, cold cream, shampoo and toothpaste. Soaps and syndet bars. Perfumes; Classification of perfumes. Perfume ingredients listed as allergens in EU regulation. Controversial ingredients: Parabens, formaldehyde liberators, dioxane.	12	CO1 CO2 CO3 CO4 CO5
[4]	Design of cosmeceutical products: Sun protection, sunscreens classification and regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor., dandruff, dental cavities, bleeding gums, mouth odor and sensitive teeth through cosmeceutical formulations.	12	CO1 CO2 CO4 CO5
[5]	Herbal Cosmetics: Herbal ingredients used in Hair care, skin care and oral care. Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers. Challenges in formulating herbal cosmetics.	12	CO1 CO2 CO4 CO5

C. TEXT BOOKS

1. Butler, H.; Poucher, W. A. Poucher's Perfumes, Cosmetics, and Soaps.; Kluwer Academic Publishers: Dordrecht ; Boston, 2000.

D. REFERENCE BOOKS

1. Ralph Gordon Harry; Rosen, M. R. *Harry's Cosmeticology*; Chemical Publishing Company: New York, 2015.

3. Sharma, P. P.; Vandana Publications. *Cosmetics : Formulation, Manufacturing & Quality Control*; Vandana Publications: Delhi, 2018.

4. Barel, A. O.; Paye, M.; Maibach, H. I. *Handbook of Cosmetic Science and Technology*; Taylor & Francis: Boca Raton, 2014.

5 And, T. *CTFA Membership Directory.*; Cosmetic, Toiletry And Fragrance Association, Inc: Washington, D.C., 1981.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember, Understand and Evaluate	To understand the key ingredients used in cosmetics and cosmeceuticals.
CO2	Remember, Understand and Evaluate	To learn key building blocks for various formulations.
CO3	Understand Apply and Evaluate	To learn the current technologies and regulatory requirements of cosmetics in the market
CO4	Understand Remember and	To understand the various basic science to develop cosmetics and cosmeceuticals
CO5	Remember, Understand and Evaluate	To learn the scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	1	1	1	3	2	3	1	3	1	3	2
CO2	3	2	3	3	1	1	1	3	3	3	1	2	2	3	2
CO3	3	3	3	3	1	1	2	2	3	2	2	2	2	3	2
CO4	3	2	3	3	1	1	2	2	3	3	1	2	2	3	2
CO5	3	3	3	3	1	2	2	3	2	2	2	3	3	3	2
Avg	3	2.4	3	3	1	1.2	1.6	2.6	2.6	2.6	1.4	2.4	2	3	2

M. PHARM. SEMESTER – I (MPH)
SUBJECT: PHARMACEUTICS PRACTICAL – II (MPH205P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	12	12	6	100	30	20	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge and skills on analytical techniques and development of various NDDS dosage forms

Objectives: Upon completion of the course student shall be able

- Formulation and evaluation of different novel drug delivery systems
- Application of QbD principles in designing dosage form.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. To study the effect of temperature change , non solvent addition, 2. incompatible polymer addition in microcapsules preparation 3. Preparation and evaluation of Alginate beads 4. Formulation and evaluation of gelatin /albumin microspheres 5. Formulation and evaluation of liposomes/niosomes 6. Formulation and evaluation of spherules 7. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique. 8. Comparison of dissolution of two different marketed products /brands 9. Development and evaluation of Creams 10. Development and evaluation of Shampoo and Toothpaste base 11. To incorporate herbal and chemical actives to develop products 12. To address Dry skin, acne, blemish, Wrinkles, bleeding gums and dandruff 	90	CO1 CO3 CO5
[2]	<ol style="list-style-type: none"> 1. Protein binding studies of a highly protein bound drug & poorly protein bound drug 2. Bioavailability studies of Paracetamol in animals. 3. Pharmacokinetic and IVIVC data analysis by WinnolineR software 4. In vitro cell studies for permeability and metabolism 5. DoE Using Design Expert® Software 6. Formulation data analysis Using Design Expert® Software 7. Quality-by-Design in Pharmaceutical Development 8. Computer Simulations in Pharmacokinetics and Pharmacodynamics 9. Computational Modeling Of Drug Disposition 10. To develop Clinical Data Collection manual 11. To carry out Sensitivity Analysis, and Population Modeling. 	90	CO2 CO4

C. TEXT BOOKS

D. REFERENCE BOOKS

E. COURSE OUTCOMES

(Minimum 5 Cos are required)

CO Number	Skill	Statement
CO1	understand and analyse	Formulate and characterize various novel drug delivery systems
CO2	Learn	Pharmacokinetic and IVIVC data analysis, simulation of pharmacokinetic using appropriate computational program/s
CO3	Understand	Preparation and characterization of cosmetic preparations, herbal active containing products and toiletry items
CO4	Understand and Remember	Applications of design of experiment software/s and Quality-by-Design in pharmaceutical development.
CO5	Understand and apply	Solubility improvement techniques & Dissolution profile comparison by various tools

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	1	2	2	2	2	2	1	3	3	1	1
CO2	3	3	2	2	2	3	2	3	2	3	2	2	3	3	3
CO3	3	3	3	2	2	2	2	3	2	3	2	3	3	2	1
CO4	3	3	3	3	1	2	1	2	2	2	3	2	3	2	3
CO5	3	3	3	3	1	2	2	2	2	3	2	2	3	3	3
Avg	3	3	2.6	2.6	1.4	2.2	1.8	2.4	2	2.6	2	2.4	3	2.2	2.2

M. PHARM. SEMESTER – II (MQA)**SUBJECT: MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES - THEORY (MQA101T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	--	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives: After completion of course, student is able to know about

1. Chemicals and excipients
2. The analysis of various drugs in single and combination dosage forms
3. Theoretical and practical skills of the instruments

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier -Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation. c. Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	11	CO1 CO2 CO5
[2]	NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³ C NMR. Applications of NMR spectroscopy	11	CO1 CO2 CO5
[3]	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	11	CO1 CO2 CO5
[4]	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: <ul style="list-style-type: none">● Thin Layer chromatography● High Performance Thin Layer Chromatography	11	CO3 CO4 CO5

	<ul style="list-style-type: none"> ● Ion exchange chromatography ● Column chromatography ● Gas chromatography ● High Performance Liquid chromatography ● Ultra High Performance Liquid chromatography ● Affinity chromatography ● Gel Chromatography. 		
[5]	<p>a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following:</p> <p>a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing</p> <p>b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.</p>	11	CO5
[6]	<p>a. Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry.</p> <p>b. Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.</p>	05	CO5

C. TEXT BOOKS

1. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..
2. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis*.; Pearson: New Delhi, 2009.

D. REFERENCE BOOKS

1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds*.; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
8. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

9. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
10. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the fundamentals of various spectroscopic techniques
CO2	Understand Apply and Evaluate	To apply the fundamentals of spectroscopy in single and combination drug analysis
CO3	Understand and remember	To understand the chromatographic separation fundamentals
CO4	Understand Apply and Evaluate	To apply the fundamentals of various chromatographic techniques in single and combination drug analysis
CO5	Understand Apply and Evaluate	To learn theoretical and practical aspects of various analytical instruments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO2	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO3	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO4	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO5	3	2	1	1	-	2	1	1	1	-	3	3	1	1	-
Avg	3	1.2	1.8	1.4	-	1.6	0.6	1	1	-	3	2.6	0.6	0.6	-

M. PHARM. SEMESTER – I (MQA)
SUBJECT: QUALITY MANAGEMENT SYSTEM-THEORY (MQA102T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	0	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart fundamental knowledge and concepts about various quality management principles and systems utilized in the manufacturing industry. It also aids in understanding the quality evaluation in the pharmaceutical industries.

Objectives: At completion of this course, it is expected that students will be able to understand-

- The importance of quality
- ISO management systems
- Tools for quality improvement
- Analysis of issues in quality
- Quality evaluation of pharmaceuticals
- Stability testing of drug and drug substances
- Statistical approaches for quality

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	<p>Introduction to Quality: Evolution of Quality, Definition of Quality, Dimensions of Quality</p> <p>Quality as a Strategic Decision: Meaning of strategy and strategic quality management, mission and vision statements, quality policy, Quality objectives, strategic planning and implementation, McKinsey 7s model, Competitive analysis, Management commitment to quality</p> <p>Customer Focus: Meaning of customer and customer focus, Classification of customers, Customer focus, Customer perception of quality, Factors affecting customer perception, Customer requirements, Meeting customer needs and expectations, Customer satisfaction and Customer delight, Handling customer complaints, Understanding customer behavior, concept of internal and external customers. Case studies.</p> <p>Cost of Quality: Cost of quality, Categories of cost of Quality, Models of cost of quality, Optimising costs, Preventing cost of quality.</p>	12	CO1 CO3
[2]	<p>Pharmaceutical quality Management: Basics of Quality Management, Total Quality Management (TQM), Principles of Six sigma, ISO 9001:2008, 9001:2015, ISO 14001:2004, Pharmaceutical Quality Management – ICH Q10, Knowledge management, Quality Metrics, Operational Excellence and Quality Management Review. OSHAS guidelines, NABL certification and accreditation, CFR-21 part 11, WHO-GMP requirements.</p>	12	CO1 CO2 CO3
[3]	<p>Six System Inspection model: Quality Management system, Production system, Facility and Equipment system, Laboratory control system, Materials system, Packaging and labeling system. Concept of self inspection. Quality systems: Change Management/ Change control. Deviations, Out of Specifications (OOS), Out of Trend (OOT), Complaints - evaluation and handling, Investigation and determination of root cause,</p>	12	CO4

	Corrective & Preventive Actions (CAPA), Returns and Recalls, Vendor Qualification, Annual Product Reviews, Batch Review and Batch Release. Concept of IPQC, area clearance/ Line clearance.		
[4]	Drug Stability: ICH guidelines for stability testing of drug substances and drug products. Study of ICH Q8, Quality by Design and Process development report Quality risk management: Introduction, risk assessment, risk control, risk review, risk management tools, HACCP, risk ranking and filtering according to ICH Q9 guidelines.	12	CO5
[5]	Statistical Process control (SPC): Definition and Importance of SPC, Quality measurement in manufacturing, Statistical control charts - concepts and general aspects, Advantages of statistical control, Process capability, Estimating Inherent or potential capability from a control chart analysis, Measuring process control and quality improvement, Pursuit of decreased process variability.	08	CO1 CO3 CO4
[6]	Regulatory Compliance through Quality Management and development of Quality Culture Benchmarking: Definition of benchmarking, Reasons for benchmarking, Types of Benchmarking, Benchmarking process, Advantages of benchmarking, Limitations of benchmarking.	04	CO1 CO3 CO4

C. TEXT BOOKS

1. Fairfield-Sonn, J. W. Corporate Culture and the Quality Organization; Quorum Books: Westport, Conn., 2001.

D. REFERENCE BOOKS

1. Endres, A. C. Implementing Juran's Road Map for Quality Leadership : Benchmarks and Results; Wiley: New York, 2000.
2. Antony J, David P, Routledge, Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases, 2002
3. Okes D, Root Cause Analysis, The Core of Problem Solving and Corrective Action, 2009, ASQ Publications.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand importance of quality and Tools for quality improvement
CO2	Understand	To study the ISO management systems
CO3	Understand and Apply	To understand the Analysis of issues in quality and Statistical approaches for quality
CO4	Understand and Remember	To study the Quality evaluation of pharmaceuticals
CO5	Understand and Apply	To understand the Stability testing of drug and drug substances

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	1	2	1	2	2	1	2	2	2	2	2
CO2	3	3	3	3	1	3	0	2	1	2	3	3	3	3	3
CO3	3	2	2	2	1	2	0	2	2	1	2	2	2	2	2
CO4	3	3	3	3	1	3	1	2	1	2	3	3	3	3	3
CO5	3	3	3	3	1	3	0	2	2	2	3	3	3	3	3
Avg	3	2.6	2.6	2.6	1	2.6	0.4	2	1.6	1.6	2.6	2.6	2.6	2.6	2.6

M. PHARM. SEMESTER – I (MQA)
SUBJECT: QUALITY CONTROL AND QUALITY ASSURANCE (MQA103T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	0	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications, GLP and regulatory affairs.

Objectives: Upon completion of this course the student should be able to

Understand the cGMP aspects in a pharmaceutical industry

- To appreciate the importance of documentation
- To understand the scope of quality certifications applicable to
- Pharmaceutical industries
- To understand the responsibilities of QA & QC departments.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction: Concept and evolution and scopes of Quality Control and Quality Assurance, Good Laboratory Practice, GMP, Overview of ICH Guidelines - QSEM, with special emphasis on Q-series guidelines. Good Laboratory Practices: Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non clinical testing, control on animal house, report preparation and documentation. CPCSEA guidelines.	12	CO1 CO2 CO5
[2]	cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention(PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination and Good Warehousing Practice.	12	CO1 CO2 CO5
[3]	Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), Developing specification (ICH Q6 and Q3), purchase specifications and maintenance of stores for raw materials. In process quality control and finished products quality control for following dosage forms in Pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products (How to refer pharmacopoeias).	12	CO1 CO2 CO4 CO5
[4]	Documentation in pharmaceutical industry: Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles- How to maintain, retention and retrieval etc. Standard operating procedures (How to write), Master Batch Record, Batch Manufacturing Record, Quality audit plan and reports. Specification and test procedures, Protocols and reports. Distribution records. Electronic data handling. Concepts of controlled and uncontrolled documents. Submission documents for regulators DMFs, as Common Technical	12	CO2 CO3 CO5

	Document and Electronic Common Technical Documentation (CTD, eCTD). Concept of regulated and non regulated markets.		
[5]	Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging, reprocessing, salvaging, handling of waste and scrap disposal. Introduction, scope and importance of intellectual property rights. Concept of trade mark, copyright and patents.	12	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Quality Assurance of Pharmaceuticals- A compedium of Guide lines and Related materials Vol I & II, 2 nd edition, WHO Publications, 1999.

D. REFERENCE BOOKS

1. Weinberg, S. Good Laboratory Practice Regulations; M. Dekker: New York, 1995.
2. Sarker, D. K. *Quality Systems and Control for Pharmaceuticals*; John Wiley & Sons: Chichester, West Sussex ; Hoboken, Nj, 2008.
3. Willig, S. H.; Stoker, J. R. *Good Manufacturing Practices for Pharmaceuticals : A Plan for Total Quality Control*; Marcel Dekker: New York, 1997.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To Understand the cGMP aspects in a pharmaceutical industry
CO2	Understand	To appreciate the importance of documentation
CO3	Understand and apply	To understand the scope of quality certifications applicable to pharmaceutical industries
CO4	Understand and evaluate	To Analyse of raw materials, finished products, packaging materials in process quality control (IPQC)
CO5	Understand and apply	To understand the responsibilities of QA & QC departments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	1	2	1	2	2	1	3	3	3	2	1
CO2	3	2	2	2	1	2	1	2	1	2	3	3	3	3	1
CO3	3	2	2	2	1	2	-	2	2	1	3	3	3	2	1
CO4	3	2	2	2	2	3	1	2	1	3	3	3	3	3	1
CO5	3	2	2	2	3	3	-	2	2	3	3	3	3	3	1
Avg	3	2	2	2	1.6	2.4	0.6	2	1.6	2	2.6	3	3	2.6	1

M. PHARM. SEMESTER – I (MPH)**SUBJECT: PRODUCT DEVELOPMENT AND TECHNOLOGY TRANSFER (MQA104T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Scope This deal with technology transfer covers the activities associated with Drug Substance, Drug Product and analytical tests and methods, required following candidate drug selection to completion of technology transfer from R&D to the first receiving site and technology transfer related to post-marketing changes in manufacturing places.

Objectives: Upon completion of this course the student should be able to

- To understand the new product development process
- To understand the necessary information to transfer technology from R&D to actual manufacturing by sorting out various information obtained during R&D
- To elucidate necessary information to transfer technology of existing products between various manufacturing places

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Principles of Drug discovery and development: Introduction, Clinical research process. Development and informational content for Investigational New Drugs Application (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Supplemental New Drug Application (SNDA), Scale Up Post Approval Changes (SUPAC) and Bulk active chemical Post approval changes (BACPAC), Post marketing surveillance, Product registration guidelines – CDSCO, USFDA.	12	CO1 CO2
[2]	Pre-formulation studies: Introduction/concept, organoleptic properties, purity, impurity profiles, particle size, shape and surface area. Solubility, Methods to improve solubility of Drugs: Surfactants & its importance, co-solvency. Techniques for the study of Crystal properties and polymorphism. Pre-formulation protocol, Stability testing during product development.	12	CO3 CO4
[3]	Pilot plant scale up: Concept, Significance, design, layout of pilot plant scales up study, operations, large scale manufacturing techniques (formula, equipment, process, stability and quality control) of solids, liquids, semisolid and parenteral dosage forms. New era of drug products: opportunities and challenges.	12	CO1 CO2
[4]	Pharmaceutical packaging: Pharmaceutical dosage form and their packaging requirements, Pharmaceutical packaging materials, Medical device packaging, Enteral Packaging, Aseptic packaging systems, Container closure systems, Issues facing modern drug packaging, Selection and evaluation of Pharmaceutical packaging materials. Quality control test: Containers, closures and secondary packing materials.	12	CO3 CO4

[5]	Technology transfer: Development of technology by R & D, Technology transfer from R & D to production, Optimization and Production, Qualitative and quantitative technology models. Documentation in technology transfer: Development report, technology transfer plan and Exhibit.	12	CO5
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C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.

D. REFERENCE BOOKS

1. Smith, C. G.; O'donnell, J. The Process of New Drug Discovery and Development; Informa Healthcare: New York, 2006.
2. Willig, S. H.; Tuckerman, M. M.; Hitchings, W. S. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control; M. Dekker: New York, 1982.
3. Lieberman, H. A. Pharmaceutical Dosage Forms. Tablets, Vol. 1-3; New York, Ny Dekker, 1989.
4. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics; Pharmamed Press: Hyderabad, India, 2013.
5. Vandana Patravale; Disouza, J. I.; Maharukh Rustomjee. Pharmaceutical Product Development: Insights into Pharmaceutical Processes, Management and Regulatory Affairs; CRC Press: Boca Raton, 2016.
6. Abdou, H. M. Dissolution, Bioavailability and Bioequivalence; Mack Publishing Company: Easton, 1989.
7. Remington, J. P.; Gennaro, A. R. Remington: The Science and Practice of Pharmacy; Lippincott Williams & Wilkins: Baltimore, Md., 2000.
8. Dr. D.A.Savant. The Pharmaceutical Sciences; the Pharma Path Way 'Pure and Applied Pharmacy; Pragathi Books Pvt. Ltd, 2018.
9. Dean, D. A.; Evans, E. R.; Hall, I. H. Pharmaceutical Packaging Technology.; Taylor And Francis: London, 2000.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand new drug approval process and product registration guideline
CO2	Understand and Apply	To understand and apply preformulation studies in drug product development.
CO3	Understand	To understand development of drug product from R&D to Large scale manufacturing.
CO4	Understand and Evaluate	To understand and evaluate packaging requirement for drug products.
CO5	Understand and Create	To understand regulation for technology transfer for drug product development

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	3	-	3	3	0	3	3	2	2	-
CO2	3	3	3	3	-	1	-	3	0	0	3	3	3	3	1
CO3	3	3	1	3	3	3	3	3	3	3	3	3	3	2	2
CO4	3	-	3	3	-	0	1	0	1	2	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	2	3	3	3	3	2
Avg	3	2.4	2	3	1.2	2	1.4	2.4	2	1.4	3	3	2.8	2.6	1.4

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Master of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table – 2: Course of study for M. Pharm. (Pharmaceutics)

Course Code	Course	Credit Hours	Credit Points	Hrs./week	Marks
Semester I					
MPH101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPH102T	Drug Delivery System	4	4	4	100
MPH103T	Modern Pharmaceutics	4	4	4	100
MPH104T	Regulatory Affair	4	4	4	100
MPH105P	Pharmaceutics Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPH201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	4	4	4	100
MPH202T	Advanced Biopharmaceutics & Pharmacokinetics	4	4	4	100
MPH203T	Computer Aided Drug Delivery System	4	4	4	100
MPH204T	Cosmetic and Cosmeceuticals	4	4	4	100
MPH205P	Pharmaceutics Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650

**Table – 12: Course of study for M. Pharm. III Semester
(Common for All Specializations)**

Course Code	Course	Credit Hours	Credit Points
MRM 301T	Research Methodology and Biostatistics*	4	4
-	Journal club	1	1
-	Discussion / Presentation (Proposal Presentation)	2	2
-	Research Work	28	14
Total		35	21

* Non University Exam

**Table – 13: Course of study for M. Pharm. IV Semester
(Common for All Specializations)**

Course Code	Course	Credit Hours	Credit Points
-	Journal Club	1	1
-	Research Work	31	16
-	Discussion/Final Presentation	3	3
Total		35	20

Table – 14: Semester wise credits distribution

Semester	Credit Points
I	26
II	26
III	21
IV	20
Co-curricular Activities (Attending Conference, Scientific Presentations and Other Scholarly Activities)	Minimum=02 Maximum=07*
Total Credit Points	Minimum=95 Maximum=100*

*Credit Points for Co-curricular Activities

M. PHARM. SEMESTER – I (MPH)**SUBJECT: MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES – THEORY (MPH101T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	--	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives: After completion of course student is able to know about

- Chemicals and excipients
- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier -Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation. c. Spectrofluorimetric: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	11	CO1 CO2 CO5
[2]	NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³ C NMR. Applications of NMR spectroscopy	11	CO1 CO2 CO5
[3]	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	11	CO1 CO2 CO5
[4]	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: <ul style="list-style-type: none">• Thin Layer chromatography• Paper Chromatography	11	CO3 CO4 CO5

	<ul style="list-style-type: none"> ● Ion exchange chromatography ● Column chromatography ● Gas chromatography ● High Performance Liquid chromatography ● Affinity chromatography 		
[5]	a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.	11	CO5
[6]	Immunological assays : RIA (Radio immuno assay), ELISA, Bioluminescence assays.	05	CO5

C. TEXT BOOKS

1. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..
2. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis*.; Pearson: New Delhi, 2009.

D. REFERENCE BOOKS

1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds*.; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
8. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
9. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.
10. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the fundamentals of various spectroscopic techniques
CO2	Understand Apply and Evaluate	To apply the fundamentals of spectroscopy in single and combination drug analysis
CO3	Understand and remember	To understand the chromatographic separation fundamentals
CO4	Understand Apply and Evaluate	To apply the fundamentals of various chromatographic techniques in single and combination drug analysis
CO5	Understand Apply and Evaluate	To learn theoretical and practical aspects of various analytical instruments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO2	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO3	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO4	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO5	3	2	1	1	-	2	1	1	1	-	3	3	1	1	-
Avg	3	1.2	1.8	1.4	-	1.6	0.6	1	1	-	3	2.6	0.6	0.6	-

M. PHARM. SEMESTER – I (MPH)
SUBJECT: DRUG DELIVERY SYSTEMS (MPH102T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

Objectives: Upon completion of the course, student shall be able to understand

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of delivering system
- The formulation and evaluation of Novel drug delivery systems

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Sustained Release (SR) and Controlled Release (CR) formulations: Introduction & basic concepts, advantages/ disadvantages, factors influencing, Physicochemical & biological approaches for SR/CR formulation, Mechanism of Drug Delivery from SR/CR formulation. Polymers: introduction, definition, classification, properties and application Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, And Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy.	10	CO5 CO2
[2]	Rate Controlled Drug Delivery Systems: Principles & Fundamentals, Types, Activation; Modulated Drug Delivery Systems; Mechanically activated, pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems Feedback regulated Drug Delivery Systems; Principles & Fundamentals.	10	CO5 CO2
[3]	Gastro-Retentive Drug Delivery Systems: Principle, concepts advantages and disadvantages, Modulation of GI transit time approaches to extend GI transit. Buccal Drug Delivery Systems: Principle of muco adhesion, advantages and disadvantages, Mechanism of drug permeation, Methods of formulation and its evaluations.	10	CO1 CO3 CO4
[4]	Ocular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers.	06	CO1 CO3 CO4
[5]	Transdermal Drug Delivery Systems: Structure of skin and barriers, Penetration enhancers, Transdermal Drug Delivery Systems, Formulation and evaluation.	10	CO1 CO3 CO4
[6]	Protein and Peptide Delivery: Barriers for protein delivery. Formulation and Evaluation of delivery systems of proteins and other macromolecules.	08	CO1 CO3 CO4
[7]	Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines.	06	CO1 CO3 CO4

C. TEXT BOOKS

1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002

D. REFERENCE BOOKS

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York, Chichester/Weinheim

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand the various approaches for development of novel drug delivery system
CO2	Learn	To learn the criteria for selection of drugs and polymers for the development of delivery system
CO3	Learn	To learn the formulation and evaluation of Novel drug delivery systems.
CO4	Analyse	Analyse various evaluation parameters for oral, parenteral, topical etc. drug delivery systems
CO5	Understand and analyse	Explain the principles and technology used in the design of sustained release and controlled release drug delivery systems

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	2	-	2	2	3	1	3	3	2	2
CO2	3	2	2	2	-	3	-	2	2	2	2	2	3	2	2
CO3	3	2	3	3	-	2	-	3	2	2	3	3	3	2	2
CO4	3	2	3	3	-	2	-	2	2	2	2	3	3	3	3
CO5	3	2	2	2	-	2	-	3	2	3	3	3	3	2	3
Avg	3	2	2.4	2.4	-	2.2	-	2.4	2	2.4	2.2	2.8	3	2.2	2.4

M. PHARM. SEMESTER – I (MPH)
SUBJECT: MODERN PHARMACEUTICS (MPH103T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course designed to impart advanced knowledge and skills required to learn various aspects and concepts at pharmaceutical industries.

Objectives: Upon completion of the course, student shall be able to understand

- The elements of preformulation studies.
- The Active Pharmaceutical Ingredients and Generic drug Product development
- Industrial Management and GMP Considerations.
- Optimization Techniques & Pilot Plant Scale Up Techniques
- Stability Testing, sterilization process & packaging of dosage forms.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Preformation Concepts – Drug Excipient interactions - different methods, kinetics of stability, Stability testing. Theories of dispersion and pharmaceutical Dispersion (Emulsion and Suspension, SMEDDS) preparation and stability Large and small volume parental – physiological and formulation consideration, Manufacturing and evaluation. b. Optimization techniques in Pharmaceutical Formulation: Concept and parameters of optimization, Optimization techniques in pharmaceutical formulation and processing. Statistical design, Response surface method, Contour designs, Factorial designs and application in formulation	20	CO1 CO4
[2]	Validation: Introduction to Pharmaceutical Validation, Scope & merits of Validation, Validation and calibration of Master plan, ICH & WHO guidelines for calibration and validation of equipments, Validation of specific dosage form, Types of validation. Government regulation, Manufacturing Process Model, URS, DQ, IQ, OQ & P.Q. of facilities.	10	CO2 CO3
[3]	cGMP & Industrial Management: Objectives and policies of current good manufacturing practices, layout of buildings, services, equipments and their maintenance Production management: Production organization, , materials management, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control, industrial and personal relationship. Concept of Total Quality Management.	10	CO2 CO3
[4]	Compression and compaction: Physics of tablet compression, compression, consolidation, effect of friction, distribution of forces, compaction profiles.	10	CO5
[5]	Study of Solubility parameters, Diffusion parameters, Dissolution parameters and Pharmacokinetic parameters, Heckle plots, Similarity factors – f2 and f1, Higuchi and Peppas plot, Linearity Concept of significance, Standard deviation, Chi square test, students T-test, ANOVA test.	10	CO5

C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013

D. REFERENCE BOOKS

1. Lieberman, H. A. *Pharmaceutical Dosage Forms Tablets, Vol. 1-3*; New York, Dekker, 1990.
2. Lieberman, H. A.; Rieger, M. M.; Banker, G. S. *Pharmaceutical Dosage Forms-- Disperse Systems. Volume 1-2*; Dekker: New York, 1998.
3. Avis, K. E.; Lieberman, H. A.; Lachman, L. *Pharmaceutical Dosage Forms: Parenteral Medications VOL 1-3*; M. Dekker: New York, 1992.
4. Banker, G. S.; Rhodes, C. T. *Modern Pharmaceutics*; Dekker: New York, 1996.
5. Remington, J. P.; Gennaro, A. R. *Remington's Pharmaceutical Sciences*; Mack Pub. Co: Easton, Pa., 1990.
6. Bean, H. S.; Carless, J. E.; Arnold Heyworth Beckett. *Advances in Pharmaceutical Sciences*; Academic Press: London, 1964.
7. Sinko, P. J.; Martin, A. N. *Martin's Physical Pharmacy Pharmaceutical Sciences: Physical Chemical Principles in the Pharmaceutical Sciences.*; Lippincott Williams & Wilkins: Philadelphia, 2006.
8. Arthur Owen Bentley; Ernest Alexander Rawlins. *Bentley's Textbook of Pharmaceutics.*; All India Traveller Book Seller: New Delhi, 2002.
9. Willig, S. H. *Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control from Manufacturer to Consumer*; Marcel Dekker, Inc: New York, N.Y., 2001.
10. Kohli, D. P. S.; Shah, D. H. *Drug Formulations Manual*; Business Horizons: New Delhi, 2012.
11. Sharma, P.P. *How to practice GMPs*. Vandana publication, 2001.
12. Berry, I. R.; Nash, R. A. *Pharmaceutical Process Validation*; Marcel Dekker: New York, 1993.
13. James Robert Evans. *Applied Production and Operations Management*; Info Access & Distribution: Singapore, 1994.
14. Swarbrick, J. *Encyclopedia of Pharmaceutical Technology*; Marcel Dekker: New York, Ny, 2004.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Learn	Learn the elements of preformulation studies.
CO2	Understand	Understand validations of processes and equipments used in Pharmaceutical Industry
CO3	Learn	Learn Industrial Management and GMP Considerations.
CO4	Understand and Remember	Understand and remember Optimization Techniques & Statistical designs
CO5	Understand and analyse	Understand physics of tablet compression and analyse dissolution & diffusion parameters

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
C01	3	2	2	2	-	2	-	2	2	2	1	3	2	1	1
C02	3	2	2	3	-	2	-	2	2	3	2	3	3	3	2
C03	3	1	2	2	-	3	-	3	2	3	2	3	3	3	2
C04	3	2	3	3	-	2	-	2	2	2	3	3	2	3	3
C05	3	3	3	3	-	2	-	2	2	2	2	3	1	3	3
Avg	3	2	2.4	2.6	-	2.2	-	2.2	2	2.4	2	3	2.2	2.6	2.2

M. PHARM. SEMESTER – I (MPH)
SUBJECT: REGULATORY AFFAIRS - THEORY (MPH104T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	--	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course designed to impart advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in different countries, different phases of clinical trials and submitting regulatory documents: filing process of IND, NDA and ANDA

Objectives: Upon completion of the course, it is expected that the students will be able to understand

- The Concepts of innovator and generic drugs, drug development process
- The Regulatory guidance's and guidelines for filing and approval process
- Preparation of Dossiers and their submission to regulatory agencies in different countries
- Post approval regulatory requirements for actives and drug products
- Submission of global documents in CTD/ eCTD formats
- Clinical trials requirements for approvals for conducting clinical trials
- Pharmacovigilance and process of monitoring in clinical trials.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Documentation in Pharmaceutical industry: Master formula record, DMF (Drug Master File), distribution records. Generic drugs product development Introduction , Hatch- Waxman act and amendments, CFR (CODE OF FEDERAL REGULATION) ,drug product performance, in-vitro, ANDA regulatory approval process, NDA approval process, BE and drug product assessment, in –vivo, scale up process approval changes, post marketing surveillance, outsourcing BA and BE to CRO. b. Regulatory requirement for product approval: API, biologics, novel, therapies obtaining NDA, ANDA for generic drugs ways and means of US registration for foreign drugs	15	CO1 CO2 CO3 CO4
[2]	CMC, post approval regulatory affairs. Regulation for combination products and medical devices.CTD and ECTD format, industry and FDA liaison. ICH - Guidelines of ICH-Q, S E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries.	15	CO2 CO3
[3]	Non clinical drug development: Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier, dossier (IMPD) and investigator brochure (IB).	15	CO2 CO5
[4]	Clinical trials: Developing clinical trial protocols. Institutional review board/ independent ethics committee Formulation and working procedures informed Consent process and procedures. HIPAA- new, requirement to clinical study process, • pharmacovigilance safety monitoring in clinical trials.	15	CO2 CO5

C. TEXT BOOKS

1. Berry, I. R.; Martin, R. P. *The Pharmaceutical Regulatory Process*; Informa Healthcare: New York, 2008.
2. Guarino, R. A. *New Drug Approval Process*; Informa Healthcare, Cop: New York, 2009.

D. REFERENCE BOOKS

1. Kanfer, I.; Shargel, L. *Generic Drug Product Development : Solid Oral Dosage Forms*; Marcel Dekker: New York, 2005.
2. Weinberg, S. *Guidebook for Drug Regulatory Submissions*; Wiley: Hoboken, N.J., 2009.
3. Pisano, D. J. *FDA Regulatory Affairs : A Guide for Prescription Drugs, Medical Devices, and Biologics*; Informa Healthcare Usa: New York, 2008.
4. Rozovsky, F. A.; Adams, R. K. *Clinical Trials and Human Research : A Practical Guide to Regulatory Compliance*; Jossey-Bass: San Francisco, 2003.
5. Administration, A. G. D. of H. T. G. TGA basics <http://www.tga.gov.au/tga-basics>
6. Your gateway to the European Union http://europa.eu/index_en.htm.
7. ICH Official web site : ICH <http://www.ich.org/>.
8. Commissioner, O. of the. U.S. Food and Drug Administration <http://www.fda.gov/>.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the Concepts of innovator and generic drugs, drug development process
CO2	Understand and Apply	To understand the Regulatory guidance and guidelines for filing and approval process
CO3	Understand and remember	To understand Preparation of Dossiers and their submission to regulatory agencies in different countries in CTD/ eCTD formats
CO4	Understand and remember	To understand Post approval regulatory requirements for actives and drug products
CO5	Understand and remember	To acquire knowledge about Non-clinical development, Clinical trials requirements, Pharmacovigilance and process of monitoring in clinical trials.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	2	2	3	3	-	3	-	3	2	-
CO2	3	-	-	-	-	2	2	3	2	-	3	-	3	2	-
CO3	3	-	-	-	1	2	2	3	2	-	3	-	3	2	-
CO4	3	-	-	-	-	2	2	3	3	-	3	-	3	-	-
CO5	3	2	1	1	1	2	2	3	3	-	3	-	1	2	1
Avg	3	0.4	0.2	0.2	0.4	2	2	3	2.6	-	3	-	2.6	1.6	0.2

M. PHARM. SEMESTER – I (MPH)
SUBJECT: PHARMACEUTICS PRACTICAL – I (MPH105P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	12	12	6	100	30	20	-	150

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge and skills on analytical techniques and development of various NDDS dosage forms

Objectives: objectives of the course is to make students able to

- Understand, learn and application of various spectrophotometric and chromatographic analytical methods in analysis of drugs and drug products.
- Application of preformulation concepts in Preparation, characterization and evaluation of conventional and novel drug delivery systems

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Analysis of pharmacopoeial compounds and their formulations by UV Vis-spectrophotometer 1. Simultaneous estimation of multi component containing formulations by UV spectrophotometry 2. Experiments based on HPLC 3. Experiments based on Gas Chromatography 4. Estimation of riboflavin/quinine sulphate by fluorimetry 5. Estimation of sodium/potassium by flame photometry	90	CO1 CO2
[2]	1. To perform In-vitro dissolution profile of CR/ SR marketed formulation 2. Formulation and evaluation of sustained release matrix tablets 3. Formulation and evaluation osmotically controlled DDS 4. Preparation and evaluation of Floating DDS- hydro dynamically balanced DDS 5. Formulation and evaluation of Muco adhesive tablets. 6. Formulation and evaluation of trans dermal patches. 7. To carry out preformulation studies of tablets. 8. To study the effect of compressional force on tablets disintegration time. 9. To study Micromeritic properties of powders and granulation. 10. To study the effect of particle size on dissolution of a tablet. 11. To study the effect of binders on dissolution of a tablet. 12. To plot Heckal plot, Higuchi and peppas plot and determine similarity factors.	90	CO2 CO3 CO4 CO5

C. TEXT BOOKS

D. REFERENCE BOOKS

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Assessment	Assessment of the drug/s using various spectroscopic and chromatographic techniques
CO2	Learn	Handling and operations of various analytical instruments
CO3	understand	Preparation and evaluation of modified release drug delivery systems
CO4	Understand and Remember	To understand effect of various excipients and process parameters on various dosage forms
CO5	Understand and apply	application of the various model dependent and model independent approaches for the assessment of dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	1	2	1	2	2	2	1	3	1	1	1
CO2	3	3	2	2	2	3	2	3	2	3	2	3	2	2	2
CO3	3	3	3	2	2	2	1	3	2	3	2	3	3	2	2
CO4	3	3	3	3	1	2	1	2	2	2	3	3	3	3	3
CO5	3	3	3	3	1	2	1	2	2	3	2	3	3	3	3
Avg	3	3	2.6	2.6	1.4	2.2	1.2	2.4	2	2.6	2	3	2.4	2.2	2.2

M. PHARM. SEMESTER – II (MPH)
SUBJECT: MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY & TARGETED DDS) (NTDS) (MPH201T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

Objectives: Upon completion of the course, student shall be able to understand

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of delivering system
- The formulation and evaluation of novel drug delivery systems

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Targeted Drug Delivery Systems: Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery.	12	CO5
[2]	Targeting Methods: introduction preparation and evaluation. Nano Particles & Liposomes: Types, preparation and evaluation.	12	CO5 CO3
[3]	Micro Capsules / Micro Spheres: Types, preparation and evaluation, Monoclonal Antibodies; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes.	12	CO2 CO3
[4]	Pulmonary Drug Delivery Systems : Aerosols, propellents, Containers Types, preparation and evaluation, Intra Nasal Route Delivery systems; Types, preparation and evaluation.	12	CO1 CO2
[5]	Nucleic acid based therapeutic delivery system : Gene therapy, introduction (ex-vivo & in-vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and nonviral gene transfer). Liposomal gene delivery systems. Biodistribution and Pharmacokinetics. knowledge of therapeutic antisense molecules and aptamers as drugs of future.	12	CO4

C. TEXT BOOKS

1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002

D. REFERENCE BOOKS

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York, Chichester/Weinheim

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand the various approaches for development of novel drug delivery systems.
CO2	Learn	To learn the criteria for selection of drugs and polymers for the development of NDDS
CO3	Understand	To understand the concepts of formulation and evaluation of Nano carrier-based drug delivery systems.
CO4	learn	To learn the nucleic acid-based drug delivery systems.
CO5	Understand and analyse	To understand concepts and methods of targeted drug delivery systems.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	2	-	2	2	3	1	3	3	2	2
CO2	3	3	3	3	-	2	-	2	2	2	1	2	3	2	2
CO3	3	2	3	2	-	2	-	3	2	2	3	2	3	2	3
CO4	3	2	2	2	-	2	-	2	2	2	3	2	3	3	2
CO5	3	2	2	2	-	2	-	3	2	3	3	3	3	2	3
Avg	3	2.2	2.4	2.2	-	2	-	2.4	2	2.4	2.2	2.4	3	2.2	2.4

M. PHARM. SEMESTER – II (MPH)**SUBJECT: ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS (MPH202T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge and skills necessary for dose calculations, dose adjustments and to apply biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of biopharmaceutics and pharmacokinetics are provided to help the students to clarify the concepts.

Objectives: Upon completion of this course it is expected that students will be able understand,

- The basic concepts in biopharmaceutics and pharmacokinetics. The use raw data and derive the pharmacokinetic models and parameters the best describe the process of drug absorption, distribution, metabolism and elimination.
- The critical evaluation of biopharmaceutic studies involving drug product equivalency.
- The design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.
- The potential clinical pharmacokinetic problems and application o basics of pharmacokinetic

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Drug Absorption from the Gastrointestinal Tract: Gastrointestinal tract, Mechanism of drug absorption, Factors affecting drug absorption, pH–partition theory of drug absorption. Formulation and physicochemical factors: Dissolution rate, Dissolution process, Noyes–Whitney equation and drug dissolution, Factors affecting the dissolution rate. Gastrointestinal absorption: role of the dosage form: Solution (elixir, syrup and solution) as a dosage form, Suspension as a dosage form, Capsule as a dosage form, Tablet as a dosage form, Dissolution methods ,Formulation and processing factors, Correlation of in vivo data with in vitro dissolution data. Transport model: Permeability-Solubility-Charge State and the pH Partition Hypothesis, Properties of the Gastrointestinal Tract (GIT), pH Microclimate Intracellular pH Environment, Tight-Junction Complex.	12	CO1 CO2
[2]	Biopharmaceutic considerations in drug product design and In Vitro Drug Product Performance: Introduction, biopharmaceutic factors affecting drug bioavailability, rate-limiting steps in drug absorption, physicochemical nature of the drug formulation factors affecting drug product performance, in vitro: dissolution and drug release testing, compendial methods of dissolution, alternative methods of dissolution testing, meeting dissolution requirements, problems of variable control in dissolution testing performance of drug products. In vitro–in vivo correlation, dissolution profile comparisons, drug product stability, considerations in the design of a drug product.	12	CO1 CO2
[3]	Pharmacokinetics: Basic considerations, pharmacokinetic models, compartment modeling: one compartment model- IV bolus, IV infusion,	12	CO3

	extra-vascular. Multi compartment model: two compartment - model in brief, non-linear pharmacokinetics: cause of non-linearity, Michaelis – Menten equation, estimation of k _{max} and v _{max} . Drug interactions: introduction, the effect of protein binding interactions, the effect of tissue-binding interactions, cytochrome p450-based drug interactions, drug interactions linked to transporters.		
[4]	Drug Product Performance, In Vivo: Bioavailability and Bioequivalence: drug product performance, purpose of bioavailability studies, relative and absolute availability. Methods for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, crossover study designs, evaluation of the data, bioequivalence example, study submission and drug review process. Biopharmaceutics classification system, methods. Permeability: In-vitro, in-situ and In-vivo methods. Generic biologics (biosimilar drug products), clinical significance of bioequivalence studies, special concerns in bioavailability and bioequivalence studies, generic substitution.	12	CO4
[5]	Application of Pharmacokinetics: Modified-Release Drug Products, Targeted Drug Delivery Systems and Biotechnological Products. Introduction to Pharmacokinetics and pharmacodynamic, drug interactions. Pharmacokinetics and pharmacodynamics of biotechnology drugs. Introduction, Proteins and peptides, Monoclonal antibodies, Oligonucleotides, Vaccines (immunotherapy), Gene therapies.	12	CO5

C. TEXT BOOKS

1. Jaiswal, Sunil B., and Brahmankar, D. M.. Biopharmaceutics and Pharmacokinetics: A Treatise. India, Vallabh Prakashan, 2005.

D. REFERENCE BOOKS

1. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics. India: Pharmamed Press. 2005.
2. Yu, Andrew B.C., and Shargel, Leon. Applied Biopharmaceutics & Pharmacokinetics, Seventh Edition. Singapore, McGraw-Hill Education, 2015.
3. Gibaldi, Milo, and Perrier, Donald. Pharmacokinetics., 2nd edition, Marcel Dekker Inc., New York, 1982
4. Swarbrick. J. Current Concepts in the Pharmaceutical Sciences: Biopharmaceutics. United States: Lea & Febiger. 1970.
5. Malcolm Rowland and Thom N. Tozer. Clinical Pharmacokinetics, Concepts and Applications. 3rd edition. Lea and Febiger, Philadelphia, 1995
6. Abdou. H.M, Dissolution, Bioavailability and Bioequivalence, Mack Publishing Company, Pennsylvania 1989
7. Robert. E. Notari. Biopharmaceutics and Clinical Pharmacokinetics, An Introduction, 4th edition, Marcel Dekker Inc, New York and Basel, 1987.
8. John. G Wagner and M. Pamarowski. Biopharmaceutics and Relevant Pharmacokinetics, 1st edition, Drug Intelligence Publications, Hamilton, Illinois, 1971.
9. James Swarbrick, James. G. Boylan. Encyclopedia of Pharmaceutical Technology, Vol 13, Marcel Dekker Inc, New York, 1996.
10. Sunil S Jambhekar and Philip J Breen. Basic Pharmacokinetics, 1st edition, pharmaceutical press, RPS Publishing, 2009.
11. Alex Avdeef. Absorption and Drug Development- Solubility, Permeability, and Charge State, John Wiley & Sons, Inc, 2003.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand basic concepts and factors affecting of absorption of drugs form GIT and bioavailability.
CO2	Understand and Apply	Understand and apply biopharmaceutic considerations and in-vitro dissolution in drug product design.
CO3	Understand and Utilize	Understand and utilize the pharmacokinetic models for the determination of pharmacokinetic parameters.
CO4	Understand, Analyze and Evaluate	Understand and analyze the bioavailability of a drug and evaluate the bioequivalence between drug products.
CO5	Remember and Understand	Remember and Understand applications of biopharmaceutics and apply in designing dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	1	2	1	1	3	2	2	3	2	3	2
CO2	3	2	3	2	1	3	2	2	2	2	3	3	3	3	2
CO3	2	1	2	3	1	2	2	2	1	1	2	2	3	3	3
CO4	3	2	2	2	1	2	1	1	3	2	3	3	2	3	2
CO5	3	2	3	3	1	2	2	2	2	2	2	3	3	3	2
Avg	2.8	1.6	2.4	2.4	1	2.2	1.6	1.6	2.2	1.8	2.4	2.8	2.6	3	2.2

M. PHARM. SEMESTER – II (MPH)
SUBJECT: COMPUTER AIDED DRUG DEVELOPMENT (MPH203T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge and skills necessary for computer Applications in pharmaceutical research and development who want to understand the application of computers across the entire drug research and development process. Basic theoretical discussions of the principles of more integrated and coherent use of computerized information (informatics) in the drug development process are provided to help the students to clarify the concepts.

Objectives: Upon completion of this course it is expected that students will be able to understand,

- History of Computers in Pharmaceutical Research and Development
- Computational Modeling of Drug Disposition
- Computers in Preclinical Development
- Optimization Techniques in Pharmaceutical Formulation
- Computers in Market Analysis
- Computers in Clinical Development
- Artificial Intelligence (AI) and Robotics
- Computational fluid dynamics (CFD)

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Computers in Pharmaceutical Research and Development: A General Overview: History of Computers in Pharmaceutical Research and Development. Statistical modeling in Pharmaceutical research and development: Descriptive versus Mechanistic Modeling, Statistical Parameters, Estimation, Confidence Regions, Nonlinearity at the Optimum, Sensitivity Analysis, Optimal Design, Population Modeling b. Quality-by-Design in Pharmaceutical Development: Introduction, ICH Q8 guideline, Regulatory and industry views on QbD, Scientifically based QbD - examples of application.	12	CO1 CO2
[2]	Computational Modeling of Drug Disposition: Introduction, Modeling Techniques: Drug Absorption, Solubility, Intestinal Permeation, Drug Distribution, Drug Excretion, Active Transport; P-gp, BCRP, Nucleoside Transporters, hPEPT1, ASBT, OCT, OATP, BBB-Choline Transporter.	12	CO3 CO4
[3]	Computer-aided formulation development: Concept of optimization, Optimization parameters, Factorial design, Optimization technology & Screening design. Computers in Pharmaceutical Formulation: Development of pharmaceutical emulsions, microemulsion drug carriers Legal Protection of Innovative Uses of Computers in R&D, The Ethics of Computing in Pharmaceutical Research, Computers in Market analysis	12	CO1 CO2

[4]	a. Computer-aided biopharmaceutical characterization: Gastrointestinal absorption simulation. Introduction, Theoretical background, Model construction, Parameter sensitivity analysis, Virtual trial, Fed vs. fasted state, In vitro dissolution and in-vitro-in-vivo correlation, Biowaiver considerations b. Computer Simulations in Pharmacokinetics and Pharmacodynamics: Introduction, Computer Simulation: Whole Organism, Isolated Tissues, Organs, Cell, Proteins and Genes. c. Computers in Clinical Development: Clinical Data Collection and Management, Regulation of Computer Systems	12	CO3 CO4
[5]	Artificial Intelligence (AI), Robotics and Computational fluid dynamics: General overview, Pharmaceutical Automation, Pharmaceutical applications, Advantages and Disadvantages. Current Challenges and Future Directions.	12	CO5

C. TEXT BOOKS

1. Ekins, S. Computer Applications in Pharmaceutical Research and Development
Ekins/Computer Applications in Pharmaceutical Research and Development; Hoboken, Nj, USA John Wiley & Sons, Inc, 2006.

D. REFERENCE BOOKS

1. Jelena Djuris. Computer-Aided Applications in Pharmaceutical Technology; Woodhead Publishing: Oxford, 2013.
2. Swarbrick, J. Encyclopaedia of Pharmaceutical Technology; Vol 1-3; Marcel Dekker: New York, Ny, 2004.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To know role of computers and application of statistical modeling in pharmaceutical research.
CO2	Understand and Apply	To understand application of QbD and optimization techniques in pharmaceutical product development.
CO3	Understand	To know computational modeling techniques of drug disposition and biopharmaceutical process.
CO4	Understand and Remember	To know and understand application of computers modeling techniques in pharmacokinetic and pharmacodynamic of drugs.
CO5	Understand and Remember	To understand artificial intelligence in development of drug product.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	3	-	-	-	-	2	-	3	-	3	0	3
CO2	3	2	3	3	-	-	3	3	2	-	3	-	3	1	3
CO3	3	2	2	3	-	-	3	3	3	-	3	-	3	3	3
CO4	3	2	2	3	-	-	3	3	3	-	3	2	3	3	3
CO5	3	1	2	3	-	-	3	2	2	-	3	3	3	0	3
Avg	3	1.6	2	3	-	-	2.4	2.2	2.4	-	3	1	3	1.4	3

M. PHARM. SEMESTER – II (MPH)
SUBJECT: COSMETIC AND COSMECEUTICALS (MPH204T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge and skills necessary for the fundamental need for cosmetic and cosmeceutical products.

Objectives: Upon completion of the course the student shall be able to

- Key ingredients used in cosmetics and cosmeceuticals.
- Key building blocks for various formulations.
- Current technologies in the market
- Various key ingredients and basic science to develop cosmetics and cosmeceuticals.
- Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Cosmetics – Regulatory : Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labeling of cosmetics Regulatory provisions relating to import of cosmetics., Misbranded and spurious cosmetics. Regulatory provisions relating to manufacture of cosmetics – Conditions for obtaining license, prohibition of manufacture and sale of certain cosmetics, loan license, offences and penalties.	12	CO3
[2]	Cosmetics - Biological aspects : Structure of skin relating to problems like dry skin, acne, pigmentation, prickly heat, wrinkles and body odor. Structure of hair and hair growth cycle. Common problems associated with oral cavity. Cleansing and care needs for face, eye lids, lips, hands, feet, nail, scalp, neck, body and under-arm.	12	CO1 CO4 CO5
[3]	Formulation Building blocks: Building blocks for different product formulations of cosmetics/cosmeceuticals. Surfactants – Classification and application. Emollients, rheological additives: classification and application. Antimicrobial used as preservatives, their merits and demerits. Factors affecting microbial preservative efficacy. Building blocks for formulation of a moisturizing cream, vanishing cream, cold cream, shampoo and toothpaste. Soaps and syndet bars. Perfumes; Classification of perfumes. Perfume ingredients listed as allergens in EU regulation. Controversial ingredients: Parabens, formaldehyde liberators, dioxane.	12	CO1 CO2 CO3 CO4 CO5
[4]	Design of cosmeceutical products: Sun protection, sunscreens classification and regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor., dandruff, dental cavities, bleeding gums, mouth odor and sensitive teeth through cosmeceutical formulations.	12	CO1 CO2 CO4 CO5
[5]	Herbal Cosmetics: Herbal ingredients used in Hair care, skin care and oral care. Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers. Challenges in formulating herbal cosmetics.	12	CO1 CO2 CO4 CO5

C. TEXT BOOKS

1. Butler, H.; Poucher, W. A. Poucher's Perfumes, Cosmetics, and Soaps.; Kluwer Academic Publishers: Dordrecht ; Boston, 2000.

D. REFERENCE BOOKS

1. Ralph Gordon Harry; Rosen, M. R. *Harry's Cosmeticology*; Chemical Publishing Company: New York, 2015.

3. Sharma, P. P.; Vandana Publications. *Cosmetics : Formulation, Manufacturing & Quality Control*; Vandana Publications: Delhi, 2018.

4. Barel, A. O.; Paye, M.; Maibach, H. I. *Handbook of Cosmetic Science and Technology*; Taylor & Francis: Boca Raton, 2014.

5 And, T. *CTFA Membership Directory.*; Cosmetic, Toiletry And Fragrance Association, Inc: Washington, D.C., 1981.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember, Understand and Evaluate	To understand the key ingredients used in cosmetics and cosmeceuticals.
CO2	Remember, Understand and Evaluate	To learn key building blocks for various formulations.
CO3	Understand Apply and Evaluate	To learn the current technologies and regulatory requirements of cosmetics in the market
CO4	Understand Remember and	To understand the various basic science to develop cosmetics and cosmeceuticals
CO5	Remember, Understand and Evaluate	To learn the scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	1	1	1	3	2	3	1	3	1	3	2
CO2	3	2	3	3	1	1	1	3	3	3	1	2	2	3	2
CO3	3	3	3	3	1	1	2	2	3	2	2	2	2	3	2
CO4	3	2	3	3	1	1	2	2	3	3	1	2	2	3	2
CO5	3	3	3	3	1	2	2	3	2	2	2	3	3	3	2
Avg	3	2.4	3	3	1	1.2	1.6	2.6	2.6	2.6	1.4	2.4	2	3	2

M. PHARM. SEMESTER – I (MPH)
SUBJECT: PHARMACEUTICS PRACTICAL – II (MPH205P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	12	12	6	100	30	20	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge and skills on analytical techniques and development of various NDDS dosage forms

Objectives: Upon completion of the course student shall be able

- Formulation and evaluation of different novel drug delivery systems
- Application of QbD principles in designing dosage form.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ol style="list-style-type: none"> 1. To study the effect of temperature change , non solvent addition, 2. incompatible polymer addition in microcapsules preparation 3. Preparation and evaluation of Alginate beads 4. Formulation and evaluation of gelatin /albumin microspheres 5. Formulation and evaluation of liposomes/niosomes 6. Formulation and evaluation of spherules 7. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique. 8. Comparison of dissolution of two different marketed products /brands 9. Development and evaluation of Creams 10. Development and evaluation of Shampoo and Toothpaste base 11. To incorporate herbal and chemical actives to develop products 12. To address Dry skin, acne, blemish, Wrinkles, bleeding gums and dandruff 	90	CO1 CO3 CO5
[2]	<ol style="list-style-type: none"> 1. Protein binding studies of a highly protein bound drug & poorly protein bound drug 2. Bioavailability studies of Paracetamol in animals. 3. Pharmacokinetic and IVIVC data analysis by WinnolineR software 4. In vitro cell studies for permeability and metabolism 5. DoE Using Design Expert® Software 6. Formulation data analysis Using Design Expert® Software 7. Quality-by-Design in Pharmaceutical Development 8. Computer Simulations in Pharmacokinetics and Pharmacodynamics 9. Computational Modeling Of Drug Disposition 10. To develop Clinical Data Collection manual 11. To carry out Sensitivity Analysis, and Population Modeling. 	90	CO2 CO4

C. TEXT BOOKS

D. REFERENCE BOOKS

E. COURSE OUTCOMES

(Minimum 5 Cos are required)

CO Number	Skill	Statement
CO1	understand and analyse	Formulate and characterize various novel drug delivery systems
CO2	Learn	Pharmacokinetic and IVIVC data analysis, simulation of pharmacokinetic using appropriate computational program/s
CO3	Understand	Preparation and characterization of cosmetic preparations, herbal active containing products and toiletry items
CO4	Understand and Remember	Applications of design of experiment software/s and Quality-by-Design in pharmaceutical development.
CO5	Understand and apply	Solubility improvement techniques & Dissolution profile comparison by various tools

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	1	2	2	2	2	2	1	3	3	1	1
CO2	3	3	2	2	2	3	2	3	2	3	2	2	3	3	3
CO3	3	3	3	2	2	2	2	3	2	3	2	3	3	2	1
CO4	3	3	3	3	1	2	1	2	2	2	3	2	3	2	3
CO5	3	3	3	3	1	2	2	2	2	3	2	2	3	3	3
Avg	3	3	2.6	2.6	1.4	2.2	1.8	2.4	2	2.6	2	2.4	3	2.2	2.2

M. PHARM. SEMESTER – III (MPH)**SUBJECT: RESEARCH METHODOLOGY AND BIOSTATISTICS -THEORY (MRM301T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: To understand the applications of Biostatistics in Pharmacy. This subject also deals to understand research methodology process, ethics in medical, clinical and pre-clinical research.

Objectives: Upon completion of the course the student shall be able to

- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems.
- To know and understand medical research and ethical practise in clinical and non-clinical research

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	General Research Methodology: Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques.	12	CO1
[2]	Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (students “t” test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxon rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values.	15	CO2
[3]	Medical Research: History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality.	15	CO3
[4]	CPCSEA guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anaesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals.	10	CO4
[5]	Declaration of Helsinki: History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.	08	CO3 CO5

C. TEXT BOOKS

1. Kothari, C R. Research Methodology: Methods & Techniques. New Delhi, New Age International (P) Ltd., Publishers, Cop, 2004.

D. REFERENCE BOOKS

1. Prabhat Pandey, and Meenu Mishra Pandey. Research Methodology: Tools & Techniques. New Delhi, Bridge Center, 2015.
2. De, James E. Basic Statistics and Pharmaceutical Statistical Applications. New York, Marcel Dekker, 1999.
3. "GUIDELINES: Committee for the Purpose of Control and Supervision of Experiments on Animals." Cpcsea.nic.in, cpcsea.nic.in/Content/55_1_GUIDELINES.aspx.
4. Ulf Schmidt, et al. Ethical Research: The Declaration of Helsinki, and the Past, Present and Future of Human Experimentation. New York, Ny, Oxford University Press, 2020.
5. World Medical Association. "WMA - the World Medical Association-Declaration of Helsinki." Wma.net, WMA - The World Medical Association-Declaration of Helsinki, 2014, www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/.

E. COURSE OUTCOMES

CO Number	Skill		Statement
CO1	Understand and Apply		To understand research methodology and application of study design in clinical research.
CO2	Remember, Understand and Apply		To learn and apply various biostatistical techniques in hypothesis testing of research.
CO3	Understand and Create		To know process of ethical medical research and protocol designing
CO4	Understand and Remember		To understand ethics and regulations use of animals in research.
CO5	Understand and Remember		To know ethics and regulation in clinical research.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	3	-	3	3	2	-	3	3	1	-	3
CO2	3	1	1	3	-	1	-	-	3	-	3	2	2	-	3
CO3	3	3	2	1	3	3	3	3	3	3	3	2	2	-	3
CO4	3	3	2	1	2	3	3	3	3	3	3	2	2	-	3
CO5	3	1	2	2	3	3	3	3	2	3	3	3	3	-	3
Avg	3	2	2	2	2.2	2	2.4	2.4	2.6	1.8	3	2.4	2	-	3

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Master of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table – 2: Course of study for M. Pharm. (Pharmaceutics)

Course Code	Course	Credit Hours	Credit Points	Hrs./week	Marks
Semester I					
MPH101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPH102T	Drug Delivery System	4	4	4	100
MPH103T	Modern Pharmaceutics	4	4	4	100
MPH104T	Regulatory Affair	4	4	4	100
MPH105P	Pharmaceutics Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPH201T	Molecular Pharmaceutics (Nano Tech and Targeted DDS)	4	4	4	100
MPH202T	Advanced Biopharmaceutics & Pharmacokinetics	4	4	4	100
MPH203T	Computer Aided Drug Delivery System	4	4	4	100
MPH204T	Cosmetic and Cosmeceuticals	4	4	4	100
MPH205P	Pharmaceutics Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF PHARMACY
Master of Pharmacy Program
Course Teaching Scheme (as per PCI)

Table – 6: Course of study for M. Pharm. (Pharmaceutical Quality Assurance)

Course Code	Course	Credit Hours	Credit Points	Hrs./week	Marks
Semester I					
MQA101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MQA102T	Quality Management System	4	4	4	100
MQA103T	Quality Control and Quality Assurance	4	4	4	100
MQA104T	Product Development and Technology Transfer	4	4	4	100
MQA105P	Pharmaceutical Quality Assurance Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MQA201T	Hazards and Safety Management	4	4	4	100
MQA202T	Pharmaceutical Validation	4	4	4	100
MQA203T	Audits and Regulatory Compliance	4	4	4	100
MQA204T	Pharmaceutical Manufacturing Technology	4	4	4	100
MQA205P	Pharmaceutical Quality Assurance Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650

M. PHARM. SEMESTER – I (MPH)**SUBJECT: MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES – THEORY (MPH101T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	--	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives: After completion of course student is able to know about

- Chemicals and excipients
- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier -Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation. c. Spectrofluorimetric: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	11	CO1 CO2 CO5
[2]	NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³ C NMR. Applications of NMR spectroscopy	11	CO1 CO2 CO5
[3]	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	11	CO1 CO2 CO5
[4]	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: <ul style="list-style-type: none">• Thin Layer chromatography• Paper Chromatography	11	CO3 CO4 CO5

	<ul style="list-style-type: none"> ● Ion exchange chromatography ● Column chromatography ● Gas chromatography ● High Performance Liquid chromatography ● Affinity chromatography 		
[5]	a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.	11	CO5
[6]	Immunological assays : RIA (Radio immuno assay), ELISA, Bioluminescence assays.	05	CO5

C. TEXT BOOKS

1. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..
2. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis*.; Pearson: New Delhi, 2009.

D. REFERENCE BOOKS

1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds*.; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
8. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
9. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.
10. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the fundamentals of various spectroscopic techniques
CO2	Understand Apply and Evaluate	To apply the fundamentals of spectroscopy in single and combination drug analysis
CO3	Understand and remember	To understand the chromatographic separation fundamentals
CO4	Understand Apply and Evaluate	To apply the fundamentals of various chromatographic techniques in single and combination drug analysis
CO5	Understand Apply and Evaluate	To learn theoretical and practical aspects of various analytical instruments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO2	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO3	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO4	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO5	3	2	1	1	-	2	1	1	1	-	3	3	1	1	-
Avg	3	1.2	1.8	1.4	-	1.6	0.6	1	1	-	3	2.6	0.6	0.6	-

M. PHARM. SEMESTER – I (MPH)
SUBJECT: DRUG DELIVERY SYSTEMS (MPH102T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

Objectives: Upon completion of the course, student shall be able to understand

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of delivering system
- The formulation and evaluation of Novel drug delivery systems

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Sustained Release (SR) and Controlled Release (CR) formulations: Introduction & basic concepts, advantages/ disadvantages, factors influencing, Physicochemical & biological approaches for SR/CR formulation, Mechanism of Drug Delivery from SR/CR formulation. Polymers: introduction, definition, classification, properties and application Dosage Forms for Personalized Medicine: Introduction, Definition, Pharmacogenetics, And Categories of Patients for Personalized Medicines: Customized drug delivery systems, Bioelectronic Medicines, 3D printing of pharmaceuticals, Telepharmacy.	10	CO5 CO2
[2]	Rate Controlled Drug Delivery Systems: Principles & Fundamentals, Types, Activation; Modulated Drug Delivery Systems; Mechanically activated, pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems Feedback regulated Drug Delivery Systems; Principles & Fundamentals.	10	CO5 CO2
[3]	Gastro-Retentive Drug Delivery Systems: Principle, concepts advantages and disadvantages, Modulation of GI transit time approaches to extend GI transit. Buccal Drug Delivery Systems: Principle of muco adhesion, advantages and disadvantages, Mechanism of drug permeation, Methods of formulation and its evaluations.	10	CO1 CO3 CO4
[4]	Ocular Drug Delivery Systems: Barriers of drug permeation, Methods to overcome barriers.	06	CO1 CO3 CO4
[5]	Transdermal Drug Delivery Systems: Structure of skin and barriers, Penetration enhancers, Transdermal Drug Delivery Systems, Formulation and evaluation.	10	CO1 CO3 CO4
[6]	Protein and Peptide Delivery: Barriers for protein delivery. Formulation and Evaluation of delivery systems of proteins and other macromolecules.	08	CO1 CO3 CO4
[7]	Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines.	06	CO1 CO3 CO4

C. TEXT BOOKS

1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002

D. REFERENCE BOOKS

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York, Chichester/Weinheim

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand the various approaches for development of novel drug delivery system
CO2	Learn	To learn the criteria for selection of drugs and polymers for the development of delivery system
CO3	Learn	To learn the formulation and evaluation of Novel drug delivery systems.
CO4	Analyse	Analyse various evaluation parameters for oral, parenteral, topical etc. drug delivery systems
CO5	Understand and analyse	Explain the principles and technology used in the design of sustained release and controlled release drug delivery systems

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	2	-	2	2	3	1	3	3	2	2
CO2	3	2	2	2	-	3	-	2	2	2	2	2	3	2	2
CO3	3	2	3	3	-	2	-	3	2	2	3	3	3	2	2
CO4	3	2	3	3	-	2	-	2	2	2	2	3	3	3	3
CO5	3	2	2	2	-	2	-	3	2	3	3	3	3	2	3
Avg	3	2	2.4	2.4	-	2.2	-	2.4	2	2.4	2.2	2.8	3	2.2	2.4

M. PHARM. SEMESTER – I (MPH)
SUBJECT: MODERN PHARMACEUTICS (MPH103T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course designed to impart advanced knowledge and skills required to learn various aspects and concepts at pharmaceutical industries.

Objectives: Upon completion of the course, student shall be able to understand

- The elements of preformulation studies.
- The Active Pharmaceutical Ingredients and Generic drug Product development
- Industrial Management and GMP Considerations.
- Optimization Techniques & Pilot Plant Scale Up Techniques
- Stability Testing, sterilization process & packaging of dosage forms.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Preformation Concepts – Drug Excipient interactions - different methods, kinetics of stability, Stability testing. Theories of dispersion and pharmaceutical Dispersion (Emulsion and Suspension, SMEDDS) preparation and stability Large and small volume parental – physiological and formulation consideration, Manufacturing and evaluation. b. Optimization techniques in Pharmaceutical Formulation: Concept and parameters of optimization, Optimization techniques in pharmaceutical formulation and processing. Statistical design, Response surface method, Contour designs, Factorial designs and application in formulation	20	CO1 CO4
[2]	Validation: Introduction to Pharmaceutical Validation, Scope & merits of Validation, Validation and calibration of Master plan, ICH & WHO guidelines for calibration and validation of equipments, Validation of specific dosage form, Types of validation. Government regulation, Manufacturing Process Model, URS, DQ, IQ, OQ & P.Q. of facilities.	10	CO2 CO3
[3]	cGMP & Industrial Management: Objectives and policies of current good manufacturing practices, layout of buildings, services, equipments and their maintenance Production management: Production organization, , materials management, handling and transportation, inventory management and control, production and planning control, Sales forecasting, budget and cost control, industrial and personal relationship. Concept of Total Quality Management.	10	CO2 CO3
[4]	Compression and compaction: Physics of tablet compression, compression, consolidation, effect of friction, distribution of forces, compaction profiles.	10	CO5
[5]	Study of Solubility parameters, Diffusion parameters, Dissolution parameters and Pharmacokinetic parameters, Heckle plots, Similarity factors – f2 and f1, Higuchi and Peppas plot, Linearity Concept of significance, Standard deviation, Chi square test, students T-test, ANOVA test.	10	CO5

C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013

D. REFERENCE BOOKS

1. Lieberman, H. A. *Pharmaceutical Dosage Forms Tablets, Vol. 1-3*; New York, Dekker, 1990.
2. Lieberman, H. A.; Rieger, M. M.; Banker, G. S. *Pharmaceutical Dosage Forms-- Disperse Systems. Volume 1-2*; Dekker: New York, 1998.
3. Avis, K. E.; Lieberman, H. A.; Lachman, L. *Pharmaceutical Dosage Forms: Parenteral Medications VOL 1-3*; M. Dekker: New York, 1992.
4. Banker, G. S.; Rhodes, C. T. *Modern Pharmaceutics*; Dekker: New York, 1996.
5. Remington, J. P.; Gennaro, A. R. *Remington's Pharmaceutical Sciences*; Mack Pub. Co: Easton, Pa., 1990.
6. Bean, H. S.; Carless, J. E.; Arnold Heyworth Beckett. *Advances in Pharmaceutical Sciences*; Academic Press: London, 1964.
7. Sinko, P. J.; Martin, A. N. *Martin's Physical Pharmacy Pharmaceutical Sciences: Physical Chemical Principles in the Pharmaceutical Sciences.*; Lippincott Williams & Wilkins: Philadelphia, 2006.
8. Arthur Owen Bentley; Ernest Alexander Rawlins. *Bentley's Textbook of Pharmaceutics.*; All India Traveller Book Seller: New Delhi, 2002.
9. Willig, S. H. *Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control from Manufacturer to Consumer*; Marcel Dekker, Inc: New York, N.Y., 2001.
10. Kohli, D. P. S.; Shah, D. H. *Drug Formulations Manual*; Business Horizons: New Delhi, 2012.
11. Sharma, P.P. *How to practice GMPs*. Vandana publication, 2001.
12. Berry, I. R.; Nash, R. A. *Pharmaceutical Process Validation*; Marcel Dekker: New York, 1993.
13. James Robert Evans. *Applied Production and Operations Management*; Info Access & Distribution: Singapore, 1994.
14. Swarbrick, J. *Encyclopedia of Pharmaceutical Technology*; Marcel Dekker: New York, Ny, 2004.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Learn	Learn the elements of preformulation studies.
CO2	Understand	Understand validations of processes and equipments used in Pharmaceutical Industry
CO3	Learn	Learn Industrial Management and GMP Considerations.
CO4	Understand and Remember	Understand and remember Optimization Techniques & Statistical designs
CO5	Understand and analyse	Understand physics of tablet compression and analyse dissolution & diffusion parameters

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	2	-	2	2	2	1	3	2	1	1
CO2	3	2	2	3	-	2	-	2	2	3	2	3	3	3	2
CO3	3	1	2	2	-	3	-	3	2	3	2	3	3	3	2
CO4	3	2	3	3	-	2	-	2	2	2	3	3	2	3	3
CO5	3	3	3	3	-	2	-	2	2	2	2	3	1	3	3
Avg	3	2	2.4	2.6	-	2.2	-	2.2	2	2.4	2	3	2.2	2.6	2.2

M. PHARM. SEMESTER – I (MPH)
SUBJECT: REGULATORY AFFAIRS - THEORY (MPH104T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	--	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Course designed to impart advanced knowledge and skills required to learn the concept of generic drug and their development, various regulatory filings in different countries, different phases of clinical trials and submitting regulatory documents: filing process of IND, NDA and ANDA

Objectives: Upon completion of the course, it is expected that the students will be able to understand

- The Concepts of innovator and generic drugs, drug development process
- The Regulatory guidance's and guidelines for filing and approval process
- Preparation of Dossiers and their submission to regulatory agencies in different countries
- Post approval regulatory requirements for actives and drug products
- Submission of global documents in CTD/ eCTD formats
- Clinical trials requirements for approvals for conducting clinical trials
- Pharmacovigilance and process of monitoring in clinical trials.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Documentation in Pharmaceutical industry: Master formula record, DMF (Drug Master File), distribution records. Generic drugs product development Introduction , Hatch- Waxman act and amendments, CFR (CODE OF FEDERAL REGULATION) ,drug product performance, in-vitro, ANDA regulatory approval process, NDA approval process, BE and drug product assessment, in –vivo, scale up process approval changes, post marketing surveillance, outsourcing BA and BE to CRO. b. Regulatory requirement for product approval: API, biologics, novel, therapies obtaining NDA, ANDA for generic drugs ways and means of US registration for foreign drugs	15	CO1 CO2 CO3 CO4
[2]	CMC, post approval regulatory affairs. Regulation for combination products and medical devices.CTD and ECTD format, industry and FDA liaison. ICH - Guidelines of ICH-Q, S E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries.	15	CO2 CO3
[3]	Non clinical drug development: Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier, dossier (IMPD) and investigator brochure (IB).	15	CO2 CO5
[4]	Clinical trials: Developing clinical trial protocols. Institutional review board/ independent ethics committee Formulation and working procedures informed Consent process and procedures. HIPAA- new, requirement to clinical study process, • pharmacovigilance safety monitoring in clinical trials.	15	CO2 CO5

C. TEXT BOOKS

1. Berry, I. R.; Martin, R. P. *The Pharmaceutical Regulatory Process*; Informa Healthcare: New York, 2008.
2. Guarino, R. A. *New Drug Approval Process*; Informa Healthcare, Cop: New York, 2009.

D. REFERENCE BOOKS

1. Kanfer, I.; Shargel, L. *Generic Drug Product Development : Solid Oral Dosage Forms*; Marcel Dekker: New York, 2005.
2. Weinberg, S. *Guidebook for Drug Regulatory Submissions*; Wiley: Hoboken, N.J., 2009.
3. Pisano, D. J. *FDA Regulatory Affairs : A Guide for Prescription Drugs, Medical Devices, and Biologics*; Informa Healthcare Usa: New York, 2008.
4. Rozovsky, F. A.; Adams, R. K. *Clinical Trials and Human Research : A Practical Guide to Regulatory Compliance*; Jossey-Bass: San Francisco, 2003.
5. Administration, A. G. D. of H. T. G. TGA basics <http://www.tga.gov.au/tga-basics>
6. Your gateway to the European Union http://europa.eu/index_en.htm.
7. ICH Official web site : ICH <http://www.ich.org/>.
8. Commissioner, O. of the. U.S. Food and Drug Administration <http://www.fda.gov/>.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the Concepts of innovator and generic drugs, drug development process
CO2	Understand and Apply	To understand the Regulatory guidance and guidelines for filing and approval process
CO3	Understand and remember	To understand Preparation of Dossiers and their submission to regulatory agencies in different countries in CTD/ eCTD formats
CO4	Understand and remember	To understand Post approval regulatory requirements for actives and drug products
CO5	Understand and remember	To acquire knowledge about Non-clinical development, Clinical trials requirements, Pharmacovigilance and process of monitoring in clinical trials.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-	-	2	2	3	3	-	3	-	3	2	-
CO2	3	-	-	-	-	2	2	3	2	-	3	-	3	2	-
CO3	3	-	-	-	1	2	2	3	2	-	3	-	3	2	-
CO4	3	-	-	-	-	2	2	3	3	-	3	-	3	-	-
CO5	3	2	1	1	1	2	2	3	3	-	3	-	1	2	1
Avg	3	0.4	0.2	0.2	0.4	2	2	3	2.6	-	3	-	2.6	1.6	0.2

M. PHARM. SEMESTER – I (MPH)
SUBJECT: PHARMACEUTICS PRACTICAL – I (MPH105P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	12	12	6	100	30	20	-	150

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge and skills on analytical techniques and development of various NDDS dosage forms

Objectives: objectives of the course is to make students able to

- Understand, learn and application of various spectrophotometric and chromatographic analytical methods in analysis of drugs and drug products.
- Application of preformulation concepts in Preparation, characterization and evaluation of conventional and novel drug delivery systems

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. Analysis of pharmacopoeial compounds and their formulations by UV Vis-spectrophotometer 1. Simultaneous estimation of multi component containing formulations by UV spectrophotometry 2. Experiments based on HPLC 3. Experiments based on Gas Chromatography 4. Estimation of riboflavin/quinine sulphate by fluorimetry 5. Estimation of sodium/potassium by flame photometry	90	CO1 CO2
[2]	1. To perform In-vitro dissolution profile of CR/ SR marketed formulation 2. Formulation and evaluation of sustained release matrix tablets 3. Formulation and evaluation osmotically controlled DDS 4. Preparation and evaluation of Floating DDS- hydro dynamically balanced DDS 5. Formulation and evaluation of Muco adhesive tablets. 6. Formulation and evaluation of trans dermal patches. 7. To carry out preformulation studies of tablets. 8. To study the effect of compressional force on tablets disintegration time. 9. To study Micromeritic properties of powders and granulation. 10. To study the effect of particle size on dissolution of a tablet. 11. To study the effect of binders on dissolution of a tablet. 12. To plot Heckal plot, Higuchi and peppas plot and determine similarity factors.	90	CO2 CO3 CO4 CO5

C. TEXT BOOKS

D. REFERENCE BOOKS

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Assessment	Assessment of the drug/s using various spectroscopic and chromatographic techniques
CO2	Learn	Handling and operations of various analytical instruments
CO3	understand	Preparation and evaluation of modified release drug delivery systems
CO4	Understand and Remember	To understand effect of various excipients and process parameters on various dosage forms
CO5	Understand and apply	application of the various model dependent and model independent approaches for the assessment of dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	1	2	1	2	2	2	1	3	1	1	1
CO2	3	3	2	2	2	3	2	3	2	3	2	3	2	2	2
CO3	3	3	3	2	2	2	1	3	2	3	2	3	3	2	2
CO4	3	3	3	3	1	2	1	2	2	2	3	3	3	3	3
CO5	3	3	3	3	1	2	1	2	2	3	2	3	3	3	3
Avg	3	3	2.6	2.6	1.4	2.2	1.2	2.4	2	2.6	2	3	2.4	2.2	2.2

M. PHARM. SEMESTER – II (MPH)
SUBJECT: MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY & TARGETED DDS) (NTDS) (MPH201T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge on the area of advances in novel drug delivery systems.

Objectives: Upon completion of the course, student shall be able to understand

- The various approaches for development of novel drug delivery systems.
- The criteria for selection of drugs and polymers for the development of delivering system
- The formulation and evaluation of novel drug delivery systems

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Targeted Drug Delivery Systems: Concepts, Events and biological process involved in drug targeting. Tumor targeting and Brain specific delivery.	12	CO5
[2]	Targeting Methods: introduction preparation and evaluation. Nano Particles & Liposomes: Types, preparation and evaluation.	12	CO5 CO3
[3]	Micro Capsules / Micro Spheres: Types, preparation and evaluation, Monoclonal Antibodies; preparation and application, preparation and application of Niosomes, Aquasomes, Phytosomes, Electrosomes.	12	CO2 CO3
[4]	Pulmonary Drug Delivery Systems : Aerosols, propellents, Containers Types, preparation and evaluation, Intra Nasal Route Delivery systems; Types, preparation and evaluation.	12	CO1 CO2
[5]	Nucleic acid based therapeutic delivery system : Gene therapy, introduction (ex-vivo & in-vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and nonviral gene transfer). Liposomal gene delivery systems. Biodistribution and Pharmacokinetics. knowledge of therapeutic antisense molecules and aptamers as drugs of future.	12	CO4

C. TEXT BOOKS

1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
2. S.P.Vyas and R.K.Khar, Controlled Drug Delivery - concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002

D. REFERENCE BOOKS

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York, Chichester/Weinheim

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand the various approaches for development of novel drug delivery systems.
CO2	Learn	To learn the criteria for selection of drugs and polymers for the development of NDDS
CO3	Understand	To understand the concepts of formulation and evaluation of Nano carrier-based drug delivery systems.
CO4	learn	To learn the nucleic acid-based drug delivery systems.
CO5	Understand and analyse	To understand concepts and methods of targeted drug delivery systems.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	-	2	-	2	2	3	1	3	3	2	2
CO2	3	3	3	3	-	2	-	2	2	2	1	2	3	2	2
CO3	3	2	3	2	-	2	-	3	2	2	3	2	3	2	3
CO4	3	2	2	2	-	2	-	2	2	2	3	2	3	3	2
CO5	3	2	2	2	-	2	-	3	2	3	3	3	3	2	3
Avg	3	2.2	2.4	2.2	-	2	-	2.4	2	2.4	2.2	2.4	3	2.2	2.4

M. PHARM. SEMESTER – II (MPH)**SUBJECT: ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS (MPH202T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
3	1	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge and skills necessary for dose calculations, dose adjustments and to apply biopharmaceutics theories in practical problem solving. Basic theoretical discussions of the principles of biopharmaceutics and pharmacokinetics are provided to help the students to clarify the concepts.

Objectives: Upon completion of this course it is expected that students will be able understand,

- The basic concepts in biopharmaceutics and pharmacokinetics. The use raw data and derive the pharmacokinetic models and parameters the best describe the process of drug absorption, distribution, metabolism and elimination.
- The critical evaluation of biopharmaceutic studies involving drug product equivalency.
- The design and evaluation of dosage regimens of the drugs using pharmacokinetic and biopharmaceutic parameters.
- The potential clinical pharmacokinetic problems and application o basics of pharmacokinetic

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Drug Absorption from the Gastrointestinal Tract: Gastrointestinal tract, Mechanism of drug absorption, Factors affecting drug absorption, pH–partition theory of drug absorption. Formulation and physicochemical factors: Dissolution rate, Dissolution process, Noyes–Whitney equation and drug dissolution, Factors affecting the dissolution rate. Gastrointestinal absorption: role of the dosage form: Solution (elixir, syrup and solution) as a dosage form, Suspension as a dosage form, Capsule as a dosage form, Tablet as a dosage form, Dissolution methods ,Formulation and processing factors, Correlation of in vivo data with in vitro dissolution data. Transport model: Permeability-Solubility-Charge State and the pH Partition Hypothesis, Properties of the Gastrointestinal Tract (GIT), pH Microclimate Intracellular pH Environment, Tight-Junction Complex.	12	CO1 CO2
[2]	Biopharmaceutic considerations in drug product design and In Vitro Drug Product Performance: Introduction, biopharmaceutic factors affecting drug bioavailability, rate-limiting steps in drug absorption, physicochemical nature of the drug formulation factors affecting drug product performance, in vitro: dissolution and drug release testing, compendial methods of dissolution, alternative methods of dissolution testing, meeting dissolution requirements, problems of variable control in dissolution testing performance of drug products. In vitro–in vivo correlation, dissolution profile comparisons, drug product stability, considerations in the design of a drug product.	12	CO1 CO2
[3]	Pharmacokinetics: Basic considerations, pharmacokinetic models, compartment modeling: one compartment model- IV bolus, IV infusion,	12	CO3

	extra-vascular. Multi compartment model: two compartment - model in brief, non-linear pharmacokinetics: cause of non-linearity, Michaelis – Menten equation, estimation of k _{max} and v _{max} . Drug interactions: introduction, the effect of protein binding interactions, the effect of tissue-binding interactions, cytochrome p450-based drug interactions, drug interactions linked to transporters.		
[4]	Drug Product Performance, In Vivo: Bioavailability and Bioequivalence: drug product performance, purpose of bioavailability studies, relative and absolute availability. Methods for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, crossover study designs, evaluation of the data, bioequivalence example, study submission and drug review process. Biopharmaceutics classification system, methods. Permeability: In-vitro, in-situ and In-vivo methods. Generic biologics (biosimilar drug products), clinical significance of bioequivalence studies, special concerns in bioavailability and bioequivalence studies, generic substitution.	12	CO4
[5]	Application of Pharmacokinetics: Modified-Release Drug Products, Targeted Drug Delivery Systems and Biotechnological Products. Introduction to Pharmacokinetics and pharmacodynamic, drug interactions. Pharmacokinetics and pharmacodynamics of biotechnology drugs. Introduction, Proteins and peptides, Monoclonal antibodies, Oligonucleotides, Vaccines (immunotherapy), Gene therapies.	12	CO5

C. TEXT BOOKS

1. Jaiswal, Sunil B., and Brahmankar, D. M.. Biopharmaceutics and Pharmacokinetics: A Treatise. India, Vallabh Prakashan, 2005.

D. REFERENCE BOOKS

1. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics. India: Pharmamed Press. 2005.
2. Yu, Andrew B.C., and Shargel, Leon. Applied Biopharmaceutics & Pharmacokinetics, Seventh Edition. Singapore, McGraw-Hill Education, 2015.
3. Gibaldi, Milo, and Perrier, Donald. Pharmacokinetics., 2nd edition, Marcel Dekker Inc., New York, 1982
4. Swarbrick. J. Current Concepts in the Pharmaceutical Sciences: Biopharmaceutics. United States: Lea & Febiger. 1970.
5. Malcolm Rowland and Thom N. Tozer. Clinical Pharmacokinetics, Concepts and Applications. 3rd edition. Lea and Febiger, Philadelphia, 1995
6. Abdou. H.M, Dissolution, Bioavailability and Bioequivalence, Mack Publishing Company, Pennsylvania 1989
7. Robert. E. Notari. Biopharmaceutics and Clinical Pharmacokinetics, An Introduction, 4th edition, Marcel Dekker Inc, New York and Basel, 1987.
8. John. G Wagner and M. Pamarowski. Biopharmaceutics and Relevant Pharmacokinetics, 1st edition, Drug Intelligence Publications, Hamilton, Illinois, 1971.
9. James Swarbrick, James. G. Boylan. Encyclopedia of Pharmaceutical Technology, Vol 13, Marcel Dekker Inc, New York, 1996.
10. Sunil S Jambhekar and Philip J Breen. Basic Pharmacokinetics, 1st edition, pharmaceutical press, RPS Publishing, 2009.
11. Alex Avdeef. Absorption and Drug Development- Solubility, Permeability, and Charge State, John Wiley & Sons, Inc, 2003.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand basic concepts and factors affecting of absorption of drugs form GIT and bioavailability.
CO2	Understand and Apply	Understand and apply biopharmaceutic considerations and in-vitro dissolution in drug product design.
CO3	Understand and Utilize	Understand and utilize the pharmacokinetic models for the determination of pharmacokinetic parameters.
CO4	Understand, Analyze and Evaluate	Understand and analyze the bioavailability of a drug and evaluate the bioequivalence between drug products.
CO5	Remember and Understand	Remember and Understand applications of biopharmaceutics and apply in designing dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	2	2	1	2	1	1	3	2	2	3	2	3	2
CO2	3	2	3	2	1	3	2	2	2	2	3	3	3	3	2
CO3	2	1	2	3	1	2	2	2	1	1	2	2	3	3	3
CO4	3	2	2	2	1	2	1	1	3	2	3	3	2	3	2
CO5	3	2	3	3	1	2	2	2	2	2	2	3	3	3	2
Avg	2.8	1.6	2.4	2.4	1	2.2	1.6	1.6	2.2	1.8	2.4	2.8	2.6	3	2.2

M. PHARM. SEMESTER – II (MPH)
SUBJECT: COMPUTER AIDED DRUG DEVELOPMENT (MPH203T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge and skills necessary for computer Applications in pharmaceutical research and development who want to understand the application of computers across the entire drug research and development process. Basic theoretical discussions of the principles of more integrated and coherent use of computerized information (informatics) in the drug development process are provided to help the students to clarify the concepts.

Objectives: Upon completion of this course it is expected that students will be able to understand,

- History of Computers in Pharmaceutical Research and Development
- Computational Modeling of Drug Disposition
- Computers in Preclinical Development
- Optimization Techniques in Pharmaceutical Formulation
- Computers in Market Analysis
- Computers in Clinical Development
- Artificial Intelligence (AI) and Robotics
- Computational fluid dynamics (CFD)

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. Computers in Pharmaceutical Research and Development: A General Overview: History of Computers in Pharmaceutical Research and Development. Statistical modeling in Pharmaceutical research and development: Descriptive versus Mechanistic Modeling, Statistical Parameters, Estimation, Confidence Regions, Nonlinearity at the Optimum, Sensitivity Analysis, Optimal Design, Population Modeling b. Quality-by-Design in Pharmaceutical Development: Introduction, ICH Q8 guideline, Regulatory and industry views on QbD, Scientifically based QbD - examples of application.	12	CO1 CO2
[2]	Computational Modeling of Drug Disposition: Introduction, Modeling Techniques: Drug Absorption, Solubility, Intestinal Permeation, Drug Distribution, Drug Excretion, Active Transport; P-gp, BCRP, Nucleoside Transporters, hPEPT1, ASBT, OCT, OATP, BBB-Choline Transporter.	12	CO3 CO4
[3]	Computer-aided formulation development: Concept of optimization, Optimization parameters, Factorial design, Optimization technology & Screening design. Computers in Pharmaceutical Formulation: Development of pharmaceutical emulsions, microemulsion drug carriers Legal Protection of Innovative Uses of Computers in R&D, The Ethics of Computing in Pharmaceutical Research, Computers in Market analysis	12	CO1 CO2

[4]	a. Computer-aided biopharmaceutical characterization: Gastrointestinal absorption simulation. Introduction, Theoretical background, Model construction, Parameter sensitivity analysis, Virtual trial, Fed vs. fasted state, In vitro dissolution and in-vitro-in-vivo correlation, Biowaiver considerations b. Computer Simulations in Pharmacokinetics and Pharmacodynamics: Introduction, Computer Simulation: Whole Organism, Isolated Tissues, Organs, Cell, Proteins and Genes. c. Computers in Clinical Development: Clinical Data Collection and Management, Regulation of Computer Systems	12	CO3 CO4
[5]	Artificial Intelligence (AI), Robotics and Computational fluid dynamics: General overview, Pharmaceutical Automation, Pharmaceutical applications, Advantages and Disadvantages. Current Challenges and Future Directions.	12	CO5

C. TEXT BOOKS

1. Ekins, S. Computer Applications in Pharmaceutical Research and Development
Ekins/Computer Applications in Pharmaceutical Research and Development; Hoboken, Nj, USA John Wiley & Sons, Inc, 2006.

D. REFERENCE BOOKS

1. Jelena Djuris. Computer-Aided Applications in Pharmaceutical Technology; Woodhead Publishing: Oxford, 2013.
2. Swarbrick, J. Encyclopaedia of Pharmaceutical Technology; Vol 1-3; Marcel Dekker: New York, Ny, 2004.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Apply	To know role of computers and application of statistical modeling in pharmaceutical research.
CO2	Understand and Apply	To understand application of QbD and optimization techniques in pharmaceutical product development.
CO3	Understand	To know computational modeling techniques of drug disposition and biopharmaceutical process.
CO4	Understand and Remember	To know and understand application of computers modeling techniques in pharmacokinetic and pharmacodynamic of drugs.
CO5	Understand and Remember	To understand artificial intelligence in development of drug product.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	1	3	-	-	-	-	2	-	3	-	3	0	3
CO2	3	2	3	3	-	-	3	3	2	-	3	-	3	1	3
CO3	3	2	2	3	-	-	3	3	3	-	3	-	3	3	3
CO4	3	2	2	3	-	-	3	3	3	-	3	2	3	3	3
CO5	3	1	2	3	-	-	3	2	2	-	3	3	3	0	3
Avg	3	1.6	2	3	-	-	2.4	2.2	2.4	-	3	1	3	1.4	3

M. PHARM. SEMESTER – II (MPH)
SUBJECT: COSMETIC AND COSMECEUTICALS (MPH204T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge and skills necessary for the fundamental need for cosmetic and cosmeceutical products.

Objectives: Upon completion of the course the student shall be able to

- Key ingredients used in cosmetics and cosmeceuticals.
- Key building blocks for various formulations.
- Current technologies in the market
- Various key ingredients and basic science to develop cosmetics and cosmeceuticals.
- Scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Cosmetics – Regulatory : Definition of cosmetic products as per Indian regulation. Indian regulatory requirements for labeling of cosmetics Regulatory provisions relating to import of cosmetics., Misbranded and spurious cosmetics. Regulatory provisions relating to manufacture of cosmetics – Conditions for obtaining license, prohibition of manufacture and sale of certain cosmetics, loan license, offences and penalties.	12	CO3
[2]	Cosmetics - Biological aspects : Structure of skin relating to problems like dry skin, acne, pigmentation, prickly heat, wrinkles and body odor. Structure of hair and hair growth cycle. Common problems associated with oral cavity. Cleansing and care needs for face, eye lids, lips, hands, feet, nail, scalp, neck, body and under-arm.	12	CO1 CO4 CO5
[3]	Formulation Building blocks: Building blocks for different product formulations of cosmetics/cosmeceuticals. Surfactants – Classification and application. Emollients, rheological additives: classification and application. Antimicrobial used as preservatives, their merits and demerits. Factors affecting microbial preservative efficacy. Building blocks for formulation of a moisturizing cream, vanishing cream, cold cream, shampoo and toothpaste. Soaps and syndet bars. Perfumes; Classification of perfumes. Perfume ingredients listed as allergens in EU regulation. Controversial ingredients: Parabens, formaldehyde liberators, dioxane.	12	CO1 CO2 CO3 CO4 CO5
[4]	Design of cosmeceutical products: Sun protection, sunscreens classification and regulatory aspects. Addressing dry skin, acne, sun-protection, pigmentation, prickly heat, wrinkles, body odor., dandruff, dental cavities, bleeding gums, mouth odor and sensitive teeth through cosmeceutical formulations.	12	CO1 CO2 CO4 CO5
[5]	Herbal Cosmetics: Herbal ingredients used in Hair care, skin care and oral care. Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers. Challenges in formulating herbal cosmetics.	12	CO1 CO2 CO4 CO5

C. TEXT BOOKS

1. Butler, H.; Poucher, W. A. Poucher's Perfumes, Cosmetics, and Soaps.; Kluwer Academic Publishers: Dordrecht ; Boston, 2000.

D. REFERENCE BOOKS

1. Ralph Gordon Harry; Rosen, M. R. *Harry's Cosmeticology*; Chemical Publishing Company: New York, 2015.

3. Sharma, P. P.; Vandana Publications. *Cosmetics : Formulation, Manufacturing & Quality Control*; Vandana Publications: Delhi, 2018.

4. Barel, A. O.; Paye, M.; Maibach, H. I. *Handbook of Cosmetic Science and Technology*; Taylor & Francis: Boca Raton, 2014.

5 And, T. *CTFA Membership Directory.*; Cosmetic, Toiletry And Fragrance Association, Inc: Washington, D.C., 1981.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Remember, Understand and Evaluate	To understand the key ingredients used in cosmetics and cosmeceuticals.
CO2	Remember, Understand and Evaluate	To learn key building blocks for various formulations.
CO3	Understand Apply and Evaluate	To learn the current technologies and regulatory requirements of cosmetics in the market
CO4	Understand Remember and	To understand the various basic science to develop cosmetics and cosmeceuticals
CO5	Remember, Understand and Evaluate	To learn the scientific knowledge to develop cosmetics and cosmeceuticals with desired Safety, stability, and efficacy.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	1	1	1	3	2	3	1	3	1	3	2
CO2	3	2	3	3	1	1	1	3	3	3	1	2	2	3	2
CO3	3	3	3	3	1	1	2	2	3	2	2	2	2	3	2
CO4	3	2	3	3	1	1	2	2	3	3	1	2	2	3	2
CO5	3	3	3	3	1	2	2	3	2	2	2	3	3	3	2
Avg	3	2.4	3	3	1	1.2	1.6	2.6	2.6	2.6	1.4	2.4	2	3	2

M. PHARM. SEMESTER – I (MPH)
SUBJECT: PHARMACEUTICS PRACTICAL – II (MPH205P)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	12	12	6	100	30	20	-	100

A. COURSE OVERVIEW

Scope: This subject is designed to impart basic knowledge and skills on analytical techniques and development of various NDDS dosage forms

Objectives: Upon completion of the course student shall be able

- Formulation and evaluation of different novel drug delivery systems
- Application of QbD principles in designing dosage form.

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	1. To study the effect of temperature change , non solvent addition, 2. incompatible polymer addition in microcapsules preparation 3. Preparation and evaluation of Alginate beads 4. Formulation and evaluation of gelatin /albumin microspheres 5. Formulation and evaluation of liposomes/niosomes 6. Formulation and evaluation of spherules 7. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique. 8. Comparison of dissolution of two different marketed products /brands 9. Development and evaluation of Creams 10. Development and evaluation of Shampoo and Toothpaste base 11. To incorporate herbal and chemical actives to develop products 12. To address Dry skin, acne, blemish, Wrinkles, bleeding gums and dandruff	90	CO1 CO3 CO5
[2]	1. Protein binding studies of a highly protein bound drug & poorly protein bound drug 2. Bioavailability studies of Paracetamol in animals. 3. Pharmacokinetic and IVIVC data analysis by WinnolineR software 4. In vitro cell studies for permeability and metabolism 5. DoE Using Design Expert® Software 6. Formulation data analysis Using Design Expert® Software 7. Quality-by-Design in Pharmaceutical Development 8. Computer Simulations in Pharmacokinetics and Pharmacodynamics 9. Computational Modeling Of Drug Disposition 10. To develop Clinical Data Collection manual 11. To carry out Sensitivity Analysis, and Population Modeling.	90	CO2 CO4

C. TEXT BOOKS

D. REFERENCE BOOKS

E. COURSE OUTCOMES

(Minimum 5 Cos are required)

CO Number	Skill	Statement
CO1	understand and analyse	Formulate and characterize various novel drug delivery systems
CO2	Learn	Pharmacokinetic and IVIVC data analysis, simulation of pharmacokinetic using appropriate computational program/s
CO3	Understand	Preparation and characterization of cosmetic preparations, herbal active containing products and toiletry items
CO4	Understand and Remember	Applications of design of experiment software/s and Quality-by-Design in pharmaceutical development.
CO5	Understand and apply	Solubility improvement techniques & Dissolution profile comparison by various tools

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3	1	2	2	2	2	2	1	3	3	1	1
CO2	3	3	2	2	2	3	2	3	2	3	2	2	3	3	3
CO3	3	3	3	2	2	2	2	3	2	3	2	3	3	2	1
CO4	3	3	3	3	1	2	1	2	2	2	3	2	3	2	3
CO5	3	3	3	3	1	2	2	2	2	3	2	2	3	3	3
Avg	3	3	2.6	2.6	1.4	2.2	1.8	2.4	2	2.6	2	2.4	3	2.2	2.2

M. PHARM. SEMESTER – II (MQA)**SUBJECT: MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES - THEORY
(MQA101T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	--	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives: After completion of course, student is able to know about

1. Chemicals and excipients
2. The analysis of various drugs in single and combination dosage forms
3. Theoretical and practical skills of the instruments

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier -Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation. c. Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	11	CO1 CO2 CO5
[2]	NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³ C NMR. Applications of NMR spectroscopy	11	CO1 CO2 CO5
[3]	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	11	CO1 CO2 CO5
[4]	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: <ul style="list-style-type: none">● Thin Layer chromatography● High Performance Thin Layer Chromatography	11	CO3 CO4 CO5

	<ul style="list-style-type: none"> ● Ion exchange chromatography ● Column chromatography ● Gas chromatography ● High Performance Liquid chromatography ● Ultra High Performance Liquid chromatography ● Affinity chromatography ● Gel Chromatography. 		
[5]	<p>a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing</p> <p>b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.</p>	11	CO5
[6]	<p>a. Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry.</p> <p>b. Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.</p>	05	CO5

C. TEXT BOOKS

1. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..
2. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis*.; Pearson: New Delhi, 2009.

D. REFERENCE BOOKS

1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds*.; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
8. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

9. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
10. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the fundamentals of various spectroscopic techniques
CO2	Understand Apply and Evaluate	To apply the fundamentals of spectroscopy in single and combination drug analysis
CO3	Understand and remember	To understand the chromatographic separation fundamentals
CO4	Understand Apply and Evaluate	To apply the fundamentals of various chromatographic techniques in single and combination drug analysis
CO5	Understand Apply and Evaluate	To learn theoretical and practical aspects of various analytical instruments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO2	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO3	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO4	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO5	3	2	1	1	-	2	1	1	1	-	3	3	1	1	-
Avg	3	1.2	1.8	1.4	-	1.6	0.6	1	1	-	3	2.6	0.6	0.6	-

M. PHARM. SEMESTER – I (MQA)
SUBJECT: QUALITY MANAGEMENT SYSTEM-THEORY (MQA102T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	0	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart fundamental knowledge and concepts about various quality management principles and systems utilized in the manufacturing industry. It also aids in understanding the quality evaluation in the pharmaceutical industries.

Objectives: At completion of this course, it is expected that students will be able to understand-

- The importance of quality
- ISO management systems
- Tools for quality improvement
- Analysis of issues in quality
- Quality evaluation of pharmaceuticals
- Stability testing of drug and drug substances
- Statistical approaches for quality

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Quality: Evolution of Quality, Definition of Quality, Dimensions of Quality Quality as a Strategic Decision: Meaning of strategy and strategic quality management, mission and vision statements, quality policy, Quality objectives, strategic planning and implementation, McKinsey 7s model, Competitive analysis, Management commitment to quality Customer Focus: Meaning of customer and customer focus, Classification of customers, Customer focus, Customer perception of quality, Factors affecting customer perception, Customer requirements, Meeting customer needs and expectations, Customer satisfaction and Customer delight, Handling customer complaints, Understanding customer behavior, concept of internal and external customers. Case studies. Cost of Quality: Cost of quality, Categories of cost of Quality, Models of cost of quality, Optimising costs, Preventing cost of quality.	12	CO1 CO3
[2]	Pharmaceutical quality Management: Basics of Quality Management, Total Quality Management (TQM), Principles of Six sigma, ISO 9001:2008, 9001:2015, ISO 14001:2004, Pharmaceutical Quality Management – ICH Q10, Knowledge management, Quality Metrics, Operational Excellence and Quality Management Review. OSHAS guidelines, NABL certification and accreditation, CFR-21 part 11, WHO-GMP requirements.	12	CO1 CO2 CO3
[3]	Six System Inspection model: Quality Management system, Production system, Facility and Equipment system, Laboratory control system, Materials system, Packaging and labeling system. Concept of self inspection. Quality systems: Change Management/ Change control. Deviations, Out of Specifications (OOS), Out of Trend (OOT), Complaints - evaluation and handling, Investigation and determination of root cause,	12	CO4

	Corrective & Preventive Actions (CAPA), Returns and Recalls, Vendor Qualification, Annual Product Reviews, Batch Review and Batch Release. Concept of IPQC, area clearance/ Line clearance.		
[4]	Drug Stability: ICH guidelines for stability testing of drug substances and drug products. Study of ICH Q8, Quality by Design and Process development report Quality risk management: Introduction, risk assessment, risk control, risk review, risk management tools, HACCP, risk ranking and filtering according to ICH Q9 guidelines.	12	CO5
[5]	Statistical Process control (SPC): Definition and Importance of SPC, Quality measurement in manufacturing, Statistical control charts - concepts and general aspects, Advantages of statistical control, Process capability, Estimating Inherent or potential capability from a control chart analysis, Measuring process control and quality improvement, Pursuit of decreased process variability.	08	CO1 CO3 CO4
[6]	Regulatory Compliance through Quality Management and development of Quality Culture Benchmarking: Definition of benchmarking, Reasons for benchmarking, Types of Benchmarking, Benchmarking process, Advantages of benchmarking, Limitations of benchmarking.	04	CO1 CO3 CO4

C. TEXT BOOKS

1. Fairfield-Sonn, J. W. Corporate Culture and the Quality Organization; Quorum Books: Westport, Conn., 2001.

D. REFERENCE BOOKS

1. Endres, A. C. Implementing Juran's Road Map for Quality Leadership : Benchmarks and Results; Wiley: New York, 2000.
2. Antony J, David P, Routledge, Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases, 2002
3. Okes D, Root Cause Analysis, The Core of Problem Solving and Corrective Action, 2009, ASQ Publications.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand importance of quality and Tools for quality improvement
CO2	Understand	To study the ISO management systems
CO3	Understand and Apply	To understand the Analysis of issues in quality and Statistical approaches for quality
CO4	Understand and Remember	To study the Quality evaluation of pharmaceuticals
CO5	Understand and Apply	To understand the Stability testing of drug and drug substances

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	1	2	1	2	2	1	2	2	2	2	2
CO2	3	3	3	3	1	3	0	2	1	2	3	3	3	3	3
CO3	3	2	2	2	1	2	0	2	2	1	2	2	2	2	2
CO4	3	3	3	3	1	3	1	2	1	2	3	3	3	3	3
CO5	3	3	3	3	1	3	0	2	2	2	3	3	3	3	3
Avg	3	2.6	2.6	2.6	1	2.6	0.4	2	1.6	1.6	2.6	2.6	2.6	2.6	2.6

M. PHARM. SEMESTER – I (MQA)
SUBJECT: QUALITY CONTROL AND QUALITY ASSURANCE (MQA103T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	0	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications, GLP and regulatory affairs.

Objectives: Upon completion of this course the student should be able to

Understand the cGMP aspects in a pharmaceutical industry

- To appreciate the importance of documentation
- To understand the scope of quality certifications applicable to
- Pharmaceutical industries
- To understand the responsibilities of QA & QC departments.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction: Concept and evolution and scopes of Quality Control and Quality Assurance, Good Laboratory Practice, GMP, Overview of ICH Guidelines - QSEM, with special emphasis on Q-series guidelines. Good Laboratory Practices: Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non clinical testing, control on animal house, report preparation and documentation. CPCSEA guidelines.	12	CO1 CO2 CO5
[2]	cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention(PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination and Good Warehousing Practice.	12	CO1 CO2 CO5
[3]	Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), Developing specification (ICH Q6 and Q3), purchase specifications and maintenance of stores for raw materials. In process quality control and finished products quality control for following dosage forms in Pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products (How to refer pharmacopoeias).	12	CO1 CO2 CO4 CO5
[4]	Documentation in pharmaceutical industry: Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles- How to maintain, retention and retrieval etc. Standard operating procedures (How to write), Master Batch Record, Batch Manufacturing Record, Quality audit plan and reports. Specification and test procedures, Protocols and reports. Distribution records. Electronic data handling. Concepts of controlled and uncontrolled documents. Submission documents for regulators DMFs, as Common Technical	12	CO2 CO3 CO5

	Document and Electronic Common Technical Documentation (CTD, eCTD). Concept of regulated and non regulated markets.		
[5]	Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging, reprocessing, salvaging, handling of waste and scrap disposal. Introduction, scope and importance of intellectual property rights. Concept of trade mark, copyright and patents.	12	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Quality Assurance of Pharmaceuticals- A compedium of Guide lines and Related materials Vol I & II, 2 nd edition, WHO Publications, 1999.

D. REFERENCE BOOKS

1. Weinberg, S. Good Laboratory Practice Regulations; M. Dekker: New York, 1995.
2. Sarker, D. K. *Quality Systems and Control for Pharmaceuticals*; John Wiley & Sons: Chichester, West Sussex ; Hoboken, Nj, 2008.
3. Willig, S. H.; Stoker, J. R. Good Manufacturing Practices for Pharmaceuticals : A Plan for Total Quality Control; Marcel Dekker: New York, 1997.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To Understand the cGMP aspects in a pharmaceutical industry
CO2	Understand	To appreciate the importance of documentation
CO3	Understand and apply	To understand the scope of quality certifications applicable to pharmaceutical industries
CO4	Understand and evaluate	To Analyse of raw materials, finished products, packaging materials in process quality control (IPQC)
CO5	Understand and apply	To understand the responsibilities of QA & QC departments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	1	2	1	2	2	1	3	3	3	2	1
CO2	3	2	2	2	1	2	1	2	1	2	3	3	3	3	1
CO3	3	2	2	2	1	2	-	2	2	1	3	3	3	2	1
CO4	3	2	2	2	2	3	1	2	1	3	3	3	3	3	1
CO5	3	2	2	2	3	3	-	2	2	3	3	3	3	3	1
Avg	3	2	2	2	1.6	2.4	0.6	2	1.6	2	2.6	3	3	2.6	1

M. PHARM. SEMESTER – I (MPH)**SUBJECT: PRODUCT DEVELOPMENT AND TECHNOLOGY TRANSFER (MQA104T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Scope This deal with technology transfer covers the activities associated with Drug Substance, Drug Product and analytical tests and methods, required following candidate drug selection to completion of technology transfer from R&D to the first receiving site and technology transfer related to post-marketing changes in manufacturing places.

Objectives: Upon completion of this course the student should be able to

- To understand the new product development process
- To understand the necessary information to transfer technology from R&D to actual manufacturing by sorting out various information obtained during R&D
- To elucidate necessary information to transfer technology of existing products between various manufacturing places

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Principles of Drug discovery and development: Introduction, Clinical research process. Development and informational content for Investigational New Drugs Application (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Supplemental New Drug Application (SNDA), Scale Up Post Approval Changes (SUPAC) and Bulk active chemical Post approval changes (BACPAC), Post marketing surveillance, Product registration guidelines – CDSCO, USFDA.	12	CO1 CO2
[2]	Pre-formulation studies: Introduction/concept, organoleptic properties, purity, impurity profiles, particle size, shape and surface area. Solubility, Methods to improve solubility of Drugs: Surfactants & its importance, co-solvency. Techniques for the study of Crystal properties and polymorphism. Pre-formulation protocol, Stability testing during product development.	12	CO3 CO4
[3]	Pilot plant scale up: Concept, Significance, design, layout of pilot plant scales up study, operations, large scale manufacturing techniques (formula, equipment, process, stability and quality control) of solids, liquids, semisolid and parenteral dosage forms. New era of drug products: opportunities and challenges.	12	CO1 CO2
[4]	Pharmaceutical packaging: Pharmaceutical dosage form and their packaging requirements, Pharmaceutical packaging materials, Medical device packaging, Enteral Packaging, Aseptic packaging systems, Container closure systems, Issues facing modern drug packaging, Selection and evaluation of Pharmaceutical packaging materials. Quality control test: Containers, closures and secondary packing materials.	12	CO3 CO4

[5]	Technology transfer: Development of technology by R & D, Technology transfer from R & D to production, Optimization and Production, Qualitative and quantitative technology models. Documentation in technology transfer: Development report, technology transfer plan and Exhibit.	12	CO5
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C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.

D. REFERENCE BOOKS

1. Smith, C. G.; O'donnell, J. The Process of New Drug Discovery and Development; Informa Healthcare: New York, 2006.
2. Willig, S. H.; Tuckerman, M. M.; Hitchings, W. S. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control; M. Dekker: New York, 1982.
3. Lieberman, H. A. Pharmaceutical Dosage Forms. Tablets, Vol. 1-3; New York, Ny Dekker, 1989.
4. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics; Pharmamed Press: Hyderabad, India, 2013.
5. Vandana Patravale; Disouza, J. I.; Maharukh Rustomjee. Pharmaceutical Product Development: Insights into Pharmaceutical Processes, Management and Regulatory Affairs; CRC Press: Boca Raton, 2016.
6. Abdou, H. M. Dissolution, Bioavailability and Bioequivalence; Mack Publishing Company: Easton, 1989.
7. Remington, J. P.; Gennaro, A. R. Remington: The Science and Practice of Pharmacy; Lippincott Williams & Wilkins: Baltimore, Md., 2000.
8. Dr. D.A.Savant. The Pharmaceutical Sciences; the Pharma Path Way 'Pure and Applied Pharmacy; Pragathi Books Pvt. Ltd, 2018.
9. Dean, D. A.; Evans, E. R.; Hall, I. H. Pharmaceutical Packaging Technology.; Taylor And Francis: London, 2000.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand new drug approval process and product registration guideline
CO2	Understand and Apply	To understand and apply preformulation studies in drug product development.
CO3	Understand	To understand development of drug product from R&D to Large scale manufacturing.
CO4	Understand and Evaluate	To understand and evaluate packaging requirement for drug products.
CO5	Understand and Create	To understand regulation for technology transfer for drug product development

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	3	-	3	3	0	3	3	2	2	-
CO2	3	3	3	3	-	1	-	3	0	0	3	3	3	3	1
CO3	3	3	1	3	3	3	3	3	3	3	3	3	3	2	2
CO4	3	-	3	3	-	0	1	0	1	2	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	2	3	3	3	3	2
Avg	3	2.4	2	3	1.2	2	1.4	2.4	2	1.4	3	3	2.8	2.6	1.4

Table – 6: Course of study for M. Pharm. (Pharmaceutical Quality Assurance)

Course Code	Course	Credit Hours	Credit Points	Hrs./wk	Marks
Semester I					
MQA101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MQA102T	Quality Management System	4	4	4	100
MQA103T	Quality Control and Quality Assurance	4	4	4	100
MQA104T	Product Development and Technology Transfer	4	4	4	100
MQA105P	Pharmaceutical Quality Assurance Practical I	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MQA201T	Hazards and Safety Management	4	4	4	100
MQA202T	Pharmaceutical Validation	4	4	4	100
MQA203T	Audits and Regulatory Compliance	4	4	4	100
MQA204T	Pharmaceutical Manufacturing Technology	4	4	4	100
MQA205P	Pharmaceutical Quality Assurance Practical II	12	6	12	150
-	Seminar/Assignment	7	4	7	100
Total		35	26	35	650

**Table – 12: Course of study for M. Pharm. III Semester
(Common for All Specializations)**

Course Code	Course	Credit Hours	Credit Points
MRM 301T	Research Methodology and Biostatistics*	4	4
-	Journal club	1	1
-	Discussion / Presentation (Proposal Presentation)	2	2
-	Research Work	28	14
Total		35	21

* Non University Exam

**Table – 13: Course of study for M. Pharm. IV Semester
(Common for All Specializations)**

Course Code	Course	Credit Hours	Credit Points
-	Journal Club	1	1
-	Research Work	31	16
-	Discussion/Final Presentation	3	3
Total		35	20

Table – 14: Semester wise credits distribution

Semester	Credit Points
I	26
II	26
III	21
IV	20
Co-curricular Activities (Attending Conference, Scientific Presentations and Other Scholarly Activities)	Minimum=02 Maximum=07*
Total Credit Points	Minimum=95 Maximum=100*

*Credit Points for Co-curricular Activities

M. PHARM. SEMESTER – II (MQA)**SUBJECT: MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES - THEORY (MQA101T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	--	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives: After completion of course, student is able to know about

1. Chemicals and excipients
2. The analysis of various drugs in single and combination dosage forms
3. Theoretical and practical skills of the instruments

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier -Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation. c. Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer. d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.	11	CO1 CO2 CO5
[2]	NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³ C NMR. Applications of NMR spectroscopy	11	CO1 CO2 CO5
[3]	Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.	11	CO1 CO2 CO5
[4]	Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following: <ul style="list-style-type: none">● Thin Layer chromatography● High Performance Thin Layer Chromatography	11	CO3 CO4 CO5

	<ul style="list-style-type: none"> ● Ion exchange chromatography ● Column chromatography ● Gas chromatography ● High Performance Liquid chromatography ● Ultra High Performance Liquid chromatography ● Affinity chromatography ● Gel Chromatography. 		
[5]	<p>a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing</p> <p>b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.</p>	11	CO5
[6]	<p>a. Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry.</p> <p>b. Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.</p>	05	CO5

C. TEXT BOOKS

1. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982..
2. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis*.; Pearson: New Delhi, 2009.

D. REFERENCE BOOKS

1. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
2. Kalsi, P. S. *Spectroscopy of Organic Compounds*.; New Age International Pvt, 2016.
3. Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Bryce, D. L. *Spectrometric Identification of Organic Compounds*; Wiley: Hoboken, Nj, 2015.
4. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
5. Hobart Hurd Willard. *Instrumental Methods of Analysis*; Wadsworth: Belmont, 1993.
6. Kemp, W. *Organic Spectroscopy*; Palgrave: Basingstoke, 2001.
7. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
8. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

9. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
10. Sharma, Y. R. *Elementary Organic Spectroscopy : Principles and Chemical Applications*; S. Chand & Company: New Delhi, 2007.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand the fundamentals of various spectroscopic techniques
CO2	Understand Apply and Evaluate	To apply the fundamentals of spectroscopy in single and combination drug analysis
CO3	Understand and remember	To understand the chromatographic separation fundamentals
CO4	Understand Apply and Evaluate	To apply the fundamentals of various chromatographic techniques in single and combination drug analysis
CO5	Understand Apply and Evaluate	To learn theoretical and practical aspects of various analytical instruments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO2	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO3	3	-	1	1	-	1	-	1	-	-	3	2	-	-	-
CO4	3	2	3	2	-	2	1	1	2	-	3	3	1	1	-
CO5	3	2	1	1	-	2	1	1	1	-	3	3	1	1	-
Avg	3	1.2	1.8	1.4	-	1.6	0.6	1	1	-	3	2.6	0.6	0.6	-

M. PHARM. SEMESTER – I (MQA)
SUBJECT: QUALITY MANAGEMENT SYSTEM-THEORY (MQA102T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	0	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart fundamental knowledge and concepts about various quality management principles and systems utilized in the manufacturing industry. It also aids in understanding the quality evaluation in the pharmaceutical industries.

Objectives: At completion of this course, it is expected that students will be able to understand-

- The importance of quality
- ISO management systems
- Tools for quality improvement
- Analysis of issues in quality
- Quality evaluation of pharmaceuticals
- Stability testing of drug and drug substances
- Statistical approaches for quality

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to Quality: Evolution of Quality, Definition of Quality, Dimensions of Quality Quality as a Strategic Decision: Meaning of strategy and strategic quality management, mission and vision statements, quality policy, Quality objectives, strategic planning and implementation, McKinsey 7s model, Competitive analysis, Management commitment to quality Customer Focus: Meaning of customer and customer focus, Classification of customers, Customer focus, Customer perception of quality, Factors affecting customer perception, Customer requirements, Meeting customer needs and expectations, Customer satisfaction and Customer delight, Handling customer complaints, Understanding customer behavior, concept of internal and external customers. Case studies. Cost of Quality: Cost of quality, Categories of cost of Quality, Models of cost of quality, Optimising costs, Preventing cost of quality.	12	CO1 CO3
[2]	Pharmaceutical quality Management: Basics of Quality Management, Total Quality Management (TQM), Principles of Six sigma, ISO 9001:2008, 9001:2015, ISO 14001:2004, Pharmaceutical Quality Management – ICH Q10, Knowledge management, Quality Metrics, Operational Excellence and Quality Management Review. OSHAS guidelines, NABL certification and accreditation, CFR-21 part 11, WHO-GMP requirements.	12	CO1 CO2 CO3
[3]	Six System Inspection model: Quality Management system, Production system, Facility and Equipment system, Laboratory control system, Materials system, Packaging and labeling system. Concept of self inspection. Quality systems: Change Management/ Change control. Deviations, Out of Specifications (OOS), Out of Trend (OOT), Complaints - evaluation and handling, Investigation and determination of root cause,	12	CO4

	Corrective & Preventive Actions (CAPA), Returns and Recalls, Vendor Qualification, Annual Product Reviews, Batch Review and Batch Release. Concept of IPQC, area clearance/ Line clearance.		
[4]	Drug Stability: ICH guidelines for stability testing of drug substances and drug products. Study of ICH Q8, Quality by Design and Process development report Quality risk management: Introduction, risk assessment, risk control, risk review, risk management tools, HACCP, risk ranking and filtering according to ICH Q9 guidelines.	12	CO5
[5]	Statistical Process control (SPC): Definition and Importance of SPC, Quality measurement in manufacturing, Statistical control charts - concepts and general aspects, Advantages of statistical control, Process capability, Estimating Inherent or potential capability from a control chart analysis, Measuring process control and quality improvement, Pursuit of decreased process variability.	08	CO1 CO3 CO4
[6]	Regulatory Compliance through Quality Management and development of Quality Culture Benchmarking: Definition of benchmarking, Reasons for benchmarking, Types of Benchmarking, Benchmarking process, Advantages of benchmarking, Limitations of benchmarking.	04	CO1 CO3 CO4

C. TEXT BOOKS

1. Fairfield-Sonn, J. W. Corporate Culture and the Quality Organization; Quorum Books: Westport, Conn., 2001.

D. REFERENCE BOOKS

1. Endres, A. C. Implementing Juran's Road Map for Quality Leadership : Benchmarks and Results; Wiley: New York, 2000.
2. Antony J, David P, Routledge, Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases, 2002
3. Okes D, Root Cause Analysis, The Core of Problem Solving and Corrective Action, 2009, ASQ Publications.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and Remember	To understand importance of quality and Tools for quality improvement
CO2	Understand	To study the ISO management systems
CO3	Understand and Apply	To understand the Analysis of issues in quality and Statistical approaches for quality
CO4	Understand and Remember	To study the Quality evaluation of pharmaceuticals
CO5	Understand and Apply	To understand the Stability testing of drug and drug substances

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	1	2	1	2	2	1	2	2	2	2	2
CO2	3	3	3	3	1	3	0	2	1	2	3	3	3	3	3
CO3	3	2	2	2	1	2	0	2	2	1	2	2	2	2	2
CO4	3	3	3	3	1	3	1	2	1	2	3	3	3	3	3
CO5	3	3	3	3	1	3	0	2	2	2	3	3	3	3	3
Avg	3	2.6	2.6	2.6	1	2.6	0.4	2	1.6	1.6	2.6	2.6	2.6	2.6	2.6

M. PHARM. SEMESTER – I (MQA)
SUBJECT: QUALITY CONTROL AND QUALITY ASSURANCE (MQA103T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	0	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It covers the important aspects like cGMP, QC tests, documentation, quality certifications, GLP and regulatory affairs.

Objectives: Upon completion of this course the student should be able to

Understand the cGMP aspects in a pharmaceutical industry

- To appreciate the importance of documentation
- To understand the scope of quality certifications applicable to
- Pharmaceutical industries
- To understand the responsibilities of QA & QC departments.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction: Concept and evolution and scopes of Quality Control and Quality Assurance, Good Laboratory Practice, GMP, Overview of ICH Guidelines - QSEM, with special emphasis on Q-series guidelines. Good Laboratory Practices: Scope of GLP, Definitions, Quality assurance unit, protocol for conduct of non clinical testing, control on animal house, report preparation and documentation. CPCSEA guidelines.	12	CO1 CO2 CO5
[2]	cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention(PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination and Good Warehousing Practice.	12	CO1 CO2 CO5
[3]	Analysis of raw materials, finished products, packaging materials, in process quality control (IPQC), Developing specification (ICH Q6 and Q3), purchase specifications and maintenance of stores for raw materials. In process quality control and finished products quality control for following dosage forms in Pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products (How to refer pharmacopoeias).	12	CO1 CO2 CO4 CO5
[4]	Documentation in pharmaceutical industry: Three tier documentation, Policy, Procedures and Work instructions, and records (Formats), Basic principles- How to maintain, retention and retrieval etc. Standard operating procedures (How to write), Master Batch Record, Batch Manufacturing Record, Quality audit plan and reports. Specification and test procedures, Protocols and reports. Distribution records. Electronic data handling. Concepts of controlled and uncontrolled documents. Submission documents for regulators DMFs, as Common Technical	12	CO2 CO3 CO5

	Document and Electronic Common Technical Documentation (CTD, eCTD). Concept of regulated and non regulated markets.		
[5]	Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging, reprocessing, salvaging, handling of waste and scrap disposal. Introduction, scope and importance of intellectual property rights. Concept of trade mark, copyright and patents.	12	CO1 CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Quality Assurance of Pharmaceuticals- A compedium of Guide lines and Related materials Vol I & II, 2 nd edition, WHO Publications, 1999.

D. REFERENCE BOOKS

1. Weinberg, S. Good Laboratory Practice Regulations; M. Dekker: New York, 1995.
2. Sarker, D. K. *Quality Systems and Control for Pharmaceuticals*; John Wiley & Sons: Chichester, West Sussex ; Hoboken, Nj, 2008.
3. Willig, S. H.; Stoker, J. R. *Good Manufacturing Practices for Pharmaceuticals : A Plan for Total Quality Control*; Marcel Dekker: New York, 1997.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To Understand the cGMP aspects in a pharmaceutical industry
CO2	Understand	To appreciate the importance of documentation
CO3	Understand and apply	To understand the scope of quality certifications applicable to pharmaceutical industries
CO4	Understand and evaluate	To Analyse of raw materials, finished products, packaging materials in process quality control (IPQC)
CO5	Understand and apply	To understand the responsibilities of QA & QC departments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	1	2	1	2	2	1	3	3	3	2	1
CO2	3	2	2	2	1	2	1	2	1	2	3	3	3	3	1
CO3	3	2	2	2	1	2	-	2	2	1	3	3	3	2	1
CO4	3	2	2	2	2	3	1	2	1	3	3	3	3	3	1
CO5	3	2	2	2	3	3	-	2	2	3	3	3	3	3	1
Avg	3	2	2	2	1.6	2.4	0.6	2	1.6	2	2.6	3	3	2.6	1

M. PHARM. SEMESTER – I (MPH)**SUBJECT: PRODUCT DEVELOPMENT AND TECHNOLOGY TRANSFER (MQA104T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: Scope This deal with technology transfer covers the activities associated with Drug Substance, Drug Product and analytical tests and methods, required following candidate drug selection to completion of technology transfer from R&D to the first receiving site and technology transfer related to post-marketing changes in manufacturing places.

Objectives: Upon completion of this course the student should be able to

- To understand the new product development process
- To understand the necessary information to transfer technology from R&D to actual manufacturing by sorting out various information obtained during R&D
- To elucidate necessary information to transfer technology of existing products between various manufacturing places

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Principles of Drug discovery and development: Introduction, Clinical research process. Development and informational content for Investigational New Drugs Application (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Supplemental New Drug Application (SNDA), Scale Up Post Approval Changes (SUPAC) and Bulk active chemical Post approval changes (BACPAC), Post marketing surveillance, Product registration guidelines – CDSCO, USFDA.	12	CO1 CO2
[2]	Pre-formulation studies: Introduction/concept, organoleptic properties, purity, impurity profiles, particle size, shape and surface area. Solubility, Methods to improve solubility of Drugs: Surfactants & its importance, co-solvency. Techniques for the study of Crystal properties and polymorphism. Pre-formulation protocol, Stability testing during product development.	12	CO3 CO4
[3]	Pilot plant scale up: Concept, Significance, design, layout of pilot plant scales up study, operations, large scale manufacturing techniques (formula, equipment, process, stability and quality control) of solids, liquids, semisolid and parenteral dosage forms. New era of drug products: opportunities and challenges.	12	CO1 CO2
[4]	Pharmaceutical packaging: Pharmaceutical dosage form and their packaging requirements, Pharmaceutical packaging materials, Medical device packaging, Enteral Packaging, Aseptic packaging systems, Container closure systems, Issues facing modern drug packaging, Selection and evaluation of Pharmaceutical packaging materials. Quality control test: Containers, closures and secondary packing materials.	12	CO3 CO4

[5]	Technology transfer: Development of technology by R & D, Technology transfer from R & D to production, Optimization and Production, Qualitative and quantitative technology models. Documentation in technology transfer: Development report, technology transfer plan and Exhibit.	12	CO5
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C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. The Theory and Practice of Industrial Pharmacy; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.

D. REFERENCE BOOKS

1. Smith, C. G.; O'donnell, J. The Process of New Drug Discovery and Development; Informa Healthcare: New York, 2006.
2. Willig, S. H.; Tuckerman, M. M.; Hitchings, W. S. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control; M. Dekker: New York, 1982.
3. Lieberman, H. A. Pharmaceutical Dosage Forms. Tablets, Vol. 1-3; New York, Ny Dekker, 1989.
4. Gibaldi, M. Biopharmaceutics and Clinical Pharmacokinetics; Pharmamed Press: Hyderabad, India, 2013.
5. Vandana Patravale; Disouza, J. I.; Maharukh Rustomjee. Pharmaceutical Product Development: Insights into Pharmaceutical Processes, Management and Regulatory Affairs; CRC Press: Boca Raton, 2016.
6. Abdou, H. M. Dissolution, Bioavailability and Bioequivalence; Mack Publishing Company: Easton, 1989.
7. Remington, J. P.; Gennaro, A. R. Remington: The Science and Practice of Pharmacy; Lippincott Williams & Wilkins: Baltimore, Md., 2000.
8. Dr. D.A.Savant. The Pharmaceutical Sciences; the Pharma Path Way 'Pure and Applied Pharmacy; Pragathi Books Pvt. Ltd, 2018.
9. Dean, D. A.; Evans, E. R.; Hall, I. H. Pharmaceutical Packaging Technology.; Taylor And Francis: London, 2000.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	To understand new drug approval process and product registration guideline
CO2	Understand and Apply	To understand and apply preformulation studies in drug product development.
CO3	Understand	To understand development of drug product from R&D to Large scale manufacturing.
CO4	Understand and Evaluate	To understand and evaluate packaging requirement for drug products.
CO5	Understand and Create	To understand regulation for technology transfer for drug product development

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	-	3	-	3	-	3	3	0	3	3	2	2	-
CO2	3	3	3	3	-	1	-	3	0	0	3	3	3	3	1
CO3	3	3	1	3	3	3	3	3	3	3	3	3	3	2	2
CO4	3	-	3	3	-	0	1	0	1	2	3	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	2	3	3	3	3	2
Avg	3	2.4	2	3	1.2	2	1.4	2.4	2	1.4	3	3	2.8	2.6	1.4

M. PHARM. SEMESTER – I (MQA)**SUBJECT: PHARMACEUTICAL QUALITY ASSURANCE – PRACTICAL-I (MQA105P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	12	12	6	100	30	20	--	150

A. COURSE OVERVIEW

Scope: This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs dosage forms, preformulation study, stability study etc. as well as Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives: After completion of course, student is able

- To understand and apply the fundamentals of spectroscopy and chromatography in single and combination drug analysis
- To understand the role of analytical techniques in preformulation, stability study, formulation analysis, QC testing and Modern statistical tools in analysis
- To understand working and handling of various analytical instruments.

B. COURSE CONTENT

NO	TOPIC	P (hrs)	COs
[1]	1. Analysis of Pharmacopoeial compounds in bulk and in their formulations (tablet/ capsules/ semisolid) by UV Vis spectrophotometer 2. Simultaneous estimation of multi-drug component containing formulations by UV spectrophotometry 3. Experiments based on HPLC 4. Experiments based on Gas Chromatography 5. Estimation of riboflavin/quinine sulphate by fluorimetry 6. Estimation of sodium/potassium by flame photometry or AAS 7. Assay of raw materials as per official monographs 8. Testing of related and foreign substances in drugs and raw materials	90	CO1 CO2 CO3 CO5
[2]	1. Case studies on <ul style="list-style-type: none"> • Total Quality Management • Six Sigma • Change Management/ Change control. Deviations, • Out of Specifications (OOS) • Out of Trend (OOT) • Corrective & Preventive Actions (CAPA) • Deviations 2. Development of Stability study protocol 3. Estimation of process capability 4. In process and finished product quality control tests for tablets, capsules, parenterals and semisolid dosage forms. 5. To carry out pre formulation study for tablets, parenterals (2 experiment). 6. To study the effect of pH on the solubility of drugs, (1 experiment) 7. Quality control tests for Primary and secondary packaging materials 8. Accelerated stability studies (1 experiment) 9. Improved solubility of drugs using surfactant systems (1 experiment) 10. Improved solubility of drugs using co-solvency method (1 experiment) 19. Determination of Pka and Log p of drugs.	90	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.
2. Lachman, L.; Liebermann, H. A. *The Theory and Practice of Industrial Pharmacy*; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.

D. REFERENCE BOOKS

1. *Indian Pharmacopoeia*; Indian Pharmacopoeial Commission, Ministry of health and family welfare, Government of India: Ghaziabad, 2014; Vol. 1-4.
2. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
3. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
4. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distributors: New Delhi, 2005.
5. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
6. Garratt, D. C. *The Quantitative Analysis of Drugs : Assisted by L. Brealey Etc.*; Chapman & Hall: London, 1964.
7. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis.*; Pearson: New Delhi, 2009.
8. Connors, K. A. *A Textbook of Pharmaceutical Analysis*; Wiley: New York, 1982.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To understand and apply the fundamentals of spectroscopy in single and combination drug analysis
CO2	Understand Apply and Evaluate	To understand and apply the fundamentals of chromatography in single and combination drug analysis
CO3	Understand Apply and Evaluate	To understand the role of analytical techniques in preformulation, stability study and formulation analysis.
CO4	Understand Apply and Evaluate	To understand the role of analytical techniques in QC testing and applications of modern statistical tools in analysis
CO5	Understand Apply and Evaluate	To understand working and handling of various analytical instruments.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	1	2	1	1	1	-	3	3	1	1	-
CO2	3	3	3	2	1	2	1	1	1	-	3	3	1	1	-
CO3	3	3	3	2	1	2	1	1	1	-	3	3	1	1	-
CO4	3	3	3	2	1	2	1	1	1	-	3	3	1	3	-
CO5	3	2	-	-	1	2	1	1	-	-	3	2	1	-	-
Avg	3	2.8	2.4	1.6	1	2	1	1	0.8	-	3	2.8	1	1.2	-

M. PHARM. SEMESTER – II (MQA)
SUBJECT: HAZARDS AND SAFETY MANAGEMENT (MQA201T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	0	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to convey the knowledge necessary to understand issues related to different kinds of hazard and their management. Basic theoretical and practical discussions integrate the proficiency to handle the emergency situation in the pharmaceutical product development process and provides the principle-based approach to solve the complex tribulations.

Objectives: At completion of this course, it is expected that students will be able to

- Understand about environmental problems among learners.
- Impart basic knowledge about the environment and its allied problems.
- Develop an attitude of concern for the industry environment.
- Ensure safety standards in pharmaceutical industry
- Provide comprehensive knowledge on the safety management
- Empower an ideas to clear mechanism and management in different kinds of hazard management system
- Teach the method of Hazard assessment, procedure, methodology for provide safe industrial atmosphere.

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Multidisciplinary nature of environmental studies: Natural Resources, Renewable and non-renewable resources, Natural resources and associated problems, a) Forest resources; b) Water resources; c) Mineral resources; d) Energy resources; e) Land resources Ecosystems: Concept of an ecosystem and Structure and function of an ecosystem. Environmental hazards: Hazards based on Air, Water, Soil and Radioisotopes.	12	CO1
[2]	Air based hazards: Sources, Types of Hazards, Air circulation maintenance industry for sterile area and non sterile area, Preliminary Hazard Analysis (PHA) Fire protection system: Fire prevention, types of fire extinguishers and critical Hazard management system.	12	CO2 CO3 CO4 CO5
[3]	Chemical based hazards: Sources of chemical hazards, Hazards of Organic synthesis, sulphonating hazard, Organic solvent hazard, Control measures for chemical hazards, Management of combustible gases, Toxic gases and Oxygen displacing gases management, Regulations for chemical hazard, Management of over-Exposure to chemicals and TLV concept.	12	CO2 CO3 CO4 CO5
[4]	Fire and Explosion : Introduction, Industrial processes and hazards potential, mechanical electrical, thermal and process hazards. Safety and hazards regulations, Fire protection system: Fire prevention, types of fire extinguishers and critical Hazard management system mechanical and chemical explosion, multiphase reactions, transport effects and global rates. Preventive and protective management from fires and explosion-	12	CO2 CO3 CO4 CO5

	electricity passivation, ventilation, and sprinkling, proofing, relief systems -relief valves, flares, scrubbers.		
[5]	Hazard and risk management: Self-protective measures against workplace hazards. Critical training for risk management, Process of hazard management, ICH guidelines on risk assessment and Risk management methods and Tools Factory act and rules, fundamentals of accident prevention, elements of safety programme and safety management, Physicochemical measurements of effluents, BOD, COD, Determination of some contaminants, Effluent treatment procedure, Role of emergency services.	12	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Bharucha E, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India.
2. Gajjar D, Nagdev S, A TEXTBOOK OF HAZARDS AND SAFETY MANAGEMENT, PV books, 2020.

D. REFERENCE BOOKS

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. T S S Dikshith. Hazardous Chemicals Safety Management and Global Regulations; Crc Press: Boca Raton, Florida, 2017.
3. “Quantitative Risk Assessment in Chemical Process Industries” American Institute of Chemical Industries, Centre for Chemical Process safety.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and apply	To understand about environmental problems among learners and impart basic knowledge about the environment and its allied problems.
CO2	Understand and Analyse	Development of attitude of concern for the industry environment and ensure safety standards in pharmaceutical industry
CO3	Understand and Remember	To provide comprehensive knowledge on the safety management
CO4	Understand and Apply	To empower ideas to clear mechanism and management in different kinds of hazard management system
CO5	Understand and Remember	To understand the method of Hazard assessment, procedure, methodology for provide safe industrial atmosphere

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	1	3	2	3	1	2	3	3	-	1	-	-
CO2	3	3	3	1	3	2	1	1	3	3	3	-	1	-	-
CO3	3	3	3	1	3	2	-	1	3	3	3	-	1	-	-
CO4	3	3	3	1	3	2	-	1	3	3	3	-	1	-	-
CO5	3	3	3	1	3	2	-	1	3	3	3	-	1	-	-
Avg	3	3	3	1	3	2	0.8	1	2.8	3	3	-	1	-	-

M. PHARM. SEMESTER – II (MPH)
SUBJECT: PHARMACEUTICAL VALIDATION (MQA202T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect.	Tut	Prac.	Total		Ext	Sess.	CM	Prac.	Total
04	-	-	04	04	75	15	10	-	100

A. COURSE OVERVIEW

Scope: The main purpose of the subject is to understand about validation and how it can be applied to industry and thus improve the quality of the products. The subject covers the complete information about validation, types, methodology and application.

Objectives:

At completion of this course, it is expected that students will be able to understand:

- Understand and remember the concept of calibration, qualification and validation
- Learn the theoretical aspects about the qualification of various equipments and instruments
- Understand and learn process validation of different dosage forms
- Learn the validation of analytical methods developed for quantification of drugs
- Understand and learn the cleaning validation of equipments employed in the manufacture of pharmaceuticals
- Learn the importance of patent and intellectual property rights

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction to validation: Definition of Calibration, Qualification and Validation, Scope, frequency and importance. Difference between calibration and validation. Calibration of weights and measures. Advantages of Validation, scope of Validation, Organization for Validation, Validation Master plan, Types of Validation, Streamlining of qualification & Validation process and Validation Master Plan. Qualification: User requirement specification, Design qualification, Factory Acceptance Test (FAT)/Site Acceptance Test (SAT), Installation qualification, Operational qualification, Performance qualification, Re-Qualification (Maintaining status- Calibration Preventive Maintenance, Change management).	10	CO1
[2]	Qualification of manufacturing equipment: Dry Powder Mixers, Fluid Bed and Tray dryers, Tablet Compression (Machine), Dry heat sterilization/Tunnels, Autoclaves, Membrane filtration, Capsule filling machine. Qualification of analytical instruments: UV-Visible spectrophotometer, FTIR, DSC, GC, HPLC, HPTLC, LC-MS.	10	CO2
[3]	Qualification of laboratory equipments: Hardness tester, Friability test apparatus, tap density tester, Disintegration tester, Dissolution test apparatus Validation of Utility systems: Pharmaceutical water system & pure steam, HVAC system, Compressed air and nitrogen.	10	CO2
[4]	Process Validation: Concept, Process and documentation of Process Validation. Prospective, Concurrent & Retrospective Validation, Re validation criteria, Process Validation of various formulations (Coated tablets, Capsules, Ointment/Creams, Liquid Orals and aerosols.), Aseptic filling: Media fill validation, USFDA guidelines on Process Validation- A life cycle approach. Analytical method validation: General principles, Validation of analytical method as per ICH guidelines and USP.	10	CO3 CO4

[5]	Cleaning Validation: Cleaning Method development, Validation of analytical method used in cleaning, Cleaning of Equipment, Cleaning of Facilities. Cleaning in place (CIP). Validation of facilities in sterile and non-sterile plant. Computerized system validation: Electronic records and digital signature - 21 CFR Part 11 and GAMP	10	CO5
[6]	General Principles of Intellectual Property: Concepts of Intellectual Property (IP), Intellectual Property Protection (IPP), Intellectual Property Rights (IPR); Economic importance, mechanism for protection of Intellectual Property –patents, Copyright, Trademark; Factors affecting choice of IP protection; Penalties for violation; Role of IP in pharmaceutical industry; Global ramification and financial implications. Filing a patent applications; patent application forms and guidelines. Types patent applications-provisional and non provisional, PCT and convention patent applications; International patenting requirement procedures and costs; Rights and responsibilities of a patentee; Practical aspects regarding maintaining of a Patent file; Patent infringement meaning and scope. Significance of transfer technology (TOT), IP and ethics-positive and negative aspects of IPP; Societal responsibility, avoiding unethical practices.	10	CO6

C. TEXT BOOKS

1. Berry, I. R.; Nash, R. A. *Pharmaceutical Process Validation*; Marcel Dekker: New York, 1993.
2. Syed Imtiaz Haider. *Pharmaceutical Master Validation Plan : The Ultimate Guide to FDA, GMP, and GLP Compliance*; St. Lucie Press: Boca Raton, 2002.

D. REFERENCE BOOKS

1. Loftus, B. T.; Nash, R. A. *Pharmaceutical Process Validation*; M. Dekker: New York ; Basel, 1984.
2. Carleton, F. J.; Agalloco, J. P. *Validation of Pharmaceutical Processes : Sterile Products*; M. Dekker: New York, 1999.
3. Lachman, L.; Liebermann, H. A. *The Theory and Practice of Industrial Pharmacy*; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.
4. Syed Imtiaz Haider. *Validation Standard Operating Procedures a Step by Step Guide for Achieving Compliance in the Pharmaceutical, Medical Device, and Biotech Industries*; Informa Healthcare, 2001.
5. Cloud, P. A. *Pharmaceutical Equipment Validation : The Ultimate Qualification Handbook*; Informa Healthcare: New York, 2007. *Validation of Pharmaceutical Processes: Sterile Products*, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker
6. Chung Chow Chan. *Analytical Method Validation and Instrument Performance Verification*; John Wiley & Sons: Hoboken, N.J., 2004.
7. Ludwig Huber. *Validation and Qualification in Analytical Laboratories*; Informa Healthcare: New York, 2007.
8. Respect, I.; Al, E. *Principles of Qualification and Validation in Pharmaceutical Manufacture : Recommendations on : Validation Master Plan : Installation and Operational Qualification : Non-Sterile Process Validation : Cleaning Validation*; S.L.] [S.N, 1996.
9. Destin Leblanc. *Validated Cleaning Technologies for Pharmaceutical Manufacturing*; Crc Press, 2000

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	Understand and remember the concept of calibration, qualification and validation
CO2	Learn	Learn the theoretical aspects about the qualification of various equipments and instruments
CO3	Understand and learn	Understand and learn analytical method validation and Pharmaceutical process validation
CO4	Learn	Understand and learn the cleaning validation of equipments employed in the manufacture of pharmaceuticals
CO5	Understand and learn	Learn the importance of patent and intellectual property rights

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	1	-	3	2	2	1	2
CO2	3	3	2	1	1	1	1	1	1	-	3	3	3	3	3
CO3	3	3	2	1	1	1	1	1	1	-	3	3	3	3	3
CO4	3	3	2	1	1	1	1	1	1	-	3	3	3	3	3
CO5	3	-	-	-	-	2	3	2	2	-	3	1	1	-	-
Avg.	3	2	1.2	0.6	0.6	1	1.2	1	1.2	-	3	2.4	2.4	2	2.2

M. PHARM. SEMESTER – II (MQA)
SUBJECT: AUDITS AND REGULATORY COMPLIANCE (MQA203T)

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course deals with the understanding and process for auditing in pharmaceutical industries. This subject covers the different aspects like methodology involved in the auditing process of different in pharmaceutical industries, preparing audit report and audit checklist preparation etc.

Objectives: Upon completion of this course the student should be able to

- To understand the importance of auditing
- To understand the methodology of auditing
- To carry out the audit process
- To prepare the auditing report
- To prepare the check list for auditing

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Introduction: Objectives, Management of audit, Responsibilities, Planning process, information gathering, administration, Classifications of deficiencies	12	CO1 CO2
[2]	Role of quality systems and audits in pharmaceutical manufacturing environment: cGMP Regulations, Quality assurance functions, Quality systems approach, Management responsibilities, Resource, Manufacturing operations, Evaluation activities, Transitioning to quality system approach, Audit checklist for drug industries.	12	CO1 CO2 CO5
[3]	Auditing of vendors and production department: Bulk Pharmaceutical Chemicals and packaging material Vendor audit, Warehouse and weighing, Dry Production: Granulation, tableting, coating, capsules, sterile production and packaging.	12	CO3 CO4 CO5
[4]	Auditing of Microbiological laboratory: Auditing the manufacturing process, Product and process information, General areas of interest in the building raw materials, Water, Packaging materials.	12	CO3 CO4 CO5
[5]	Auditing of Quality Assurance and engineering department: Quality Assurance Maintenance, Critical systems: HVAC, Water, Water for Injection systems, ETP	12	CO3 CO4 CO5

C. TEXT BOOKS

1. Ginsbury, K., Bismuth, G. Compliance auditing for Pharmaceutical Manufacturers, Interpharm/CRC, London, 2018

D. REFERENCE BOOKS

1. Gad, C.S. Pharmaceutical Manufacturing Handbook, Wiley-Interscience, 1st ed.; New Jersey, 2008
2. Baird, R.M., Hodges, N.A., Denyar, S.P. Handbook of microbiological Quality control, 1st ed.; CRC Press, London, 2017.
3. Singer, D.C., Stefan, R., Van Staden, J.F. Laboratory auditing for quality and regulatory compliance, 1st ed.; Taylor and Francis, Boca Raton, 2005

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand and remember	To discuss the importance of auditing
CO2	Understand and remember	To explain the methodology of auditing
CO3	Apply and evaluate	To describe the audit process
CO4	Analysis, Apply and Create	To prepare the audit report
CO5	Apply and create	To prepare the check list for auditing

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	2	1	-	-	-	-	-	3	2	2	1	2
CO2	2	1	0	3	1	-	-	-	-	-	3	2	3	2	2
CO3	2	1	2	2	1	-	-	-	-	-	3	3	3	3	2
CO4	2	2	1	2	1	-	-	2	-	-	3	2	3	2	2
CO5	3	1	1	2	2	-	-	2	-	-	3	1	3	1	3
Avg	2.2	1.2	1	2.2	1.2	-	-	0.8	-	-	3	2	2.8	1.8	2.2

M. PHARM. SEMESTER – II (MQA)**SUBJECT: PHARMACEUTICAL MANUFACTURING TECHNOLOGY (MQA204T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: This course is designed to impart knowledge and skills necessary to train the students with the industrial activities during Pharmaceutical Manufacturing.

Objectives: Upon completion of the course the student shall be able to

- The common practice in the pharmaceutical industry developments, plant layout and production planning
- Will be familiar with the principles and practices of aseptic process technology, non-sterile manufacturing technology and packaging technology.
- Have a better understanding of principles and implementation of Quality by design (QbD) and process analytical technology (PAT) in pharmaceutical manufacturing

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	Pharmaceutical industry developments: Legal requirements and Licenses for API and formulation industry, Plant location- Factors influencing. Plant layout: Factors influencing, Special provisions, Storage space requirements, sterile and aseptic area layout. Production planning: General principles, production systems, calculation of standard cost, process planning, routing, loading, scheduling, dispatching of records, production control.	12	CO1 CO5
[2]	Aseptic process technology: Manufacturing, manufacturing flowcharts, in process-quality control tests for following sterile dosage forms: Ointment, Suspension and Emulsion, Dry powder, Solution (Small Volume & large Volume). Advanced sterile product manufacturing technology : Area planning & environmental control, wall and floor treatment, fixtures and machineries, change rooms, personnel flow, utilities & utilities equipment location, engineering and maintenance. Process Automation in Pharmaceutical Industry: With specific reference to manufacturing of sterile semisolids, Small Volume Parenterals & Large Volume Parenterals (SVP & LVP), Monitoring of Parenteral manufacturing facility, Cleaning in Place (CIP), Sterilization in Place (SIP), Prefilled Syringe, Powdered Jet, Needle Free Injections, and Form Fill Seal Technology (FFS). Lyophilization technology: Principles, process, equipment.	12	CO1 CO2 CO4
[3]	Non sterile manufacturing process technology: Manufacturing, manufacturing flowcharts, in process-quality control tests for following Non-Sterile solid dosage forms: Tablets (compressed & coated), Capsules (Hard & Soft). Advance non-sterile solid product manufacturing technology: Process Automation in Pharmaceutical Industry with specific reference to manufacturing of tablets and coated products, Improved Tablet Production: Tablet production process, granulation and pelletization equipments, continuous and batch mixing, rapid mixing granulators, rota granulators, spheronizers and marumerisers, and other specialized granulation and drying equipment. Problems encountered.	12	CO1 CO3 CO4

	Coating technology: Process, equipments, particle coating, fluidized bed coating, application techniques. Problems encountered.		
[4]	Containers and closures for pharmaceuticals: Types, performance, assuring quality of glass; types of plastics used, Drug plastic interactions, biological tests, modification of plastics by drugs; different types of closures and closure liners; film wrapper; blister packs; bubble packs; shrink packaging; foil / plastic pouches, bottle seals, tape seals, breakable seals and sealed tubes; quality control of packaging material and filling equipment, flexible packaging, product package compatibility, transit worthiness of package, Stability aspects of packaging. Evaluation of stability of packaging material.	12	CO4 CO5
[5]	Quality by design (QbD) and process analytical technology (PAT): Current approach and its limitations. Why QbD is required, Advantages, Elements of QbD, Terminology: QTPP, CMA, CQA, CPP, RLD, Design space, Design of Experiments, Risk Assessment and mitigation/minimization. Quality by Design, Formulations by Design, QbD for drug products, QbD for Drug Substances, QbD for Excipients, Analytical QbD. FDA initiative on process analytical technology. PAT as a driver for improving quality and reducing costs: quality by design (QbD), QA, QC and GAMP. PAT guidance, standards and regulatory requirements.	12	CO3

C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. *The Theory and Practice of Industrial Pharmacy*; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.

D. REFERENCE BOOKS

1. Martin, A.; Bustamante, P.; Chun, A. H. C. *Physical Pharmacy : Physical Chemical Principles in the Pharmaceutical Sciences*; Lea & Febiger: Philadelphia, 1993.
2. Lieberman, H. A. *Pharmaceutical Dosage Forms Tablets, Vol. 1-3*; New York, Ny [U.A.] Dekker, 1990.
4. Banker, G. S.; Rhodes, C. T. *Modern Pharmaceutics*; Marcel Dekker: New York, 2002.
5. Willig, S. H.; Stoker, J. R. *Good Manufacturing Practices for Pharmaceuticals : A Plan for Total Quality Control*; Marcel Dekker: New York, 1997.
6. Ministry, India. *Indian Pharmacopoeia, 1996. Veterinary Supplement 2000*; Controller Of Publications: Delhi, 2000.
7. Great Britain. Stationery Office. *British Pharmacopoeia 2016.*; The Stationary Office: London, 2015.
8. United States Pharmacopoeial Convention. *The United States Pharmacopoeia : The National Formulary*; United States Pharmacopoeial Convention: Rockville, Md, 2019.
9. Jean, U. K.; Goupale, D. C.; S Nayak. *Pharmaceutical Packaging Technology*; Hyderabad Pharmamed Pres, 2008..
10. Bauer, E. J. *Pharmaceutical Packaging Handbook*; Informa Healthcare: New York, 2009.
11. Shayne Cox Gad. *Pharmaceutical Manufacturing Handbook.*; Wiley-Interscience, 2008.

E. COURSE OUTCOMES

(Minimum 5 Cos are required)

CO Number	Skill	Statement
CO1	Understand and Analyse	To learn the common practice in the pharmaceutical industry developments, plant layout and production planning
CO2	Understand and Analyse	To be familiar with the principles and practices of aseptic process technology technology
CO3	Understand Apply and Evaluate	To have a better understanding of principles and implementation of Quality by design (QbD) process analytical technology (PAT) in pharmaceutical manufacturing
CO4	Understand and apply	To understand non sterile manufacturing technology, Process Automation in Pharmaceutical Industry with specific reference to manufacturing of tablets and coated products
CO5	Understand and analyse	To learn the quality control of packaging material, container and closure and evaluation of stability of packaging material

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Avg	3	3	3	3	2.8	2.8	3	3	3	3	3	3	3	3	3

M. PHARM. SEMESTER – II (MQA)**SUBJECT: PHARMACEUTICAL QUALITY ASSURANCE – PRACTICAL-II (MQA105P)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
-	-	12	12	6	100	30	20	--	150

A. COURSE OVERVIEW

Scope: The main purpose of the subject is to understand about method validation, process validation, equipment qualification and how it can be applied to industry and thus improve the quality of the products. The subject also covers drugs and environmental analysis as well as Qbd and PAT.

Objectives

At completion of this course, it is expected that students will be able

- To Understand the fundamentals of analytical method, instrument and Pharmaceutical process validation.
- To Understand the fundamentals of pharmaceutical equipment and analytical instrument qualification. And aspects of Pat, QbD

B. COURSE CONTENT

NO	TOPIC	P (Hrs)	COs
[1]	<ul style="list-style-type: none">• Organic contaminants residue analysis by HPLC• Estimation of Metallic contaminants by Flame photometer• Identification of antibiotic residue by TLC• Estimation of Hydrogen Sulphide in Air.• Estimation of Chlorine in Work Environment.• Sampling and analysis of SO₂ using Colorimetric method• Validation of an analytical method for a drug• Qualification of at least two analytical instruments	90	CO1 CO2 CO3
[2]	<ul style="list-style-type: none">• Check list for Bulk Pharmaceutical Chemicals vendors• Check list for tableting production.• Check list for sterile production area• Check list for Water for injection.• Design of plant layout: Sterile and non-sterile• Case study on application of QbD• Case study on application of PAT• Validation of a processing area• Qualification of Pharma equipments like Autoclave, Hot air oven, Powder Mixer (Dry), Tablet Compression Machine• Cleaning validation of one equipment• Qualification of Pharmaceutical Testing Equipment (Dissolution testing apparatus, Friability Apparatus, Disintegration Tester)	90	CO2 CO3 CO4 CO5

C. TEXT BOOKS

1. Lachman, L.; Liebermann, H. A. *The Theory and Practice of Industrial Pharmacy*; Cbs Publishers & Distributors Pvt. Ltd: New Delhi, 2013.
2. Loftus, B. T.; Nash, R. A. *Pharmaceutical Process Validation*; M. Dekker: New York ; Basel, 1984.

D. REFERENCE BOOKS

1. Indian Pharmacopoeia, Indian Pharmacopoeial Commission, Ministry of health and family welfare, Government of India, Vol- I, II, III, 2014.
2. JW Munson. *Pharmaceutical Analysis - Modern Methods Part-B*; Marcel. Dekker Series.; Vol. 11.
3. Skoog, D. A.; F James Holler; Crouch, S. R. *Principles of Instrumental Analysis*; Thomson, Brooks/Cole: Belmont, Ca, 2007.
4. Sethi, P. D. *Quantitative Analysis of Drugs in Pharmaceutical Formulations*; Cbs Publishers & Distritutors: New Delhi, 2005.
5. Sharma B K. *Instrumental Methods of Chemical Analysis*, 27th edition.; Goel Publishing House: Meerut, 2011.
6. Chung Chow Chan; Netlibrary, I.; Al, E. *Analytical Method Validation and Instrument Performance Verification*; John Wiley & Sons: Hoboken, N.J., 2004.
7. *International conference on harmonisation of technical requirements for registration of pharmaceuticals for human use ich harmonised tripartite guideline validation of analytical procedures: text and methodology Q2(R1)*.
8. Cloud, P. A. *Pharmaceutical Equipment Validation : The Ultimate Qualification Handbook*; Informa Healthcare: New York, 2007.
9. Mendham, A. *Vogel's Textbook of Quantitative Chemical Analysis*.; Pearson: New Delhi, 2009.
10. Beckett, A. H.; Stenlake, J. B. *Practical Pharmaceutical Chemistry*; Athlone Press: London, 1988.

E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand Apply and Evaluate	To apply the fundamentals of spectroscopy and chromatography in drug and environmental analysis
CO2	Understand Apply and Evaluate	To Understand and apply the fundamentals of analytical method and Pharmaceutical process and utilities validation.
CO3	Understand Apply and Evaluate	To Understand and apply the fundamentals of pharmaceutical equipment and analytical instrument qualification.
CO4	Understand and Analyse	To understand the role of modern tools like QbD and PAT in Pharmaceutical processing.
CO5	Understand and Remember	To remember checklists for various dosage forms

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2	1	2	1	1	1	3	3	2	1	1	-
CO2	3	3	3	2	1	2	1	1	1	-	3	2	2	2	3
CO3	3	3	3	2	1	2	1	1	1	-	3	2	2	2	3
CO4	3	-	-	2	-	1	-	1	-	-	3	3	2	3	-
CO5	3	-	-	-	-	1	-	1	-	-	3	1	1	1	-
Avg	3	1.8	1.8	1.6	0.6	1.6	0.6	1	0.6	0.6	3	2	1.6	1.8	1.2

M. PHARM. SEMESTER – III (MPH)**SUBJECT: RESEARCH METHODOLOGY AND BIOSTATISTICS -THEORY (MRM301T)**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	CM	Prac	Total
4	-	-	4	4	75	15	10	-	100

A. COURSE OVERVIEW

Scope: To understand the applications of Biostatistics in Pharmacy. This subject also deals to understand research methodology process, ethics in medical, clinical and pre-clinical research.

Objectives: Upon completion of the course the student shall be able to

- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems.
- To know and understand medical research and ethical practise in clinical and non-clinical research

B. COURSE CONTENT

NO	TOPIC	L (Hrs)	COs
[1]	General Research Methodology: Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques.	12	CO1
[2]	Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (students “t” test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxon rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values.	15	CO2
[3]	Medical Research: History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality.	15	CO3
[4]	CPCSEA guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anaesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals.	10	CO4
[5]	Declaration of Helsinki: History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.	08	CO3 CO5

C. TEXT BOOKS

1. Kothari, C R. Research Methodology: Methods & Techniques. New Delhi, New Age International (P) Ltd., Publishers, Cop, 2004.

D. REFERENCE BOOKS

1. Prabhat Pandey, and Meenu Mishra Pandey. Research Methodology: Tools & Techniques. New Delhi, Bridge Center, 2015.
2. De, James E. Basic Statistics and Pharmaceutical Statistical Applications. New York, Marcel Dekker, 1999.
3. "GUIDELINES: Committee for the Purpose of Control and Supervision of Experiments on Animals." Cpcsea.nic.in, cpcsea.nic.in/Content/55_1_GUIDELINES.aspx.
4. Ulf Schmidt, et al. Ethical Research: The Declaration of Helsinki, and the Past, Present and Future of Human Experimentation. New York, Ny, Oxford University Press, 2020.
5. World Medical Association. "WMA - the World Medical Association-Declaration of Helsinki." Wma.net, WMA - The World Medical Association-Declaration of Helsinki, 2014, www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/.

E. COURSE OUTCOMES

CO Number	Skill		Statement
CO1	Understand and Apply		To understand research methodology and application of study design in clinical research.
CO2	Remember, Understand and Apply		To learn and apply various biostatistical techniques in hypothesis testing of research.
CO3	Understand and Create		To know process of ethical medical research and protocol designing
CO4	Understand and Remember		To understand ethics and regulations use of animals in research.
CO5	Understand and Remember		To know ethics and regulation in clinical research.

F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	3	-	3	3	2	-	3	3	1	-	3
CO2	3	1	1	3	-	1	-	-	3	-	3	2	2	-	3
CO3	3	3	2	1	3	3	3	3	3	3	3	2	2	-	3
CO4	3	3	2	1	2	3	3	3	3	3	3	2	2	-	3
CO5	3	1	2	2	3	3	3	3	2	3	3	3	3	-	3
Avg	3	2	2	2	2.2	2	2.4	2.4	2.6	1.8	3	2.4	2	-	3

B. TECH. SEMESTER – I (EC/CE/IT)
SUBJECT: MATHEMATICS – I

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

Reference Code: BSC102

A. COURSE OBJECTIVES

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

B. DETAILED SYLLABUS

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

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

[3]	VECTOR SPACES
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Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Linear Independence of vectors, Diagonalization.

[4]	MULTIVARIABLE CALCULUS (Differentiation)
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Limit, Continuity and Partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Vector Differential Calculus; Gradient, curl and divergence.

C. RECOMMENDED TEXT/ REFERENCE BOOK

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

2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxi Publications, Reprint, 2010.
8. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

D. COURSE OUTCOMES

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

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

B. TECH. SEMESTER – I (EC/CE/IT)

SUBJECT: BASIC ELECTRICAL ENGINEERING

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

Reference Code ESC104

*TW Marks includes Viva based on TW

A. COURSE OBJECTIVES

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

B. DETAILED SYLLABUS

Unit Topic(s)

[1] DC CIRCUITS

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

[2] AC CIRCUITS

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

[3] ELECTRO-MAGNETIC INDUCTION

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

[4] MAGNETIC CIRCUITS

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

[5] TRANSFORMERS

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

[6] ELECTRICAL MACHINES

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited DC motor. Construction and working of synchronous generators, Construction, Principles and working theory and Types of DC Motors & Generators, 1-Ph & 3-Ph Induction Motor, AC Generator.

C. RECOMMENDED TEXT / REFERENCE BOOKS

1. Basic Electrical, Electronics and Computer Engineering, R. Muthu Subramanian, S. Salvahanan, K. A. Muraleedharan, 2nd Edition, Tata McGraw Hill.
2. Electronics Principles, Albert Paul Malvino, 6th Edition, Tata McGraw Hill
3. Electrical Technology (Vol: II), B. L. Theraja , A. K. Theraja, 23rd Edition, R. Chand & Company
4. Basic Electrical Engineering, D.P. Kothari, I. J. Nagrath, 3rd Edition, Tata McGraw Hill
5. Introduction to VLSI Circuit & Systems, John P. Uyemura, 1st Edition, John Willey & Sons Inc.
6. Basic Electrical Engineering, D.C. Kulshreshtha, 1st Edition, Tata McGraw Hill
7. Electrical and Electronics Technology, E. Hughes, 10th Edition, Pearson
8. Electrical Engineering Fundamentals, V.D. Toro, 2nd Edition, Prentice Hall India
9. Fundamentals of Electrical Engineering, L.S. Bobrow, , Oxford University Press

D. COURSE OUTCOMES

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

- Apply basic circuit laws (KVL, KCL and Ohm's) and Theorems (Thevenin's and Norton's) for simplifying the complex resistive network to compute node voltages and loop currents for given excitation.
- Analyse Single Phase AC Circuits, compute and demonstrate the waveforms and phasor diagram representation of alternating quantities.
- Design low pass, high pass, band pass and band elimination filter networks, analyse the frequency response of circuits to show the correlation between time domain and frequency domain response specifications.

- Analyse 3-Phase circuit (star-delta) and compute power for balanced and unbalanced load.
- Predict the behaviour of any electrical and magnetic circuits with an ability to identify, formulate, and solve magnetic circuit problems in electrical machines.
- Model the Equivalent Circuit of a Transformer for Performance Analysis
- Discriminate the constructional details, principle of operation and applications of AC and DC electrical machines.

B. TECH. SEMESTER – I (EC/CE/IT)

SUBJECT: PROGRAMMING FOR PROBLEM SOLVING - I

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

Reference Code ESC105

*TW Marks includes Viva based on TW

A. COURSE OBJECTIVES

The objectives of teaching this course are:

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

B. DETAILED SYLLABUS

Unit	Topic(s)
[1]	OVERVIEW OF C Basic structure of C program. Compiling and running C program
[2]	CONSTANTS, VARIABLES, AND DATA TYPES Types of constants. Basic data types, Identifier, Variable, Enum, Symbolic constant, Typedef. Keywords, Overflow and Underflow
[3]	OPERATORS AND EXPRESSIONS Arithmetic, relational, logical, Assignment, bitwise, and sizeof operator. Operator precedence and associativity. Expression evaluation
[4]	MANAGING INPUT AND OUTPUT OPERATIONS getchar and putchar functions. Formatted I/O using printf and scanf.
[5]	DECISION MAKING AND BRANCHING if and if...else statement. Nested and ladder if...else. Conditional operator, switch statement, goto statement with warning
[6]	DECISION MAKING AND LOOPING while, do...while. for loops, nested loops. break and continue statements
[7]	ARRAYS AND STRINGS Introduction to arrays. Declaration, initialization and access of one-dimensional and two-dimensional arrays. Introduction to multi-dimensional and variable length arrays.

Declaration and initialization of strings. Printing and scanning strings to/from standard I/O. String handling functions, list of strings

[8] USER-DEFINED FUNCTIONS

Function prototype and function declaration, function definition. Function call, actual and formal parameters/arguments. Return type and return statement. Nested function call, recursion. Scope, visibility, and lifetime of variables

[9] STRUCTURES AND UNIONS

Defining structure, declaring and initializing structure variables, typedef. Accessing structure members. Copying and comparing structure variables. Nested structures, arrays and structures. Structures and functions, unions

[10] POINTERS

Introduction, accessing address of a variable. Declaration and initialization of pointer variables. Accessing variable using pointer, chain of pointers. Scale factor and pointer expressions. Pointers and arrays, Pointer to array Vs array of pointers. Passing arrays and strings to the function. Array of pointers, pointers and functions, pointers and structures. const pointer vs pointer to const

C. RECOMMENDED TEXT/REFERENCE BOOK

1. Programming in ANSI C by Balagurusamy, 8th Ed., Tata McGraw Hil
2. Programming with C by Byron Gottfried, 3rd Ed., McGraw Hill Education
3. The C Programming Language by Kernighan and Ritchie, 2nd Ed., PHI Learning
4. Expert C Programming: Deep C Secrets by Peter Van Der Linden, Pearson Education
5. Let Us C by YashvantKanetkar, 12th Ed., BPB Publication
6. Programming in C by Ashok N. Kamthane, 2nd Ed., Pearson Education

D. COURSE OUTCOMES

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

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

- Apply concepts to write, compile, debug, execute, and document C programs with different test cases using appropriate tool(s).

B. TECH. SEMESTER – I (EC/CE/IT)

SUBJECT: ENGINEERING GRAPHICS & DESIGN

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

Reference Code ESC106

*TW Marks includes Viva based on TW

A. COURSE OBJECTIVES

The objectives of this course are:

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

B. DETAILED SYLLABUS

Unit Topic(s)

[1] INTRODUCTION TO ENGINEERING DRAWING

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

[2] ORTHOGRAPHIC PROJECTIONS

Principles of Orthographic Projections-Conventions -Projections of Points and lines inclined to both planes; Projections of planes inclined Planes-Auxiliary Planes;

[3] PROJECTIONS OF REGULAR SOLIDS

Planes-Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

[4] SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solid s, objects from industry and dwellings (foundation to slab only)

[5] ISOMETRIC PROJECTIONS

Principles of Isometric projection –Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice versa, Conventions;

[6] OVERVIEW OF COMPUTER GRAPHICS

Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software

[7] CUSTOMIZATION AND CAD DRAWING

Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

[8] ANNOTATIONS, LAYERING, AND OTHER FUNCTIONS

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

C. RECOMMENDED TEXT/REFERENCE BOOKS

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

D. COURSE OUTCOMES

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

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

B. TECH. SEMESTER – I (EC/CE/IT)

SUBJECT: SOFTWARE WORKSHOP

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

Reference Code ESC107

*TW Marks includes Viva based on TW

A. COURSE OBJECTIVES

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

B. DETAILED SYLLABUS

Unit	Topic(s)
[1]	OPERATING SYSTEM Introduction to Operating System and Linux Architecture
[2]	SOFTWARE Installation of open source/freeware software using package manager for programming/simulation.
[3]	SHELL COMMANDS Linux usage, commands & shell scripting. Command structure and general-purpose utility
[4]	FILE HANDLING Basic of file handling. The file system, Handling ordinary files, File attributes and permission, file system details
[5]	SHELL SCRIPTING Basic Shell commands, Looping and Branching. Various program using Shell Scripting
[6]	SHELL UTILITIES Find command and shell, simple filters, advance filters.
[7]	EDITORS VI editor for basic text editing, LATEX for scientific documents and report writing

**NOTE: Topics will be covered in experiments

C. RECOMMENDED TEXT/REFERENCE BOOKS

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

D. COURSE OUTCOMES

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

- Have knowledge of installation and maintainance of softwares
- Perform computational tasks using various utilities and commands related to operating systems.
- Manage and maintain software system on a PC.

B. TECH. SEMESTER – II (EC/CE/IT)**SUBJECT: MATHEMATICS-II**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	1	-	4	4	60	50	-	-	100

Reference Code BSC301

A. COURSE OBJECTIVES

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

B. DETAILED SYLLABUS**Unit Topic(s)****[1] FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS AND INTRODUCTION TO HIGHER ORDER DIFFERENTIAL EQUATIONS**

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

[2] NUMERICAL METHODS

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

[3] MULTIVARIABLE CALCULUS (INTEGRATION)

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

[4] LAPLACE TRANSFORM

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

C. RECOMMENDED TEXT/REFERENCE BOOKS

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. W. E. Boyce and R. C. Di Prima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
5. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
6. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.
9. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008

D. COURSE OUTCOMES

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

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

B. TECH. SEMESTER – II (EC/CE/IT)

SUBJECT: PROGRAMMING FOR PROBLEM SOLVING - II

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

Reference Code ESC201

*TW Marks includes Viva based on TW

A. COURSE OBJECTIVES

The objectives of teaching this course are:

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

B. DETAILED SYLLABUS

Unit	Topic(s)
[1]	BASICS OF C++ Overview, Program structure, keywords, identifiers, constants, data types. Symbolic constants, declaration of variables, operators, namespaces, control structures. Dynamic memory – C style - malloc, calloc, realloc and free Vs C++ style. New and delete keywords, reference and pointer
[2]	FUNCTIONS IN C++ Main function (variations in signature), function prototype, inline functions. Call and return by reference, default parameters, function overloading
[3]	INTRODUCTION TO OBJECT ORIENTED PROGRAMMING Procedural Vs Object Oriented Programming. Principles of OOP, Benefits and applications of OOP
[4]	CLASSES AND OBJECTS – ENCAPSULATION AND ABSTRACTION Introduction, private and public members, defining member functions, static members. Objects as function arguments and return type. Friend functions, const member functions, Constructors and their types, Destructor. Operator overloading, type conversion
[5]	INTRODUCTION TO C++ STRING CLASS
[6]	INHERITANCE Introduction, types of inheritance – single, multiple, multilevel, hierarchical, and hybrid

inheritance. Protected members, overriding, virtual base class

[7] POLYMORPHISM

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

[8] INPUT/OUTPUT

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

[9] EXCEPTION HANDLING

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

[10] TEMPLATES

Basics of class templates and function templates

C. RECOMMENDED TEXT/REFERENCE BOOKS

1. Object-Oriented programming with C++, Seventh Edition, by E Balagurusamy, TMH publication
2. The C++ Programming Language, Fourth Edition, by Bjarne Stroustrup, Addison - Wesley publication
3. Object-Oriented Programming in C++, Fourth Edition, by Robert Lafore, SAMS publication
4. Accelerated C++: Practical Programming by Example, First Edition, by Andrew Koenig and Barbara E. Moo, Addison-Wesley publication
5. C++ Black Book, First edition, by Steven Holzner, Paraglyph Press
6. C++: The Complete Reference, Fourth Edition, by Herbert Schildt, McGraw Hill Education

D. COURSE OUTCOMES

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

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

- Apply concepts to write, compile and execute C++ programs with different test cases. Also be able to debug and document C++ programs.

B. TECH. SEMESTER – II (EC/CE/IT)

SUBJECT: PHYSICS

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

Reference Code BSC101

*TW Marks includes Viva based on TW

A. COURSE OBJECTIVES

The course provide the in-depth understanding of the concepts associated with Semiconductor, Optoelectronics, Communication, Oscillators and Basic Switching devices. It also serves the basic design ideas around rectification and amplification. The course focuses on modulation techniques and its components. The overall aspects of basic physics application in electronics with practical approach are covered in this subject. This course also includes the analog modulation & demodulation techniques (AM, FM and PM) and digital modulation (ASK, FSK and PSK).

B. DETAILED SYLLABUS

Unit Topic(s)

[1] SEMICONDUCTORS

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

[2] DIODE

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

[3] LIGHT-SEMICONDUCTOR INTERACTION

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

[4] ACTIVE COMPONENTS AND APPLICATIONS

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

[5] OSCILLATORS

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

[6] MOSFET

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

[7] FIBER OPTICS

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

[8] COMMUNICATION SYSTEMS

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

C. RECOMMENDED TEXT / REFERENCE BOOKS

1. Electronics Principles, Albert Paul Malvino, 6th Edition, Tata McGraw Hill
2. David Griffiths, Introduction to Electrodynamics
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. R.P Khare, Fiber Optics and Optoelectronics, Oxford University Press
5. Sanjay Sharma, Communication Systems: Analog and Digital
6. Halliday and Resnick, Physics
7. W. Saslow, Electricity, magnetism and light
8. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
9. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
10. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
11. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997)
12. Behrouz A. Forouzan, Data communication and Networking.
13. B. P lathi, Modern Digital and Analog Communication Systems, 3rd edition.

D. COURSE OUTCOMES

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

- Illustrate intrinsic and extrinsic semiconductors, their applications and carrier generation and recombination with variations in doping density, temperature and other regulations.
- Design half wave, full wave rectifier circuit and voltage regulator circuit using Zener diode, PN diode and NPN, PNP transistors.
- Implement a transistor as a switch and Analyse Transistor input output characteristics, biasing circuits, Compute load line and calculate the operating point.
- Analyze structure of the oscillator. Discriminate Sinusoidal oscillator, Phase shift

oscillator and Crystal oscillator.

- Assess the performance & characteristics of Opto-electronic semiconductor devices like LED, LASER, Photo detectors
- Devise the ray optics propagation in step index and graded index fiber and Synthesize the use of optoelectronic devices in fiber optic communications.
- Illustrate pro and cons of analog and digital modulation techniques (AM, FM, PM, ASK, FSK, PSK) based on the need of system components.
- Justify the requirement of CMOS based on the fundamental study of nMOS and pMOS and describe working of 1 bit DRAM cell.

B. TECH. SEMESTER – II (EC/CE/IT)**SUBJECT: HARDWARE WORKSHOP**

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

Reference Code ESC201

*TW Marks includes Viva based on TW

A. COURSE OBJECTIVES

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

B. DETAILED SYLLABUS**Unit Topic(s)****[1] ELECTRONIC COMPONENTS**

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

[2] COMPUTER HARDWARE

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

[3] PERIPHERALS

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

[4] INTERNET

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

[5] WEB INFRASTRUCTURE

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

[6] IOT BOARDS AND CIRCUIT SIMULATION

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

[7] MINI PROJECT

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

****NOTE:**Topics will be covered in experiments

C. RECOMMENDED TEXT/REFERENCE BOOKS

1. Electronic Components and Materials Principles, Dr. Madhuri A Joshi, 2nd Edition, Shroff Publishers & Distributors PVT. LTD.
2. A Textbook of Computer Hardware and Networking, Jyotika Deshmukh, D J Publications
3. Learning Web Design, Jennifer Robbins, 4th edition, O'Reilly Media

D. COURSE OUTCOMES

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

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

B. TECH. SEMESTER – II (EC/CE/IT)

SUBJECT: ENGLISH

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

Reference Code HSMC201

*TW Marks includes Viva based on TW

A. COURSE OBJECTIVES

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

B. DETAILED SYLLABUS

Unit Topic(s)

[1] VOCABULARY BUILDING

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

[2] BASIC WRITING SKILLS

Sentence Structures, use of phrases and clauses in sentences, Importance of proper punctuation, creating coherence, organizing principles of paragraphs in documents, Techniques for writing precisely

[3] IDENTIFYING COMMON ERRORS IN WRITING

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

[4] NATURE AND STYLE OF SENSIBLE WRITING

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

[5] WRITING PRACTICES

Comprehension, Précis Writing, Essay Writing

[6] ORAL COMMUNICATION

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

C. RECOMMENDED TEXT/REFERENCE BOOK

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

D. COURSE OUTCOMES

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

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

B. TECH. SEMESTER – II (EC/CE/IT)
SUBJECT: ENVIRONMENTAL STUDIES

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

Reference Code MC-II

A. COURSE OBJECTIVES

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

B. DETAILED SYLLABUS

Unit Topic(s)

[1] THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance & need for public awareness

[2] NATURAL RESOURCES

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

[3] ECOSYSTEMS

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

[4] BIODIVERSITY AND ITS CONSERVATION

Introduction definition: Genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity

[5] ENVIRONMENTAL POLLUTION

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

[6] SOCIAL ISSUES AND THE ENVIRONMENT

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

[7] HUMAN POPULATION AND THE ENVIRONMENT

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

[8] FIELD WORK

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

C. RECOMMENDED TEXT/ REFERENCE BOOK

1. Erach Bharucha Textbook of Environmental Studies; Second Edition, Universities Press: Hyderabad, 2013
2. Poonia, M. P.; Sharma, S. C. Environmental studies; Khanna Publishing House: New Delhi, 2017
3. Rajagopalan, R. Environmental Studies; Oxford University Press: India, 2015
4. Varandani, N. S. Basics of Environmental studies; Lambert Academic Publishing: Germany, 2013.
5. Basak, A. Environmental Studies; Dorling Kindersley: India, 2009.
6. Dhameja, S. K. Environmental studies; S. K. Kataria and Sons: New Delhi, 2007.
7. Rao, C. S. Environmental Pollution Control Engineering; Wiley publishers: New Delhi, 2006.
8. Brunner, R. C. Hazardous Waste Incineration; McGraw Hill: Michigan, 1989.
9. Clark, R. S. Marine Pollution; Clanderson Press Oxford: Bath, 2001.
10. Trivedy, R. K. Handbook of Environmental Laws, Acts, Guidelines, Compliances & standards; B. S. publications: Hyderabad, 2005.
11. Jadhav, H.; Bhosale, V. M. Environmental Protection and Laws; Himalaya Pub. House: Delhi, 1995.
12. Agarwal, K. C. Environmental Biology; Nidi Publ.: Bikaner, 2001.

13. Bharucha, E. The Biodiversity of India; Mapin Publishing: Ahmedabad, India, 2002.
14. Cunningham, W.P.; Cooper; Gorhani, T. H. E.; Hepworth, M.T., Environmental Encyclopedia; Jaico Publ. House: Mumbai, 2001.
15. De, A. K. Environmental Chemistry; Wiley Eastern: New Delhi, 2006.
16. Gleick, H. P. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security; Stockholm Env. Institute Oxford Univ. Press: New York, 1993.
17. Hawkins, R.E., Encyclopedia of Indian Natural History; Bombay Natural History Society: Bombay, 1987.
18. Heywood, V. H.; Waston, R. T. Global Biodiversity Assessment; Cambridge Univ. Press: Cambridge, 1995.
19. Mckinney, M.L.; School, R.M. Environmental Science systems & Solutions; Web enhanced edition: USA, 1996.
20. Miller, T.G. Jr.; Spoolman, S. E. Environmental Science; Cengage learning: Wadsworth, 2014.
21. Odum, E.P. Fundamentals of Ecology; W.B. Saunders: USA, 1971.
22. Rao, M. N.; Datta, A.K. Waste Water treatment; Oxford & IBH Publ.: New Delhi, 1987.
23. Sharma, B. K., Environmental Chemistry; Goel Publ. House: Meerut, 2001.
24. Townsend, C., Harper, J.; Michael, B. Essentials of Ecology; Blackwell: Oxford, 2008.
25. Trivedi, R. K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II; B. S. Publications, Hyderabad, 2010.
26. Trivedi, R. K.; Goel, P. K. Introduction to air pollution; ABD Publishers: Jaipur, 2003.
27. Wanger, K. D., Environmental Management; W.B. Saunders Co. Philadelphia, USA, 1998.

D. COURSE OUTCOMES

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

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

B. TECH. SEMESTER – III (IT)
SUBJECT: PROBABILITY THEORY AND STATISTICS

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

Reference Code BSC3XX

A. COURSE OBJECTIVES

The objectives of teaching this course are:

- To provide an understanding of the basic concepts of probability, conditional probability, and independent events.
- To focus on the random variable, mathematical expectation and different types of distributions, sampling theory, and estimation theory.
- To demonstrate and teach the design of statistical hypothesis about the real-world problem and conduct appropriate tests for drawing valid inferences about the population characteristics
- To explain the significance of hypothesis testing for any research work

B. DETAILED SYLLABUS

Unit Topic(s)

[1] BASIC PROBABILITY

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

[2] CONTINUOUS PROBABILITY DISTRIBUTIONS

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

[3] BIVARIATE DISTRIBUTIONS

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

[4] BASIC STATISTICS

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

[5] APPLIED STATISTICS

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

[6] SMALL SAMPLES

Test for single mean, difference of means and correlation coefficients, test for ratio of

variances - Chi-square test for goodness of fit and independence of attributes.

C. RECOMMENDED TEXT/REFERENCE TBOOK

1. Introduction to Probability and Statistics for Engineers and Scientists, Sheldon M. Ross, 4th edition¹.
2. Head First Statistics, Dawn Griffiths, O'Reilly
3. Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003 (Reprint).
4. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India, 2002.
5. An Introduction to Probability Theory and its Applications, W. Feller, Vol. 1, 3rd Ed., Wiley, 1968.

D. COURSE OUTCOMES

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

- Define and explain the different statistical distributions (e.g., Normal, Binomial, Poisson) and the typical phenomena that each distribution often describes.
- Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances
- Apply the concepts of hypothesis testing and p-value.
- Evaluate correlation coefficient and estimate parameters of regression model using the method of least squares to estimate the parameters in a regression
- Analyse samples of the different populations using sampling theory.

B. TECH. SEMESTER – III (IT)
SUBJECT: COMMUNICATION SYSTEMS

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

Reference Code ESC3XX

A. COURSE OBJECTIVES

To impart an in-depth understanding of the major concepts, techniques, and performance criteria used in the analysis of various signal operations (time domain and frequency domain), this course covers the Fourier analysis of the signals, provides knowledge of various blocks that constitute an analog and digital communication system and their interrelation and correlates the concepts of Information Theory with reference to analog & digital communication systems. This course also includes the analog modulation & demodulation techniques (AM, FM and PM) and digital modulation & demodulation techniques (PCM, DPCM and DM).

B. DETAILED SYLLABUS

Unit Topic(s)

[1] WAVEFORM SPECTRA

Introduction, Sinusoidal Waveform, General Periodic Waveforms Trigonometric Fourier Series for a Periodic Waveforms, Fourier Coefficients, Spectrum for the Trigonometric Fourier Series, Rectangular Waves, Saw tooth Waveform, Pulse Train, Some General Properties of Periodic Waveforms, Exponential Fourier Series, Approximate Formulas for the Fourier Coefficient, Energy Signals for Fourier Transform, Filtering of Signals, Power Signals, Bandwidth Requirements for Analog Information Signals

[2] DIGITAL LINE WAVEFORMS

Symbols, Binits, Bits and Bauds, Functional notations for Pulses, Line codes and Waveforms, M-ary Encoding, Inter Symbol Interference

[3] AMPLITUDE MODULATION

Introduction, Amplitude Modulation, Amplitude Modulated Transmitters, AM Receivers

[4] SINGLE SIDEBAND MODULATION

Introduction, Single Sideband Principles, The Balanced Modulator SSB Generation, SSB Reception, Modified SSB Systems.

[5] ANGLE MODULATION

Introduction, Frequency Modulation, Phase Modulation, Equivalence between FM and PM, Angle Modulator Circuits, Angle Modulation Detectors

[6] PULSE MODULATION

Pulse Amplitude Modulation, Pulse Code Modulation, Pulse Frequency Modulation, Pulse Time Modulation, Pulse Position Modulation, Pulse Width Modulation

[7] DIGITAL COMMUNICATION

Synchronization, Asynchronous Transmission, Probability of Bit Error in Baseband Transmission, Matched Filters, Optimum Terminal Filters, Bit Timing Recovery, Eye Diagram, Digital Carrier System, Carrier Recovery Circuit, DPSK, Hard and Soft Decision, Error Control Coding

[8] INTRODUCTION TO INFORMATION THEORY

Measure of Information, Source Encoding

C. RECOMMENDED TEXT/REFERENCE BOOK

1. Modern Digital and Analog Communication System, B. P. Lathi, 2nd Edition, Oxford Publication
2. Communication Systems, Simon Haykin, 3rd Edition, John Wiley & Sons.
3. Electronic Communication System-Fundamental through Advance, Thomas W., 3rd Edition, Wiley.
4. Communication System Analog & Digital, R. P. Singh, Tata McGrawHill.

D. COURSE OUTCOMES

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

- Analyse and understand the frequency domain representation of time domain periodic and aperiodic signals.
- Interpret the differences between Polar, Unipolar, Manchester, AMI line coding schemes and recognize channel encoding techniques.
- Discuss various types of amplitude modulation techniques along with calculation of modulation index, Single side band principle and its generation and reception.
- Student can calculate maximum bandwidth, average power and deviation ratio for sinusoidal and non-sinusoidal Frequency modulation.
- Differentiate phase and frequency modulation techniques and calculate modulation index and total power of modulated signal.
- Describe PAM, PCM, PTM, and PFM pulse modulation techniques.
- Recognize the blocks of digital communication system along with illustration of error control, source encoding techniques and calculation of BER and bit error probabilities for digital carrier schemes.

B. TECH. SEMESTER – III (IT)
SUBJECT: DESIGN OF DIGITAL CIRCUITS

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

Reference Code ESC3XX

A. COURSE OBJECTIVES

The objectives of teaching this course are:

- The subject design of digital circuits aims to explain to the students about the basic knowledge of digital logic and circuit design.
- To familiarize the student with digital representations of information, Number systems, Logic gates, Boolean algebra, designing the circuits and their applications.
- To teach the student about fundamental principles of digital design using combinational and sequential logic to analyze and design the digital circuits.

B. DETAILED SYLLABUS

Unit Topic(s)

[1] BINARY SYSTEMS

Introduction to Digital Computers and Digital Systems. Binary Numbers, Number Base Conversion, Octal and Hexadecimal Numbers. Complements, binary Codes. Binary Storage and Registers, Binary Logic. Integrated Circuits.

[2] BOOLEAN ALGEBRA AND LOGIC GATES

Basic Definitions, Axiomatic Definition of Boolean algebra. Basic Theorems and Properties of Boolean algebra. Boolean Functions. Canonical and Standard Forms, Other Logic Operations. Digital Logic Gates, IC Digital Logic Families.

[3] SIMPLIFICATION OF BOOLEAN FUNCTIONS

The Map Method. Two and Three Variable Maps, Four-Variable Map, Five and Six Variable Maps. Product of Sum simplification. NAND and NOR Implementations. Don't-Care Conditions. The Tabulation Method. Determination of Prime- Implicants, selection of Prime implicants.

[4] COMBINATIONAL LOGIC

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

[5] COMBINATIONAL LOGIC WITH MSI AND LSI

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

[6] SEQUENTIAL LOGIC

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

[7] REGISTERS, COUNTERS AND THE MEMORY UNIT

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

[8] DIGITAL INTEGRATED CIRCUITS

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

C. RECOMMENDED TEXT/ REFERENCE BOOKS

1. Digital Logic and Computer Design by: M. Morris Mano
2. Microelectronics by: Jacob Millman & Arvin Grabel, Second Edition McGraw Hill International Edition

D. COURSE OUTCOMES

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

- Understand the basic concepts of Digital system and circuits, the structure of various number systems, and the working and design process of different combinational and sequential circuits.
- Apply knowledge of mathematics to solve the given problem, Also be able to apply different minimization techniques to simplify the hardware requirements for designing the digital circuits.
- Analyze the given problem and be able to choose appropriate technique(s) for designing the digital circuit.
- Design a solution for given problem statement, to implement it, and also to design and apply it for real time digital systems.
- Apply concepts to write, document, assemble and test the digital circuits.

B. TECH. SEMESTER – III (IT)

SUBJECT: EFFECTIVE TECHNICAL COMMUNICATION

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
3	-	-	3	3	50	-	50	-	100

Reference Code HSMC3XX

A. COURSE OBJECTIVES

The objectives of teaching this course are:

- To discuss and explain technical writing and professional communication along with importance of Ethics, Etiquettes, and Values.
- To prepare students for effective public speaking, group discussion, and interviews.
- To explain how to study and validate various information sources such as web sites, business documents, and professional journals.
- To teach how to carry out self development and self assessment.
- To prepare students to produce effective technical documents.

B. DETAILED SYLLABUS

Unit Topic(s)

[1] INFORMATION DESIGN AND DEVELOPMENT

Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

[2] TECHNICAL WRITING, GRAMMAR AND EDITING

Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing, Localization

[3] SELF DEVELOPMENT AND ASSESSMENT

Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

[4] COMMUNICATION AND TECHNICAL WRITING

Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

[5] ETHICS

Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity

C. RECOMMENDED TEXT/REFERENCE BOOK

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.

D. COURSE OUTCOMES

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

- Understand basics of technical writing and professional communication
- Understand and Demonstrate Profession, Social and Business Ethics, Etiquettes and Values.
- Apply communication skills in an effective way at public speaking, group discussion and interviews
- Analyze self-development and practice self-assessment in all aspects.
- Evaluate effectiveness and validity of information sources, such as web sites, business documents, and professional journals
- Create/produce different documents, like report, assignment, review, letters, applications, etc. by applying technical writing skills

B. TECH. SEMESTER – III (IT)

SUBJECT: OBJECT ORIENTED PROGRAMMING USING JAVA

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

Reference Code PCC3XX

A. COURSE OBJECTIVES

The objectives of teaching this course are:

- To teach fundamental knowledge of object-oriented programming principles including defining classes, polymorphism, inheritance, encapsulation, abstraction, and interface, and explain with examples how to represent the solution of a given problem in object oriented representation.
- To explain how to use library API such as String, Arrays, StringBuffer, StringTokenizer, and Math in framing solutions to problems.
- To impart knowledge of package, exception, and multithreading and show their usage in practical problems.
- To discuss concepts of making user interactive programs using GUI programming, Stream API, and Network Programming and demonstrate their use in solving problems.
- To demonstrate skills to write, debug, and execute java programs and enable them to create Java solutions for given problem statements.

B. DETAILED SYLLABUS

Unit	Topic(s)
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[1]	INTRODUCTION TO PROGRAMMING LANGUAGE – JAVA
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Java programming: History of java Primitive data types, variables, constants, scope and life time of variables, Comments. Operators, operator hierarchy, expressions. Type conversion and casting

[2]	CONTROL STRUCTURE AND METHODS
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Control flow statements and loops, Loops – for, while, do-while. Console input and output, formatting output. Constructors and methods, Overloading of methods and constructors, recursion, Parameter passing, static fields and methods, access control, this reference. Garbage collection

[3]	OBJECT ORIENTED PROGRAMMING PRINCIPLES
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OOP Concepts, Classes and objects, Data abstraction, encapsulation, inheritance, Polymorphism. Procedural and object oriented programming paradigm. Object Oriented Programming Using Java, Inheritance: Inheritance types, super and subclasses, member access rules, super keyword, preventing inheritance: final classes and methods, the object class and its methods; Polymorphism: dynamic binding, method overriding, abstract classes and methods; Interface: Interfaces vs Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface.

[5] ARRAYS, STRING AND PACKAGES

Arrays: Array; 1,2,N-dimension array, jagged array, array of objects. String: Exploring concepts of String, StringBuffer and StringTokenizer classes. Packages: Defining, creating and accessing a package, understanding CLASSPATH, importing packages, Exploring Java.Util.

[6] EXCEPTION HANDLING

Exception Handling: Benefits of exception handling, the classification of exceptions. Exception hierarchy: Throwable, checked exceptions and unchecked exceptions. Usage of try, catch, throw, throws and finally. Re-throwing exceptions, exception specification, built in exceptions. Creating and using own/user-defined exception sub classes.

[7] MULTITHREADING

Multithreading: Multi-Threading and Multitasking. Thread Life Cycle, thread states, creating threads: Thread Priorities, Thread Groups, Daemon Threads, interrupting threads, thread priorities. Synchronizing threads, inter thread communication

[8] GETTING STARTED WITH GRAPHIC PROGRAMMING

The AWT class hierarchy, Containers: Frame, Dialog, Panel. Events: Event Sources, Event Classes, Event Listeners, Delegation Event Model. Handling Action, Mouse, Window, Keyboard etc. events, Adapter Classes

[9] CREATING USER INTERFACE AND ADVANCED GRAPHICS

The AWT Class Hierarchy. User Interface Components: Labels, Button, Canvas, Scrollbars, Text Components, Check Box, Check Box Groups, Choices, Lists. Panels: Scrollpane, Dialogs, Menubar, Graphics, Layout Manager. Layout Manager Types: Border, Grid, Flow, Card, Grid Bag, No layout etc

[10] INPUT AND OUTPUT

Input/Output classes. File management using file class Streams: Byte streams, character stream; Text input/output, binary input/output; Random access file operations

[11] NETWORK PROGRAMMING

Networking concepts: Introduction to TCP and UDP protocol. Socket programming classes: Socket, ServerSocket, InetAddress, URL, URL Connection; Client-server and multi threaded application.

[12] JAVA UNIT TESTING – JUNIT

JUnit : Types of Testing, Test Driven Development, Assert class, Test cases.

C. RECOMMENDED TEXT/REFERENCE BOOKS

1. An Introduction to JAVA programming, Y. Daniel Liang, Publisher: PHI
2. The Complete Reference Java, Herbert Schildt 5th edition Publisher: Tata McGraw-Hill

D. COURSE OUTCOMES

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

- Understand and use Java programming language concepts and API
- Apply the concepts of Java to solve the given problem on console based application or GUI based application.
- Analyze the given problem and be able to choose appropriate concept(s) of Java language to solve the problem.
- Design a solution for given problem statement and to prepare required design diagrams, specification, class/interface structures, etc. using Java concepts
- Apply concepts to write, document, debug, run, and test Java programs or applications.

B. TECH. SEMESTER – III (IT)
SUBJECT: DATA STRUCTURES AND ALGORITHMS

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

Reference Code PCC3XX

A. COURSE OBJECTIVES

The objectives of teaching this course are:

- To teach different data structures and their operations.
- To teach and demonstrate the selection of efficient data structure for improving the efficiency (time complexity and space complexity) of the system.
- To explain concepts that are useful to students to understand subjects like Database Management System and Design and Analysis of Algorithms.
- To impart the knowledge of real-world applications of the data structures.

B. DETAILED SYLLABUS

Unit Topic(s)

[1] BASIC CONCEPTS

System Life Cycle. Object Oriented Design: Algorithm Decomposition versus OO Decomposition, Fundamental Definitions and Concepts of OO programming. Data Abstraction and Encapsulations. Algorithm Specification: Introduction, Recursive Algorithms.

[2] ARRAYS

Abstract Data Types and the C++ Class. The Array as an Abstract Data Type. The Polynomial Abstract Data: Polynomial Representation, Polynomial Addition, Polynomial Multiplication, Disadvantages of Representing Polynomials by Arrays

[3] STACK AND QUEUE

The Stack Abstract Data Type. The Queue Abstract Data Type. Evaluation of Expressions: Expressions, Postfix Notation, Infix to Postfix, Multiple Stacks And Queues

[4] LINKED LISTS

Singly Linked Lists. Representing Lists in C++: Defining a List Node in C++, Designing a List in C++, Pointer Manipulation in C++, List Manipulation Operations, Linked List Operations, Circular Lists, Linked Stacks and Queues. Polynomials: Polynomial Representation, Adding Polynomials. Doubly Linked Lists. Generalized Lists: Representation of Generalized Lists, Recursive Algorithms for Lists, Reference Counts, Shared and Recursive Lists.

[5] TREES

Introduction: Terminology, Representation of Trees. Binary Trees: The Abstract Data Type, Properties of Binary Trees, Binary Tree Representations. Binary Tree Traversal and Tree Iterators: Introduction, Inorder Traversal, Preorder Traversal, Postorder Traversal, Iterative Inorder Traversal, Level-Order Traversal. Additional Binary Tree Operations: Copying Binary Trees, Testing Equality, The Satisfiability Problem.

Threaded Binary Trees: Threads, Inorder Traversal of a Threaded Binary Tree, Inserting a Node into a Threaded Binary Tree. Heaps: Definitions, Insertion and Deletion Of Max Heaps. Binary Search Trees: Definition, Searching a Binary Search Tree, Insertion and Deletion and Joining into a Binary Search Tree, Height of a Binary Search Tree.

[6] GRAPHS

The Graph Abstract Data Type: Introduction, Definitions, Graph Representations. Elementary Graph Operations: Depth First Search, Breadth First Search, Connected Components, Spanning Trees, Biconnected Components. Shortest Paths and Transitive Closure: All-Pairs Shortest Paths.

[7] SORTING

Insertion Sort. Quick Sort. Merge Sort: Merging, Iterative Merge Sort, Recursive Merge Sort. Heap Sort. List and Table Sorts. Summary of Internal Sorting.

[8] HASHING

The Symbol Table Abstract Data Type. Static Hashing. Hash Tables. Hashing Functions. Overflow Handling.

[9] ADVANCED SEARCH STRUCTURES

AVL Trees. 2-3 Trees. 2-3-4 Trees. Red-Black Trees. B-Trees. Splay Trees. Digital Search Trees. Tries.

C. RECOMMENDED TEXT/REFERENCE BOOKS

1. Fundamentals of Data Structures using C++ by: Horowitz, Sahni, Galgotia Pub. 1998 ed.
2. Data Structures & Algorithms, by: Aho, Ullman, Addison Wesley
3. An Introduction to Data Structures with applications, by: Tremblay, Sorenson, McGraw Hill.
4. The art of Computer Programming Vol. I & III, by: Kunth, Addison Wesley.
5. Data Structures using C and C++, by: YedidyahLangsam, Tenenbaum

D. COURSE OUTCOMES

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

- Understand and use the concepts of different data structures and algorithms with reusability.
- Apply the concepts of appropriate data structures to solve the real world problems.
- Analyze the given problem and be able to select appropriate data structure like array, stack, queue, linkedlist, tree, graph etc. to solve the problem to improve efficiency.
- Design a solution for given problem statement and to prepare efficient algorithm using appropriate data structure.
- Apply different data structures and algorithms to write, document, debug, and run the programs.

B. TECH. SEMESTER – IV (IT)
SUBJECT: UNIVERSAL HUMAN VALUES - II

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

Reference Code HSMC4XX

A. COURSE OBJECTIVES

The objectives of teaching this course are:

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

B. DETAILED SYLLABUS

Unit Topic(s)

[1] COURSE INTRODUCTION

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

[2] UNDERSTANDING HARMONY IN THE HUMAN BEING

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

[3] UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY

Harmony in Human-Human Relationship Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence,

Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family

[4] UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE

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

[5] IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

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

C. RECOMMENDED TEXT/REFERENCE BOOK

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

D. COURSE OUTCOMES

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

- Start exploring themselves: get comfortable with each other and with the teacher; they start appreciating the need and relevance for the course.
- Note that the natural acceptance (intention) is always for living in harmony, only competence is lacking
- Present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.
- Grasp the right utilization of their knowledge in their streams of Technology/Engineering/Management/any other area of study to ensure mutual fulfilment. E.g. mutually enriching production system with rest of nature.

B. TECH. SEMESTER – IV (IT)
SUBJECT: DISCRETE MATHEMATICS

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

Reference Code PCC4XX

A. COURSE OBJECTIVES

The objectives of teaching this course are:

- To impart an in-depth understanding of various concepts related to Discrete Mathematics, correct terminology, and notation.
- To teach how to construct correct direct and indirect proofs, the division into cases in a proof, use of counterexamples, etc.
- To explain Sets, Functions, Relations, Groups, Graphs, Trees, and their applications using real-world examples.
- Demonstrate and teach how to apply logical reasoning to solve a variety of problems.

B. DETAILED SYLLABUS

Unit Topic(s)

[1] SETS AND PROPOSITIONS

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

[2] PROPOSITIONAL LOGIC

Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy

[3] PERMUTATIONS, COMBINATIONS, DISCRETE PROBABILITIES

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

[4] RELATIONS AND FUNCTIONS

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

[5] GRAPHS

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

[6] TREES

Trees, rooted trees, path length, prefix codes, binary search trees, spanning trees and

cut-sets, minimum spanning trees, transport networks.

[7] RECURRENCE RELATIONS

Linear recurrence relations with constant coefficient, homogeneous, particular and total solutions, generating functions, sorting algorithms, matrix multiplication.

[8] DISCRETE NUMERICAL FUNCTIONS

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

[9] GROUP

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

[10] LATTICES AND BOOLEAN ALGEBRAS

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

C. RECOMMENDED TEXT/ REFERENCE BOOK

1. Discrete Mathematics Applications, Kenneth H. Rosen, 7th edition, Mc Graw Hill
2. Elements of Discrete Mathematic, by: C.L. Liu, 2nd Ed. McGraw-Hill
3. Modern Applied Algebra, by: Birkoff and Bartee, McGraw-Hill, CBS.
4. Discrete Mathematics - A Unified Approach, by: Stephen A. Wiitala. Computer Science Series, McGraw-Hill.

D. COURSE OUTCOMES

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

- Classify the algebraic structure of the given mathematical problem.
- Express terms of predicates, quantifiers, and logical connectives for the given logic sentence
- Derive the solution using deductive logic and prove the solution based on logical inference for the given a problem.
- Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
- Develop the given problem as graph networks and solve with techniques of graph theory.

B. TECH. SEMESTER – IV (IT)

SUBJECT: COMPUTER AND COMMUNICATION NETWORK

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

Reference Code PCC4XX

A. COURSE OBJECTIVES

The objectives of teaching this course are:

- To teach about network hardware, software, services, and protocols and explain the uses of computer networks in daily life.
- To explain the layered architecture of network software and compare OSI and TCP/IP model
- To explain the functionalities and working of different layers in TCP/IP protocol stack.
- To demonstrate and teach the usage of various network devices, their configurations, and setup

B. DETAILED SYLLABUS

Unit Topic(s)

[1] INTRODUCTION

Introduction and Applications of computer Networks. Network Hardware-LAN,MAN, WAN, internetworks. Network Software. Design Issues. Interfaces & Services. Connection Oriented & Connectionless services. Service primitives. Relationship of services to protocols.

[2] STUDY OF REFERENCE MODELS

OSI & TCP/IP, their comparison & critiques.

[3] THE PHYSICAL LAYER

Guided Transmission Media: magnetic media, twisted pair, baseband & broadband, co-axial cable, fiber optics. Wireless Transmission: radio, microwave, infrared, light wave.

[4] THE DATA LINK LAYER

DLL Design issues Error Detection & Correction. Elementary Data link Protocols: Simplex protocol, Stop and Wait and Automatic Repeat Request, Sliding Window Protocols (1-bit sliding window, Go Back N, Selective Repeat Protocols). Examples of Data link layer protocols: HDLC, PPP.

[5] MEDIUM ACCESS SUB LAYER

Channel Allocation Problem: Static & Dynamic, Multiple Access protocols (ALOHA, CSMA/CA AND CD, Collision Free Protocols, Limited contention protocols, WDMA, FDMA, TDMA, CDMA). Wireless LAN protocols. IEEE-802.3(Ethernet). 802.4(Token Bus). 802.5(Token Ring). Bridges: From 802.x to 802.y, transparent Bridges, Spanning Tree, Source Routing Bridges, remote bridge.

[6] THE NETWORK LAYER

Network layer Design issues. Internetworking-How networks differ, how networks can be connected, concatenated virtual circuits ,connectionless internetworking ,tunneling, internetwork routing. The network layer in the internet: the IP protocol, IPv4 Header, fragmentation, IP addresses & subnets, Internet Control Protocols – ARP,RARP,ICMP,IGMP. Routing Algorithms: Static Routing, Dynamic Routing, Intradomain: Distance Vector Routing(RIP), Link state (OSPF), Interdomain Routing: Path vector (BGP)

[7] THE TRANSPORT LAYER

The Transport Service: services provided to upper layers, transport services primitives. Elements of Transport Protocols. The Internet Transport Protocols. TCP service model: TCP protocol, TCP Segment Header, TCP Connection Management, TCP Transmission Policy, TCP Congestion Policy. UDP & overview of Socket

[8] CONGESTION CONTROL AND QUALITY OF SERVICE

Congestion control algorithm general policies. Congestion prevention policies. Traffic shaping. Flow specifications. Congestion control in VC subnets. Congestion controls in Data gram Subnets. Load shedding, jitter control. Quality of services-requirements. Techniques to achieving good quality of services: Leaky bucket algorithm, Token bucket algorithm, Resource reservation, Admission control, Packet scheduling.

[9] THE APPLICATION LAYER

Application Layer Protocols. File transfer protocol. Domain Name System. Electronic mail (SMTP, IMAP, POP). HTTP

C. RECOMMENDED TEXT/ REFERENCE BOOKS

1. Data Communications and Networking by Behrouz A. Forouzan, 4th Edition, Tata- McGraw Hill Edition.
2. Computer Networks By Andrew S. Tanenbaum, 4th Edition. Prentice-Hall of India(PHI)
3. Data & Computer Communications - William Stallings, 2ed, Maxell Macmillan Int.
4. Communication Networks, Fundamental Concepts & key Architectures – Leon Garcia &Widjaja, Tata- McGraw Hill Edition.

D. COURSE OUTCOMES

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

- Understand basics of concepts of networking, layered approach, responsibilities performed at each layer and basic of cryptography and network security.
- Analyse working of various network protocols, network devices and configure it if necessary.
- Apply concepts of IP addressing, routing algorithm and congestion control and network programing techniques to resolve the problem in existent network or system.
- Design a small to medium efficient LAN, WAN in CISCO Packet tracer and client server paradigm for a given problem using the concepts of computer networks.

B. TECH. SEMESTER – IV (IT)
SUBJECT: DATABASE MANAGEMENT SYSTEM

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

Reference Code PCC4XX

A. COURSE OBJECTIVES

The objectives of teaching this course are:

- To explain basic database concepts, data models, schemas, instances, and applications of database systems.
- To demonstrate the use of constraints and relational algebra principles and operations.
- To describe the basics of SQL and construct queries using SQL / POSTGRESQL.
- To emphasize the importance of normalization in databases.
- To facilitate students in Database designing and implementation through projects.
- To familiarize issues of concurrency control and transaction management.

B. DETAILED SYLLABUS

Unit Topic(s)

[1] BASIC CONCEPTS

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

[2] ENTITY RELATIONSHIP MODEL

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

[3] RELATIONAL DATABASE MANAGEMENT SYSTEM

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

[4] NOSQL

Introduction to NOSQL. Structure of NoSQL. NoSQL Queries.

[5] FILE SYSTEM STRUCTURE

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

[6] QUERY PROCESSING

Cost estimation. Measures of query cost: Selection operation, Sorting, Join operation. Choice of evaluation plans.

[7] TRANSACTION PROCESSING

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

[8] CONCURRENCY CONTROL

Lock based protocols. Time-stamp based protocol. Validation based protocol. Multiple granularity. Multi-version schemes. Deadlock handling.

[9] RECOVERY SYSTEM

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

[10] DISTRIBUTED DATA BASES

[11] SECURITY AND INTEGRITY OF DATA BASE

C. RECOMMENDED TEXT / REFERENCE BOOK

1. Database System Concepts, by: Henry F. Korth and A. Silberschatz. 2nd Ed. McGraw-Hill 1991.
2. Fundamentals of Database Systems by: Shamkant Navathe

D. COURSE OUTCOMES

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

- Understand different types of keys, databases, transactions, concurrency control and requirement of database management system
- Apply the concept of database design techniques to solve the given problem on different types of applications
- Analyse the given problem and be able to choose appropriate database concepts to create normalized and optimized database.
- Design a solution for variety of applications for given problem statement and to prepare required ER-model, Relational Schema, Data Dictionary and database diagram.
- Apply concepts to write, document, debug, run and test SQL, NO SQL, PLSQL, triggers and cursors for applications

B. TECH. SEMESTER – IV (IT)
SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS

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

Reference Code PCC4XX

A) COURSE OBJECTIVES

The objectives of teaching this course are:

- To explain the fundamental concepts of algorithms, performance analysis, and problem-solving paradigm in general.
- To demonstrate and teach various methods for performance analysis of different types of algorithms
- To make the students familiar with major algorithmic design paradigms and demonstrate their application using suitable examples.
- To guide students in applying appropriate algorithm design techniques to solve common engineering design requirements.

B) DETAILED SYLLABUS

Unit	Topic(s)
[1]	INTRODUCTION TO ALGORITHMS Definition of algorithm. Characteristic of algorithms. Types of algorithm design Paradim. Recursive Algorithms. The Need for Analysis
[2]	ANALYZING ALGORITHMS Analysis Techniques - Space and Time Complexity. Asymptotic Notations for analysis of algorithms - Omega, Theta, BigOh ,Little Oh, Little omega. Recurrence relations and analysis of recursive algorithms- Recurrence tree, Substitution method, Master method
[3]	GRAPH CONCEPTS Traversal -dfs/bfs. Articulation points.
[4]	DIVIDE AND CONQUER ALGORITHM DESIGN STRATEGY Binary search, Merge Sort, Quick sort
[5]	GREEDY ALGORITHM DESIGN STRATEGY Knapsack Problem, Minimum Cost Spanning Trees, Optimal Merge Patterns, Single-Source Shortest Paths.
[6]	DYNAMIC PROGRAMMING DESIGN STRATEGY Multistage Graphs, Matrix Chain Multiplication, Single-Source and All-Pairs Shortest Paths, Traveling Salesperson Problem, Longest Common Subsequence.
[7]	BACK TRACKING N-Queens Problem, Graph Coloring, Hamiltonian Cycles.

[8] BRANCH-AND-BOUND

Knapsack problem, Job assignment problem. Comparison of backtracking and branch and bound

[9] NP-HARD AND NP-COMPLETE

Definition of P and NP classes. Relation between complexity classes. Examples of problems in various classes.

C) RECOMMENDED TEXT / REFERENCE BOOKS

1. G. Brassard, P. Bratley, “Fundamentals of Algorithmics”, (PHI).
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest “Introduction to Algorithms”, PHI.
3. Ellis Horowitz and Sartaz Sahani, “Fundamentals of Computer Algorithms”, Computer Science Press.
4. Design & Analysis of Computer Algorithms, by: Aho, Ullman, Addison Wesley.
5. The art of Computer Programming Vol. I & III, by: Kunth, Addison Wesley.

D) COURSE OUTCOMES

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

- Understand basic concepts of algorithm, performance analysis of algorithms, algorithm design techniques, tractable and intractable algorithms
- Evaluate the performance of the algorithm using appropriate techniques based on the structure and type of algorithm
- Apply the algorithm design techniques to solve the real world problems from different domains like searching, sorting, graph theory, optimization, etc.,
- Analyze the given problem definition, understand the nature of the problem, and be able to choose appropriate algorithm design techniques to solve the given problem.
- Design a solution for given problem statement and to clearly mention the requirements, inputs, outputs, processes, models, algorithms, pseudocode, test cases etc.,
- Apply concepts to design, document, implement, debug, run, test and do profiling, of algorithms for various problems from the diversified domains like graph theory, string/text processing, searching, sorting, optimizations, etc., using relevant tools.

B. TECH. SEMESTER – IV (IT)

SUBJECT: MICROPROCESSOR ARCHITECTURE PROGRAMMING AND INTERFACING

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

Reference Code PCC4XX

A) COURSE OBJECTIVES

The objectives of teaching this course are:

- To explain the architecture and the instruction set of the Intel 8086/80286 and 80386 microprocessor family.
- To teach the basic concepts of microprocessor and its interfacing with memory and programmable peripheral chips involving system design.
- To impart knowledge about Interrupts and their applications.
- To demonstrate and teach assembly language programming using Turbo Assembler (TASM) software.

B) DETAILED SYLLABUS

Unit Topic(s)

[1] MICROPROCESSOR ARCHITECTURES

Introduction, Main features of 8086, 8086 Pin diagram, 8086 internal architecture, Machine cycle and Instruction Cycle, Minimum and Maximum Mode, 8086 Memory System

[2] 8086 ASSEMBLY LANGUAGE PROGRAMMING

Program Development Steps, Constructing the Machine Codes for 8086 Instructions, Addressing Modes, Assembly Language Program Development Tools.

[3] 8086 INSTRUCTION SET AND ASSEMBLER DIRECTIVES

Assembler Directives, Data Transfer Instructions, Arithmetic Instructions, Logical Instructions, Shift and Rotate Instructions, Transfer or Branch Control Instructions, Looping or Iteration Control Instructions, String Instructions, Processor Control Instructions.

[4] STACKS, PROCEDURES AND MACROS

Stack Instructions, Defining and Calling Procedure, Parameter Passing Methods, Working with Macros.

[5] 8086 INTERRUPTS AND I/O

The 8086 Interrupts, Interrupt types, Interrupt processing

[6] BASIC INTERFACING TECHNIQUES

Interfacing memory, Peripheral devices interfacing, programming and interfacing of VLSI based peripheral Devices like 8255, 8254, 8259, DMA Controller etc.

[7] 80286/386/486 MICROPROCESSORS

Multi User/Multitasking Operating System Concepts, Introduction to 80286/80386 /80486, The 80286/386 Segments, Descriptor Tables and Selectors. Real Address Mode and Protected Virtual Address Mode of 80286/80386/80486, Multitasking and Exceptions.

[8] MODERN MICROPROCESSORS

The Pentium Architecture, Hyper-Threading and Multi-core Technologies, Study of latest microprocessors.

C) RECOMMENDED TEXT/ REFERENCE BOOKS

1. Microprocessors and Interfacing (Programming & Hardware), Douglas V. Hall, McGraw Hill
2. 8086 Programming and Advance Processor Architecture, M. T. Savaliya, WIND Series, 2012
3. Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium And Pentium Pro Processor, by: Barry B. Brey

D) COURSE OUTCOMES

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

- Describe the architecture and organization of the Intel 8086, 80286 and other advance microprocessors, interfacing of the processor with memory and I/O devices, understanding of interrupts and study of descriptors in 80286 & 80386.
- Relate various descriptors and operating mode of 80286/80386 processor.
- Analyse as well as design circuits using various interfacing techniques
- Develop interrupt service routines for specific problem statement.
- Develop, debug and run assembly language programmes with the help of 8086-instruction set and various addressing modes using tasm.

SYLLABI BOOK

BACHELOR OF TECHNOLOGY MECHANICAL ENGINEERING



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

TEACHING SCHEME FOR THE COURSE
B. TECH., MECHANICAL ENGINEERING
 (Admission Year_2021)

SEMESTER I

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	MATHEMATICS -I	3	1	0	60	40	0	0	100	4.0
2	THERMODYNAMICS	3	0	2	60	40	50	0	150	4.0
3	BASIC ELECTRICAL ENGG.	3	0	2	60	40	50	0	150	4.0
4	MECHANICS	3	0	2	60	40	0	0	100	4.0
5	COMPUTER PROGRAMMING	2	0	3	40	0	0	50	90	3.5
6	ENVIRONMENTAL STUDIES	2	0	0	40	0	0	0	40	0.0
7	WORKSHOP PRACTICE - I	0	0	2	0	0	50	0	50	1.0
									680	20.5

SEMESTER II

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	MATHEMATICS-II	3	1	0	60	40	0	0	100	4.0
2	ENGINEERING GRAPHICS	3	0	3	60	40	50	0	150	4.5
3	BASIC ELECTRONICS	3	0	2	60	40	50	0	150	4.0
4	MECHANICS OF SOLIDS	3	0	2	60	40	50	0	150	4.0
5	CHEMISTRY	3	0	0	60	0	0	0	60	3.0
6	WORKSHOP PRACTICE - II	0	0	3	0	0	0	50	50	1.5
									660	21

SEMESTER III

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	NUMERICAL TECHNIQUES	3	0	2	60	40	25	25	150	4.0
2	ELECTRICAL MACHINES AND DRIVES	3	0	2	60	40	25	25	150	4.0
3	FLUID MECHANICS	3	0	2	60	40	25	25	150	4.0
4	MATERIAL SCIENCE AND METALLURGY	3	0	2	60	40	25	25	150	4.0
5	KINEMATICS OF MACHINES	3	1	2	60	40	25	25	150	5.0
6	ENGLISH	2	0	2	40	0	0	50	90	3.0
									840	24.0

SEMESTER IV

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
<u>1</u>	APPLIED THERMODYNAMICS	3	0	2	60	40	25	25	150	4.0
<u>2</u>	ADVANCE SOLID MECHANICS	3	0	2	60	40	25	25	150	4.0
<u>3</u>	MANUFACTURING TECHNOLOGY - I	3	0	4	60	40	25	25	150	5.0
<u>4</u>	DYNAMICS OF MACHINES	3	1	2	60	40	25	25	150	5.0
<u>5</u>	MACHINE DRAWING & INDUSTRIAL DRAFTING	0	0	4	0	0	25	25	50	2.0
<u>6</u>	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	1	0	2	0	0	0	100	100	2.0
<u>7</u>	UNIVERSAL HUMAN VALUES	3	0	0	60	0	0	0	60	3.0
									810	25.0

SEMESTER V

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	MEASUREMENT AND METROLOGY	3	0	2	60	40	25	25	150	4.0
2	HEAT AND MASS TRANSFER	3	0	2	60	40	25	25	150	4.0
3	MANUFACTURING TECHNOLOGY - II	3	0	4	60	40	25	25	150	5.0
4	MACHINE DESIGN - I	3	1	2	60	40	25	25	150	5.0
5	OPEN ELECTIVE - I	3	0	0	60	0	0	0	60	3.0
6	INDUSTRIAL MANAGEMENT & ECONOMICS	2	0	2	40	0	0	50	90	3.0
7	MENDATORY COURSE - 2 (CONSTITUTION OF INDIA OR ESSENCE OF INDIAN KNOWLEDGE TRADITION)	2	0	0	40	0	0	0	40	2.0
									790	26.0

SEMESTER VI

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	MACHINE DESIGN - II	3	1	2	60	40	25	25	150	5.0
2	FLUID MACHINES	3	0	2	60	40	25	25	150	4.0
3	COMPUTER AIDED DESIGN & MANUFACTURING	3	0	2	60	40	25	25	150	4.0
4	PROFESSIONAL ELECTIVE - I	3	0	2	60	40	25	25	150	4.0
5	PROFESSIONAL ELECTIVE - II	3	0	2	60	40	25	25	150	4.0
6	OPEN ELECTIVE - II	3	0	0	60	0	0	0	60	3.0
									810	21

SEMESTER VII

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	FINITE ELEMENT ANALYSIS	3	0	2	40	0	0	50	90	4.0
2	PROFESSIONAL ELECTIVE - III	3	0	2	60	40	25	25	150	4.0
3	PROFESSIONAL ELECTIVE - IV	3	0	2	60	40	25	25	150	4.0
4	OPEN ELECTIVE - III	3	0	0	60	0	0	0	60	3.0
5	OPERATION RESEARCH	3	0	2	60	40	25	25	150	4.0
6	EFFECTIVE TECHNICAL COMMUNICATION	3	0	0	60	0	0	0	60	3.0
7	SEMINAR	0	0	2	0	0	0	100	100	1.0
									760	23.0

SEMESTER VIII

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	PROFESSIONAL ELECTIVE - V	2	0	3	40	0	25	25	90	3.5
2	PROFESSIONAL ELECTIVE - VI	2	0	3	40	0	25	25	90	3.5
3	PROFESSIONAL ELECTIVE - VII	2	0	3	40	0	25	25	90	3.5
4	PROJECT	0	0	4	0	0	0	100	100	2.0
5	INDUSTRIAL TRAINING (8 Weeks)	0	3	12	0	0	150	100	250	9.0
									620	21.5

B. TECH. SEMESTER – I (CH/CL/IC/MH)**SUBJECT: MATHEMATICS - I (BS102)**

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

DETAILED SYLLABUS**1 CALCULUS: INTEGRAL CALCULUS**

Evolutes and involutes, Applications of definite integrals to evaluate surface areas and volumes of revolutions.

2 LINEAR ALGEBRA: MATRICES, VECTORS, DETERMINANTS, LINEAR SYSTEMS:

Matrices, Vectors: Addition and Scalar Multiplication, Matrix Multiplication, Rank of a matrix, Solutions of Linear Systems: Existence, Uniqueness, Determinants, Cramer's Rule, Inverse of a matrix, Eigen values, Eigenvectors, Symmetric, Skew-symmetric, Linear Independence of vectors, Diagonalization.

3 SEQUENCES AND SERIES:

Convergence of sequence and series, Introduction to tests for convergence; Power series, Series for exponential, Trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

4 MULTIVARIABLE CALCULUS (DIFFERENTIATION)

Partial derivatives, Total derivative; Tangent plane and normal line; Taylor series expansion for function of two variables, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers, Introduction to Vector Differential Calculus; Directional derivatives, Gradient, Curl and divergence.

LEARNING OUTCOMES:

The students will learn:

- To apply differential and integral calculus to notions of curvature and applications of definite integrals.
- Convergence, divergence, and analysis of sequences and infinite series.
- To develop functions as a Fourier series.
- The essential tools of matrices and linear algebra including linear transformations, eigen values, diagonalization.

TEXT/REFERENCE BOOKS:

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

2. G. B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
8. V. Krishnamurthy, V.P. Mainra and J. L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: THERMODYNAMICS (ES111)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	50*	--	150

* TW marks include Viva based on TW

DETAILED SYLLABUS

1 INTRODUCTION:

Macroscopic versus microscopic view point, thermodynamic systems and control volume, thermodynamic properties, processes and cycles, homogeneous and heterogeneous systems, thermodynamic equilibrium, quasi-static process, pure substance, concept of continuum, temperature and zeroth law of thermodynamics, ideal gas and gas laws

2 ENERGY AND ENERGY TRANSFER:

Forms of energy, energy transfer by heat and work, mechanical forms of work, first law of thermodynamics, energy conversion efficiencies

3 PROPERTIES OF PURE SUBSTANCES:

Pure substance, phases and phase change process, thermodynamic properties, property diagrams, ideal gas equation of state, van der waal equation, virial equation of state

4 ENERGY ANALYSIS OF A CLOSED SYSTEM:

PdV work in various quasi-static processes, energy balance, specific heats, internal energy, enthalpy and specific heats of solids, liquids and ideal gases.

5 ENERGY ANALYSIS OF A OPEN SYSTEM:

Conservation of mass, flow work and energy of a flowing fluid, energy analysis of steady and unsteady flow systems.

6 SECOND LAW OF THERMODYNAMICS:

Introduction to second law, thermal energy reservoir, heat engine, refrigerator and heat pump, Clausis and Kelvin-Plank statement, perpetual motion machines, reversible and irreversible processes, Carnot and reversed Carnot cycle, , entropy principle and isentropic process, Tds and Maxwell relation.

7 SEAM BOILERS:

Introduction, classification, mountings and accessories, classification and comparison of boiler draught systems.

8 APPLICATIONS OF THERMODYNAMICS:

Construction and working of pumps, compressors, IC engine- Otto and Diesel engines, vapour compression refrigeration system, vapour absorption refrigeration system.

TEXT/REFERENCE BOOKS:

1. Yunus A. Cengel, Michael A. Boles., "Thermodynamics- An engineering approach", Tata McGraw Hill publishing co. ltd.
2. Nag P.K., "Engineering Thermodynamics", Tata McGraw Hill publishing co. ltd.
3. Smith J.M., Van Ness H.C., Abbott M.M, "Introduction to chemical engineering thermodynamics", McGraw Hill publishing co. Ltd.
4. Sonntag. R.E., Borgnakke, C. and Van Wylen G.J., "Fundamental of thermodynamics", John Wiley and Sons.
5. Moran M.J. and Shapiro H.N., "Fundamentals of engineering thermodynamics", John Wiley and Sons.

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: ELEMENTS OF ELECTRICAL ENGINEERING (ES112)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	50*	--	150

* TW marks include Viva based on TW

DETAILED SYLLABUS

1 D.C. CIRCUITS

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

2 A.C. CIRCUITS

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

3 TRANSFORMERS

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

4 ELECTRICAL MACHINES

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

5 ELECTRICAL INSTALLATIONS

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption, power factor improvement. DC-DC buck and boost converters. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

6 SEMICONDUCTORS, DIODES AND APPLICATIONS

Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener

Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) in brief.

TEXT/REFERENCE BOOKS:

1. R. Muthu Subramanian, S. Salivahanan, and K. A. Muraleedharan, Basic Electrical, Electronics and Computer Engineering, 2nd Edition, Tata McGraw Hill
2. V. K. Mehta & Rohit Mehta, Principles of Electronics, 11th Edition, S. Chand & Company
3. B. L. Theraja , A. K. Theraja, Electrical Technology (Vol: II), 23rd Edition, S. Chand & Company
4. D.P. Kothari and I. J. Nagrath, Basic Electrical Engineering, 3rd Edition, Tata McGraw Hill

B. TECH. SEMESTER – I (CH/CL/IC/MH)**SUBJECT: MECHANICS (BS103)**

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	50*	--	150

* TW marks include Viva based on TW

DETAILED SYLLABUS**1 STATICS**

Resultant force for 2D and 3D force system, concept of free body diagrams, equilibrium equations for particles and rigid body subjected to 2D and 3D force system, centroid and center of gravity, moment of inertia, Friction

2 DYNAMICS AND VIBRATIONS

Rotational Transformation of scalars and vectors, Newton's Laws for particle motion, Potential Energy function $F = -\text{Grad } V$, conservative and non-conservative forces, Conservation of momentum, angular momentum, collision, energy equation, free harmonic motion, damped harmonic motion, forced oscillation and resonance, kinematics in a coordinate system rotating and translating in a plane.

TEXT/REFERENCE BOOKS:

1. Engineering Mechanics, M. K. Harbola, 2nd Edition, Cengage Learning, 2013.
2. Mechanics – J P Den Hartog, Dover Publications, 2003.
3. Mechanical Vibrations - J P Den Hartog, Dover Publications, 1985.
4. Theory of Vibrations with Applications – W. T. Thomson, 5th Edition, Pearson Education, 2008.
5. Engineering Mechanics: Statics (V.1), Dynamics (V.2), J. L. Meriam and L. G. Kraige, 5th edition, Wiley, 2017.
6. Engineering Mechanics: Statics & Dynamics, Irving H. Shames, 4th edition, Pearson Education, 2005.
7. Vector Mechanics for Engineers: Statics (V.1), Dynamics (V.2), F. P. Beer and E. R. Johnston, 10th SI edition, McGraw Hill Education, 2017

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: COMPUTER PROGRAMMING (ES113)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	40	0	50*	--	90

* TW marks include Viva based on TW

DETAILED SYLLABUS

1 INTRODUCTION:

Introduction to components of computer system, Idea of algorithm, Introduction to C, Constants, Variables & Data types in C, Managing input and Output operators.

2 OPERATORS AND EXPRESSIONS:

C Operators: Arithmetic, relational, logical, increment & decrement, assignment and conditional, Arithmetic Expressions & Precedence Rule, Type conversion in C, Mathematical Functions.

3 DECISION MAKING AND BRANCHING:

Decision making with If & If...else statements, goto statements.

4 DECISION MAKING AND LOOPING:

The while statement, the break statement & the do... while loop, the for loop, Jump within loops - Programs.

5 ARRAYS:

Array 1D, 2D, Character Array as String

6 USER DEFINED FUNCTIONS:

Categories of Functions (Including using built in library), Call by Value, Parameter passing to function, Recursion.

7 STRUCTURE:

Defining structure, Assigning value to the structure members, Array of structure

8 POINTER:

Idea of pointer, declaration and Initialization of pointer, passing address as function argument, passing array to function using pointer.

9 FILE HANDLING

(only if time is available, otherwise should be done as part of the lab)

TEXT/REFERENCE BOOKS:

1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. Yashvant Kanetkar, Let Us C, 12th Edition, BPB Publication.

4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

B. TECH. SEMESTER – I (CH/CL/IC/MH)
SUBJECT: ENVIRONMENTAL STUDIES (SM101)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
2	0	0	2	0	50	0	0	0	50

DETAILED SYLLABUS:

1 THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance & Need for public awareness

2 NATURAL RESOURCES

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

3 ECOSYSTEMS

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

4 BIODIVERSITY AND ITS CONSERVATION

Introduction definition: Genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity: Consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity, habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity

5 ENVIRONMENTAL POLLUTION

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

6 SOCIAL ISSUES AND THE ENVIRONMENT

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

7 HUMAN POPULATION AND THE ENVIRONMENT

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

8 FIELD WORK

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

TEXT BOOKS/ REFERENCE BOOKS

1. Erach Bharucha Textbook of Environmental Studies; Second Edition, Universities Press: Hyderabad, 2013.
2. Poonia, M. P.; Sharma, S. C. Environmental studies; Khanna Publishing House: New Delhi, 2017.
3. Rajagopalan, R. Environmental Studies; Oxford University Press: India, 2015.
4. Varandani, N. S. Basics of Environmental studies; Lambert Academic Publishing: Germany, 2013.
5. Basak, A. Environmental Studies; Dorling Kindersley: India, 2009.
6. Dhameja, S. K. Environmental studies; S. K. Kataria and Sons: New Delhi, 2007.
7. Rao, C. S. Environmental Pollution Control Engineering; Wiley publishers: New Delhi, 2006.
8. Brunner, R. C. Hazardous Waste Incineration; McGraw Hill: Michigan, 1989.
9. Clark, R. S. Marine Pollution; Clanderson Press Oxford: Bath, 2001.

10. Trivedy, R. K. Handbook of Environmental Laws, Acts, Guidelines, Compliances & standards; B. S. publications: Hyderabad, 2005.
11. Jadhav, H.; Bhosale, V. M. Environmental Protection and Laws; Himalaya Pub. House: Delhi, 1995.
12. Agarwal, K. C. Environmental Biology; Nidi Publ.: Bikaner, 2001.
13. Bharucha, E. The Biodiversity of India; Mapin Publishing: Ahmedabad, India, 2002.
14. Cunningham, W.P.; Cooper; Gorhani, T. H. E.; Hepworth, M.T., Environmental Encyclopedia; Jaico Publ. House: Mumbai, 2001.
15. De, A. K. Environmental Chemistry; Wiley Eastern: New Delhi, 2006.
16. Gleick, H. P. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security; Stockholm Env. Institute Oxford Univ. Press: New York, 1993.
17. Hawkins, R.E., Encyclopedia of Indian Natural History; Bombay Natural History Society: Bombay, 1987.
18. Heywood, V. H.; Waston, R. T. Global Biodiversity Assessment; Cambridge Univ. Press: Cambridge, 1995.
19. Mckinney, M.L.; School, R.M. Environmental Science systems & Solutions; Web enhanced edition: USA, 1996.
20. Miller, T.G. Jr.; Spoolman, S. E. Environmental Science; Cengage learning: Wadsworth, 2014.
21. Odum, E.P. Fundamentals of Ecology; W.B. Saunders: USA, 1971.
22. Rao, M. N.; Datta, A.K. Waste Water treatment; Oxford & IBH Publ.: New Delhi, 1987.
23. Sharma, B. K., Environmental Chemistry; Goel Publ. House: Meerut, 2001.
24. Townsend, C., Harper, J.; Michael, B. Essentials of Ecology; Blackwell: Oxford, 2008.
25. Trivedi, R. K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II; B. S. Publications, Hyderabad, 2010.
26. Trivedi, R. K.; Goel, P. K. Introduction to air pollution; ABD Publishers: Jaipur, 2003.
27. Wanger, K. D., Environmental Management; W.B. Saunders Co. Philadelphia, USA, 1998

B. TECH. SEMESTER – I (CH/CL/IC/MH)**SUBJECT: WORKSHOP PRACTISE - I**

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

Reference Code ESC104A

* TW marks include Viva based on TW

LABORTORY WORKS/SCHEDULE:

Lab	Workshop-I
1	Introduction to Workshop, Basic Workshop types
2	Safety requirement in workshop, Safety rules
3	To Understand "5S" Concept for Workplace
4	Demonstration of Tin smithy Tools and it's exercise
5	To make job for Tin smithy shop
6	Demonstration of Plumbing tools, It's accessories.
7	To make job for Plumbing shop
8	Introduction to Fabrication shop, Welding Equipment
9	To make job for Fabrication shop
10	Introduction of Machine shop
11	Introduction and Demonstration of Lathe machine.
12	Introduction and Demonstration of Milling and Radial Drilling m/c

TEXT/ REFERENCE BOOKS

1. Work shop technology, A. K. Hajrachaudhari & S. K. Hajrachaudhari
2. ITB Hand book, Engineering industry training board
3. Work shop Technology Vol. I & II, Gupta & Kaushik

B. TECH. SEMESTER – II (CH/CL/IC/MH)
SUBJECT: MATHEMATICS – II (BS203)

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

DETAILED SYLLABUS

1 SERIES SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS BY POWER SERIES METHOD:

Introduction, Validity of series solution of the equation, General Method, Forms of series solution.

2 PARTIAL DIFFERENTIAL EQUATIONS:

Basic Concepts, Classification and Solutions of partial differential equations: Lagrange's linear equation of first order, Non-linear equations of first order-Charpit's method, Homogenous linear equations with constant coefficient to find the complementary functions and the particular integral, Introduction to non-homogenous linear equations with constant coefficients, Method of separation of variables.

3 MULTIVARIABLE CALCULUS (INTEGRATION

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

4 LAPLACE TRANSFORM:

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

TEXT/REFERENCE BOOKS:

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 40th Edition, 2007.
2. G. B. Thomas and R. L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. W. E. Boyce and R. C. Di Prima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
5. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

6. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,1995.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications,1958.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill,2004.
9. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,2008.

B. TECH. SEMESTER – II (CH/CL/IC/MH)
SUBJECT: ENGINEERING GRAPHICS (ES203)

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	3	6	4.5	60	40	50	0	150

Reference Code ESC102

* TW marks include Viva based on TW

DETAILED SYLLABUS

1 INTRODUCTION TO ENGINEERING DRAWING

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic section curves (Ellipse, Parabola, Hyperbola), Cycloidal Curves (Cycloid, Epicycloid, Hypocycloid), Involute; Archimedean Spiral

2 SOLID GEOMETRY

Projection of points, projection of lines and their applications. Projection of regular planes such as square, rectangle, triangle, circle, pentagon, hexagon, rhombus. Projection of right and regular solids inclined to both the planes (prisms, pyramids, cylinder and cone)

3 ORTHOGRAPHIC PROJECTIONS

First angle and third angle projection methods, conversion of pictorial views into Orthographic projections with dimensioning, sectional orthographic projection, special sections

4 SECTION OF SOLIDS AND DEVELOPMENT OF SOLIDS

Sections and Sectional Views of Right Angular Solids Covering, Prism, Cylinder, Pyramid, Cone

5 DEVELOPMENT OF SURFACES

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

6 ISOMETRIC PROJECTIONS

Principles of Isometric projection – Isometric Scale, Isometric projection and view, Conversion of orthographic views to isometric projections and views

7 WORKING ENVIRONMENT OF CAD SOFTWARE

Menu bar, Quick access toolbar, Dashboard/Ribbon, Toolbars, drawing space, Navigation bar (View controls: zoom, pan, orbit,), Command prompt, Status bar, Drawing Area (Background, Crosshairs, Coordinate System), Shortcut Menu, Properties manager.

8 DRAWING CUSTOMIZATION

Setting up the drawing sheet (drawing sheet templates, drawing limits, drawing units etc.), Coordinate system (User coordinate system, Absolute and relative coordinates, Cartesian and Polar coordinates), Modes of drawing (Grid, Snap, Ortho, Osnap, Otrack, Polar tracking, Iso draft, etc.) Formatting (colours, line type, line weight, point style etc.).

9 PREPARING COMPUTER AIDED DRAWING

Exploring various commands with exercises of Orthographic drawing views and Isometric drawing views using different drawing tools, modifying tools, dimensioning tools etc.

10 PLOTTING AND EXCHANGING DRAWING

Printing/Plotting the drawing (page setup, plot area, plot scale, drawing orientation, plot options etc.), Drawing standard (DXF), Generating PDF drawing documents, file management.

TEXT/REFERENCE BOOKS:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
3. Shah P. J., (2014) Engineering Graphics, S. Chand Publishing
4. Luzadder W., Duff J., (1992), Fundamentals of Engineering Drawing, Peachpit Press
5. Gill P. S., (2009), Engineering Drawing, S. K. Kataria & Sons
6. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

B. TECH. SEMESTER – II (CH/CL/IC/MH)**SUBJECT: BASIC ELECTRONICS**

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	50	0	150

* TW marks include Viva based on TW

DETAILED SYLLABUS**1 TRANSISTOR & CHARACTERISTICS**

Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration

2 FIELD EFFECT TRANSISTOR (FET)

Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits

3 TRANSISTOR AMPLIFIERS AND OSCILLATORS

Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift

4 OPERATIONAL AMPLIFIERS AND APPLICATIONS

Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, and inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator, Wein bridge oscillator.

5 DIGITAL ELECTRONICS FUNDAMENTALS

Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification, Logic ICs, Implementation of combinational logic - half and full adder/subtractor, multiplexers, de-multiplexers.

6 SENSORS & SIGNAL CONDITIONING CIRCUITS

Types of sensors – pneumatic, electromagnetic, electronic, smart sensors. Diaphragm, bellows and Bourdon tube, Resistive, Capacitive, Inductive, ultrasonic, LVDT, piezoelectric, optoelectronic transducers, thermocouple, RTD and thermistors, Application of sensors for flow, level, temperature and stress measurement, Bridge Circuit, Differential Amplifier, Instrumentation Amplifier

TEXT/REFERENCE BOOKS:

1. Principles of Electronics, 11th Edition By: V. K. Mehta & Rohit Mehta Publisher: S. Chand & Company
2. Electrical & Electronic Measurement & Measuring Instruments, 17th Edition By: A.K. Sawhney Publisher: Dhanpat rai
3. M. M. Mano, "Digital logic and Computer design", Publisher : Pearson Education India.

B. TECH. SEMESTER – II (CH/CL/IC/MH)**SUBJECT: MECHANICS OF SOLIDS**

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	2	5	4	60	40	50	0	150

Reference Code ESC205

*TW marks include Viva based on TW

DETAILED SYLLABUS

- 1 Concept of stress and strain, elasticity, generalized Hooke's law for 3D, concept of isotropy and homogeneity, plane stress and plane strain idealization, axial, volumetric and thermal stresses and strains
- 2 Transformation of stress and strain at a point, Principal stresses and strains, Mohr's Circle, strain rosette
- 3 Mechanical properties of metals – elasticity, plasticity, strain hardening, hardness, toughness, fatigue, strain energy
- 4 Force-strain-deformation analysis for axial load, flexure, shear and torsion

TEXT/REFERENCE BOOKS:

1. Strength of Materials: Part– I and II, Stephen Timoshenko, 3rd Edition, CBS Publisher, 2002.
2. Strength of Materials, Sadhu Singh, 1st Edition, Khanna Book Publishing Company, 2016.
3. Advanced Mechanics of Solid, L. S. Srinath, 3rd Edition, McGraw Hill Publication, 2017.
4. Engineering Mechanics of Solids, E P Popov, 2nd Edition, Prentice Hall India Learning Pvt. Ltd, 2002.

B. TECH. SEMESTER – II (CH/CL/IC/MH)**SUBJECT: CHEMISTRY**

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	0	3	3	100	0	0	0	100

Reference Code BSC102

DETAILED SYLLABUS:**1 ATOMIC AND MOLECULAR STRUCTURE**

Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

2 SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

3 INTERMOLECULAR FORCES AND POTENTIAL ENERGY SURFACES

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H₃, H₂F and HCN and trajectories on these surfaces.

4 USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

5 PERIODIC PROPERTIES

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

6 STEREOCHEMISTRY

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

7 ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecules.

TEXT/REFERENCE BOOKS

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins (vi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

B. TECH. SEMESTER – II (CH/CL/IC/MH)**SUBJECT: WORKSHOP PRACTISE - II**

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
0	0	3	3	1.5	0	0	50*	0	150

Reference Code ESC104B

*TW marks include Viva based on TW

LABORTORY WORKS/SCHEDULE:

Lab	Workshop-II
1	Introduction to Carpentry Shop, application of various carpentry tools
2	Demonstration of Carpentry Job 1 & 2
3	To make Job 1 for Carpentry shop
4	To make Job 2 for Carpentry shop
5	Introduction to Black smithy shop and Demonstration of it's job
6	To make Job for Black smithy shop
7	Introduction to Fitting shop, to understand application of various tools of this shop
8	Demonstration of Fitting Job
9	To make job for Fitting shop
10	To make job for Fitting shop
11	Assignment for Carpentry shop
12	Assignment for Fitting shop

TEXT/ REFERENCE BOOKS

1. Work shop technology, A. K. Hajrachaudhari & S. K. Hajrachaudhari
2. ITB Hand book, Engineering industry training board
3. Work shop Technology Vol. I & II, Gupta & Kaushik

B. TECH. SEMESTER – III
SUBJECT: NUMERICAL TECHNIQUES

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

Reference Code BSC202

DETAILED SYLLABUS:

1 ERROR ANALYSIS

Significant figures, accuracy and precision, error definitions, round-off errors, truncation errors, Taylor series, total numerical error, blunders, formulation errors, and data uncertainty

2 ROOTS OF EQUATIONS

Introduction, bracketing methods: bisection method and false-position method, open methods: Newton-Raphson method, Secant and Modified Secant method, roots of polynomials

3 ALGEBRAIC EQUATIONS

Introduction, numerical solutions of linear algebraic equations: Cramer's rule, Gauss elimination method, numerical solution of nonlinear equations: Gauss-Jordan method, LU decomposition, special matrices: tridiagonal matrices analysis, Cholesky decomposition, Iterative methods: Gauss-Seidel method and Jacobi's method

4 CURVE FITTING AND INTERPOLATION

Introduction, least square regression: linear regression, polynomial regression
Introduction, Newton's forward and backward difference interpolation, Lagrange interpolation, inverse interpolation, spline interpolation

5 NUMERICAL DIFFERENTIATION AND INTEGRATION

Introduction, high accuracy differentiation formulas: forward, backward and central difference method, Richardson extrapolation, Newton-Cotes integration formulas: trapezoidal and Simpson's rule.

6 NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS AND PARTIAL DIFFERENTIAL EQUATIONS

Introduction, initial value problems: Euler's method, Heun's method, fourth order Runge-Kutta method, multistep methods: Milne's method and Adam's method
Elliptic equations: Laplace difference equation, Liebmann's iterative method, boundary conditions, parabolic equations: implicit method, explicit method, the Crank Nicolson method

TEXT/REFERENCE BOOKS

1. Numerical Methods for Engineers, Steven C. Chapra, Raymond P. Canale, Tata McGraw Hill
2. Numerical Methods, E Balagurusamy, Tata McGraw Hill
3. Applied Numerical Analysis, Curtis F. Gerald, Patrick O. Wheatley, Addison Wesley, Pearson
4. Numerical Methods in Engineering and Science, Grewal. B.S. and Grewal. J.S., Khanna Publishers, New Delhi
5. Applied Numerical Methods Using MATLAB, W.Y. Yang, W. Cao, T.S. Chung and J. Morris, Wiley India Edition
6. Numerical Methods for Engineers, S. K. Gupta, New Age International Publishers

B. TECH. SEMESTER – III
SUBJECT: ELECTRICAL MACHINES AND DRIVES

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

Reference Code ESC201

DETAILED SYLLABUS:

1 TRANSFORMERS & ITS SWITCHGEARS

General aspects, basic definition, working principle of transformer, types of transformers, transformer construction: core/shell/spiral transformers, transformers on no load & on load, vector diagrams, equivalent circuit, losses and condition for maximum efficiency, all day efficiency, Sumpner's test, conditions for parallel operation, introduction to 3-phase transformer, construction, instrument transformers, Relay, circuit breaker and isolator, fuses

2 ALTERNATOR

Introduction, constructional details, types, armature winding, EMF equation, factor affecting size of alternator, alternator operation on load, voltage regulation, losses and efficiency, parallel operation of alternators, armature reaction, damper winding

3 DC GENERATOR

Classification, working principle of generator, construction of DC Machines, types of DC generator, open circuit characteristic, external characteristic and internal characteristic of DC generator, efficiency and power stages with example, condition for maximum efficiency

4 DC MOTORS

Construction, types, principle of operation, torque equation, losses and efficiency, speed torque characteristics of shunt, series and compound motor, D.C. shunt motor 3-point starter, speed control of D.C. shunt and series motors, Stepper motor, Single line diagrams of DC motors

5 SINGLE PHASE, THREE-PHASE INDUCTION MOTOR & ITS SWITCHGEARS

Construction, principle of operation, production of magnetic field, comparison between three phase and single-phase induction motors, speed and slip, rotor current, relation between rotor copper loss and rotor input, torque of an induction motor, torque slip curve, losses and efficiency, starters for three phase induction motor, speed control of three phase induction motor, single line diagram of induction motor

6 INTRODUCTION TO DRIVES

Introduction to Thyristor, Insulated Gate Bipolar transistors (IGBTs), Power MOSFET, general configuration of a motor drive, matching power electronic converter and motor, thyristor controlled single phase and three phase converter drive, modes of operation, block diagram and DC drive examples

TEXT/REFERENCE BOOKS

1. Power systems, V. K. Mehta, S. Chand publication
2. Principles of power systems, V.K. Mehta, S. Chand publication
3. Electrical Technology- Vol. II, B. L. Theraja, S. Chand publication
4. A course in power systems, J. B. Gupta, S. K. Kataria Publication
5. Electrical power systems, S. L. Upal, Khanna Publishers
6. A course in Electrical Power, P. V. Gupta, M. L. Soni, U. S. Bhatnagar, Dhanpat Rai & Co.
7. Theory & Performance of Electrical Machines, J. B. Gupta, Katson books
8. Power Electronics, P.S. Bimbhra, Khanna Publishers

B. TECH. SEMESTER – III
SUBJECT: FLUID MECHANICS

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

Reference Code ME203A

DETAILED SYLLABUS:

1 FLUID PROPERTIES AND PRESSURE MEASUREMENT

Properties of fluid: Mass Density, specific weight, specific gravity and specific volume, Types of fluid, Newton's law of viscosity, continuum concept of a fluid, viscosity, surface tension and capillarity, vapor pressure, cavitation, compressibility, Pressure, Pascal's law, hydrostatic law, hydrostatic paradox, absolute and gauge pressures, measurement of pressure, manometers: simple and differential manometers

2 FLUID STATICS

Total pressure force and center of pressure, hydrostatic force on submerged surfaces -horizontal, inclined, vertical and curved surfaces, buoyancy, stability of floating body and submerged body, metacenter, analytical method to determine meta-centric height

3 FLUID KINEMATICS

Langrangian approach and Eulerian approach, types of flow, streamline, stream tube, path line and streak line, continuity equation, continuity equation in differential form for cartesian coordinate system, local and convective acceleration, translation, rotation and deformation of fluid element, rotation and vorticity, stream function and velocity potential function, stream lines and equipotential lines, relation between stream function and velocity potential, flow nets

4 FLUID DYNAMICS

Newton's Laws of Motion, Euler's Equation, Bernoulli's Equation, venturimeter, orifice meter and pitot tube, impulse-momentum equation and its application, moment of momentum equation, vortex flow, forced and free vortex flow, equation of motion for vortex flow, equation of forced and free vortex flow, dimensionless parameters and their significance, Dimensional analysis.

5 VISCOUS FLOW

Concepts of laminar and turbulent flows, Reynolds number and Reynold's experiment, exact solution of Navier -Stokes equation for simple flows, relation between shear stress and pressure gradient, concept of developing and fully developed flow, Flow of viscous fluid in circular pipes - Hagen-Poiseuille law, laminar flow between parallel plates for moving and stationary plates

6 FLOW THROUGH PIPES

Loss of energy in pipes, friction factor, Moody's Chart, Darcy Weisbach Equation, major and minor losses in pipes, hydraulic gradient lines and total energy line, pipes connected in series and parallel, equivalent pipe, branched pipes, flow through orifices and mouthpieces

TEXT / REFERENCE BOOKS

1. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Prakashan
2. Fluid Mechanics and Fluid Power Engineering, D.S. Kumar, S. K. Kataria & Sons
3. Fluid Mechanics, Yunus A. Cengel, McGraw Hill Publication
4. Fluids Mechanics, F.M. White, McGraw-Hill Inc
5. Fluid Mechanics and Hydraulic Machines, Sukumar Pati, McGraw-Hill Inc
6. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som., G. Biswas, Tata McGraw Hill Co. Pvt. Ltd

B. TECH. SEMESTER – III
SUBJECT: MATERIAL SCIENCE AND METALLURGY

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

Reference Code ME205

DETAILED SYLLABUS:

1 STRUCTURE OF MATERIALS

Crystalline structure of solids, crystalline materials vs amorphous materials, concept of unit cell and space lattice, lattice parameters, Miller indices, crystal structure of ferrous and non-ferrous metals, crystal imperfections, atomic packing factors for various cubic systems, Bragg's law

2 MECHANICAL PROPERTY AND MEASUREMENTS

Tensile, compression and torsion test, Young's modulus, relations between true and engineering stress-strain curves, generalized Hook's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery, Hardness: Rockwell, Brinell and Vickers and their relation to strength

3 PHASE DIAGRAM AND IRON-CARBON EQUILIBRIUM DIAGRAM

Alloys, substitutional and interstitial solid solutions, phase diagrams, interpretation of binary phase diagrams and microstructure development, eutectic, peritectic, peritectoid, and monotectic reactions. Iron- Iron carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite, cast iron

4 STEELS AND HEAT TREATMENTS

Introduction and purpose of heat treatments, classification of heat treatment processes, annealing, tempering, normalising and spheroidising, isothermal transformation diagram for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructure and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening. Property variation with microstructure, classification and application of steels, transformation product of austenite, TTT and CCT curves, critical cooling rate. Introduction and applications of various case hardening and surface hardening treatments

5 FERROUS-NON-FERROUS ALLOYS, COMPOSITES & OTHER NON-METALS

Classification of steels, alloying of steels, properties of various stainless steels and tool steels, designation of steels. Cast irons; grey, white, malleable and spheroidal cast irons. Copper and copper alloys, brasses, equivalent zinc in brasses, season cracking of brasses, aluminium bronzes, tin bronzes, beryllium bronzes, silicon bronzes, copper nickel alloys, aluminium and aluminium alloys, nickel and nickel alloys, bearing materials, Ceramic materials, polymers, composites, particles-

reinforced composites, fiber reinforced composites, Material standards and its equivalency (ISO, ASTM, DIN, JIS).

6 NON-DESTRUCTIVE TESTING

Introduction to non-destructive testing, radiography testing, dye penetration testing, magnetic particle testing, ultrasonic testing, Jominy end quench test, macro-examination, spark test, macro-etching, microscopic examinations, electron microscopy, magnetic testing, chemical analysis of steel and iron, NDT certification and its applicability to industry.

TEXT / REFERENCE BOOKS

1. Material Science & Engineering, V. Raghvan, PHI Learning Pvt Ltd.
2. Introduction to Physical Metallurgy, Sidney H Avner, Tata McGraw-Hill
3. Material Science and Engineering, W. Callister, Willey Publication
4. The science and engineering of Materials, Donald Asklund and Pradeep Phule, Wadsworth Publishing.
5. Material Science and Metallurgy for Engineers, V.D. Kodgire, Everest Publishing House
6. Elements of Material Science and Engineering, Lawrence Vlack, PEARSON
7. Physical Metallurgy for Engineers, Donald S Clark & Wilbur R Varney, East-west press pvt Ltd.

B. TECH. SEMESTER – III
SUBJECT: KINEMATICS OF MACHINES

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	1	2	7	5	60	40	25	25	150

Reference Code ME304A

DETAILED SYLLABUS:

1 MECHANISM AND MACHINES

Terminology and definitions, mechanism & machines. rigid and resistance body, link, kinematic pair types of motion, degrees of freedom, classification of Kinematic pairs, kinematic chain, linkage, kinematic inversions of single and double slider crank chain, four bar chain mechanism with lower pairs, straight line mechanism and approximate straight-line mechanism, quick return mechanisms, Steering gear mechanisms

2 VELOCITY ANALYSIS

Vectors, displacement of a rigid body, relative displacement, definition of velocity, angular velocity, rotation of a rigid body, translation and rotation of a rigid body, relative velocity method, instantaneous axes of motion, properties of instantaneous centers, the Aronhold Kennedy theorem of three centers, velocity analysis by instantaneous centers.

3 ACCELERATION ANALYSIS

Definition of acceleration, angular acceleration, a general case of acceleration, radial and transverse components of acceleration, the Coriolis component of acceleration, examples of Acceleration analysis, acceleration diagrams

4 BELTS, ROPES & CHAIN DRIVES

Introduction, belt and rope drives, open and crossed belt drives, velocity ratio, slip, materials for belt and ropes, law of belting, length of belt, ratio of friction tensions, power transmitted, centrifugal effect on belts, maximum power transmitted by a belt, initial tension, creep, chain drive-chain length, angular speed ratio, classification of chains

5 GEARS & GEAR TRAINS

Introduction, classification of gears, gear terminology, law of gearing, velocity of sliding, forms of teeth, cycloidal profile teeth, involute profile teeth, comparison of cycloidal and involute tooth forms, birth of contact, arc of contact, number of pairs of teeth in contact, interference in involute gears, minimum number of teeth, interference between rack and pinion, undercutting, introduction to helical, spiral, worm and bevel gears

6 CAMS

Introduction, types of cams, types of followers, cam terminology, displacement diagrams, motions of the follower, graphical construction of cam profile

TEXT / REFERENCE BOOKS

1. Theory of Machines, S. S. Rattan, Tata McGraw-Hill Publishing Co. Ltd New Delhi
2. Theory of Machines, P. L. Ballaney, Khanna Publishers, New Delhi
3. Theory of Machines and Mechanisms, Joseph Shigley and John Uicker, Jr., McGraw Hill
4. Theory of Mechanisms & Machines, Amitabha Ghosh & Ashok Mallik, Affiliated East-West Press Pvt. Ltd
5. Theory of Machines, Thomas Bevan, CBS publishers and distributors
6. Theory of Machines, Sadhu Singh, Pearson Education
7. Mechanism and Machine Theory, J.S. Rao and R.V. Duddipati, New Age International Publisher
8. Kinematics & Dynamics of Machinery, Charles Wilson & J. Peter Sadler, Pearson Education

B. TECH. SEMESTER – III

SUBJECT: ENGLISH

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

Reference Code HSMC-01

*TW marks include Viva based on TW

DETAILED SYLLABUS:

1 VOCABULARY BUILDING

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

2 BASIC WRITING SKILLS

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

3 IDENTIFYING COMMON ERRORS IN WRITING

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

4 NATURE AND STYLE OF SENSIBLE WRITING

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

5 WRITING PRACTICES

Comprehension, Précis Writing, Essay Writing

6 ORAL COMMUNICATION

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

TEXT / REFERENCE BOOKS

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan. 2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

B. TECH. SEMESTER – IV
SUBJECT: APPLIED THERMODYNAMICS

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

Reference Code ME202

DETAILED SYLLABUS:

1 EXERGY: WORK POTENTIAL OF ENERGY

Overview of laws of thermodynamics, exergy associated with kinetic and potential energy, reversible work and irreversibility, second law efficiency

THERMODYNAMIC RELATIONS

Maxwell relations, Clapeyron equation, Clausius-Clapeyron equation

2 GAS POWER CYCLE

Basic considerations in the analysis of power cycles, air-standard cycles: assumptions, Otto cycle, diesel cycle, dual cycle and their comparison, simple Brayton cycle and its modification-intercooling, reheating and regeneration

3 VAPOUR POWER CYCLES

The Carnot vapour power cycle, simple Rankine cycle and its energy analysis, modified Rankine cycle: superheating, reheating and regeneration

4 FUELS AND COMBUSTIONS

Calorific values of fuel, requirements of good fuel, proximate and ultimate analysis of fuel, theoretical determination of calorific value using Dulong's formula, air requirement for combustion, boiler performance

5 REFRIGERATION CYCLE

Reversed Carnot cycle, Joule-Thompson effect, analysis of ideal vapour compression refrigeration cycle, actual vapour Compression refrigeration cycle, refrigerants and its properties, selection, air refrigeration (Bell-Coleman) cycle

6 PSYCHROMETRY AND AIR-CONDITIONING

Psychrometric properties and processes, adiabatic saturation temperature, psychrometric chart, human comfort and industrial air-conditioning

TEXT / REFERENCE BOOKS

1. Thermodynamics- An engineering approach, Yunus A. Cengel, Michael A. Boles., Tata McGraw Hill publishing co. ltd.
2. Engineering Thermodynamics, P.K. Nag, Tata McGraw Hill publishing co. ltd.
3. Fundamental of thermodynamics, Sonntag. R.E., Borgnakke C. and Van Wylen G.J, John Wiley and Sons.
4. Fundamentals of engineering thermodynamics, Moran M.J. and Shapiro H.N., John Wiley and Sons.

B. TECH. SEMESTER – IV
SUBJECT: ADVANCE SOLID MECHANICS

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

Reference Code ME302

DETAILED SYLLABUS:

1 STRESSES AND STRAINS IN THREE DIMENSIONS

Solid mechanics approaches, concept of continuum, homogeneity and isotropy, types of forces on a body, state of stress at a point, rectangular stress components, stress sign convention, equality of cross shear, traction on an arbitrary surface, principal stresses and planes, stress invariants, hydrostatic and deviatoric stress tensor, Mohr's circle for general state of stress, plane of maximum shear, stress transformations, octahedral planes and stresses, differential equation of equilibrium

Difference between displacement and deformation, strain at a point, strain displacement relationship, engineers and mathematician's strain tensors, change in length of a linear element – Total strain concept, rigid body rotation, cubical dilatation, principle axes of strain and principal strain, strain deviator, strain invariants, strain transformation, compatibility conditions, stress-strain relationship and elastic constants required for different types of materials, stress strain relationship for isotropic material, plane stress and plane strain

2 THEORIES OF ELASTIC FAILURE UNDER STATIC LOADING

Concept of factor of safety, factors affecting factor of safety, maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, maximum strain energy theory, maximum shear strain energy theory, region of safety for all theories

3 THICK CYLINDERS

Cylinder Classification, design of thick cylinders, Lamé's theory, Design based on various failure theories, cylinders subjected to external pressure, Methods of prestressing of cylinders, Analysis of compound cylinders

4 COLUMNS AND STRUTS AND STRESSES DUE TO ROTATION

Classification of columns, strength of columns, end conditions and equivalent length, Euler's formula, Rankine's hypothesis, columns subjected to eccentric loading, beam columns

Stresses in rotating ring, stresses in rotating thin solid and hollow disc, stresses in thin disc with a pin hole, disc of uniform strength

5 SLOPE AND DEFLECTION OF BEAMS

Introduction, Beam deflection, relation between slope, deflection and radius of curvature, slope and deflection at a section by various methods

6 BENDING OF CURVED BARS

Introduction, Stresses in curved bars (Winkler-Bach theory) (Rectangular section, Circular section, Triangular section, Trapezoidal section, T-Section)

TEXT / REFERENCE BOOKS

1. Advanced Mechanics of Solids, L. S. Srinath, Tata McGraw Hill
2. Strength of Materials, R. K. Rajput, S. Chand & Co. Ltd.
3. Solid Mechanics, S. M. A. Kazimi, Tata McGraw Hill
4. Strength of Materials, D. S. Bedi, Khanna book publishing co. Pvt ltd.
5. Elements of Strength of Materials, Timoshenko S. P. and Young D.H., East-West Press Pvt. Ltd.
6. Mechanics of Materials, Timoshenko and Gere, CBS Publishers
7. Mechanics of Structures, S. B. Junarkar, Charotar Publishers

B. TECH. SEMESTER – IV
SUBJECT: MANUFACTURING TECHNOLOGY-I

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	0	4	7	5	60	40	25	25	150

Reference Code ME302

DETAILED SYLLABUS:

1 SAND CASTING PROCESS

Principal of casting process, different types of patterns, pattern materials, pattern allowances, pattern colours, types of sand, moulding materials and core, moulding processes, melting practice and metal pouring, gating system design, fettling process and casting defects

2 SPECIAL CASTING PROCESSES

Gravity die casting, pressure die casting, centrifugal casting, investment casting, continuous casting, vacuum casting, squeeze casting, comparison with conventional sand casting process

3 LATHE MACHINE

Function, working principle, classification, specifications, main parts, feed mechanism, lathe accessories, lathe operations, cutting tool materials, tool geometry of single point cutting tool, cutting Parameters: speed, feed and depth of cut, machining time, material removal rate, specification of lathe machine, capstan and turret lathe, working principle, parts

4 MILLING, SHAPER AND PLANNER MACHINE

Working principle, main parts, classification of milling machines, specification, milling machine mechanism, work holding devices, cutter holding devices, different milling cutters, tool geometry of plain milling cutter, milling operations, cutting parameters, machining time, milling attachments, principle of indexing, types of indexing

Function of shaper, working principle, classification, main parts, driving mechanism of shaper, feed mechanism of shaper, different operations on shaper machine, cutting parameters: speed, feed and depth of cut, machining time, specification of shaper machine

Working principle of planer, classification, difference between shaper and planer, planner operations, specification of planner machine

5 DRILLING, BORING AND GRINDING MACHINE

Working principle of drilling, classification, main parts, specification, different operations on drilling, machining time

Working principle & types of boring machines, boring tools

Working principle, main parts, classification of grinding machines, specification, Grinding operations, types of grinding wheels, wheel marking, truing, glazing, loading

6 INTRODUCTION TO ADDITIVE MANUFACTURING

Additive manufacturing – basics, processes and applications

TEXT / REFERENCE BOOKS

1. Element of Workshop Technology, S. K. Hajra Choudhury, Vol. 1, Media Promoters and publishers Pvt.
2. Element of Workshop Technology, S. K. Hajra Choudhury, Vol. 2, Media Promoters and publishers Pvt.
3. Foundry Technology, O. P. Khanna, Dhanpat Rai Publication
4. A course in Workshop Technology, B.S.Raghuwanshi, Dhanpat Rai & Sons, Delhi
5. Elements of Lathe work, B.Brushtein and V.Dementyev, Peace Publishers, Moscow
6. Manufacturing Engg. And Technology, S. Kalpakajain, PHI/Pearson
7. H.M.T, "Production Technology", Tata McGraw Hill
8. Manufacturing Processes for Engineering Materials, Kalpakjain S. and Schmid Steven R., Pearson Publication
9. Workshop Technology Vol. I, II & III, Chapman
10. Manufacturing Technology – 1 Foundry, Forming and Welding, P. N. Rao

B. TECH. SEMESTER – IV
SUBJECT: DYNAMICS OF MACHINE

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
3	1	2	5	5	60	40	25	25	150

Reference Code ME304B

DETAILED SYLLABUS:

[1] STATIC FORCE ANALYSIS

Introduction, conditions of static equilibrium, equilibrium of different members, free body diagrams, principle of super position, static force analysis of various mechanism, principle of virtual work, static force analysis with friction

[2] DYNAMIC FORCE ANALYSIS

Introduction, D'Alembert's principle, equivalent offset inertia force, dynamic analysis of simple mechanisms, combined static and inertia force analysis of different mechanisms, dynamic force analysis of reciprocating engine: inertia of reciprocating mass and connecting rod, dynamically equivalent system

[3] FLYWHEEL

Introduction, function, turning-moment diagrams, fluctuation of energy, dimensions of flywheel rims

[4] BALANCING

Introduction, static balancing, dynamic balancing of several masses in different planes, balancing of reciprocating and rotary masses

[5] GOVERNORS

Introduction, different types of governors, various terminologies, effort and power of a governor, controlling force

[6] GYROSCOPE

Concept of gyroscope, angular velocity, angular acceleration, gyroscopic couple, gyroscopic effect on aviation, marine and automobiles

TEXT / REFERENCE BOOK

1. Theory of Machines, S S Rattan, Tata McGraw Hill.
2. Theory of Machines, R. S. Khurmi and J. K. Gupta, S. Chand and Company Ltd.
3. Theory of Machines and Mechanisms, Joseph Shigley and John Uicker, Jr., McGraw Hill.
4. Theory of Mechanisms & Machines, Amitabha Ghosh & Ashok Mallik, Affiliated East-West Press Pvt. Ltd.
5. Kinematics & Dynamics of Machinery, Charles Wilson & J. Peter Sadler, Pearson Education.

6. Dynamics of Machinery, Farazdak Haideri, Nirali Publication.
7. Mechanism and Machine Theory, J.S. Rao and R.V. Duddipati, New Age International Publisher

B. TECH. SEMESTER – IV

SUBJECT: MACHINE DRAWING AND INDUSTRIAL DRAFTING

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
0	0	4	4	2	0	0	25	25	50

Reference Code ME308

DETAILED SYLLABUS:

PART A: MACHINE DRAWING

1 FUNDAMENTALS OF MACHINE DRAWING

Introduction to Machine drawing, conventional representations of various machine elements such as threaded parts, bearing, gears, spring, etc. conventional representation of part materials, standard abbreviations.

2 DETACHABLE FASTNERS

Introduction, screw thread nomenclature, forms of thread, thread designation, drawing representations of threads: normal, schematic and conventional. part drawing exercises of threaded fasteners such as bolts, nuts, screws, studs, nut locking arrangements

3 PERMANENT FASTNERS

Rivets and riveted joints, BIS symbols for riveted joints. types of welded joints, BIS symbols for welded joints. drawing exercises for representation of riveted joints and welded joints

4 ASSEMBLY DRAWING

Detail drawing of machine components. assembly drawings of various machines, mechanisms and equipment such as cotter joint, knuckle joint, flange coupling, universal coupling, screw jack etc. from detail drawings, sketches and actual machine components

5 PRODUCTION DRAWING

Introduction to limits, fits, dimensional tolerance, surface roughness and their drawing representation. Geometric dimensioning and tolerancing: basic terminology, indication of geometric tolerance in drawing

PART B: COMPUTER AIDED DRAFTING

1 DRAWING OBJECTS

Starting with AutoCAD, AutoCAD dialog boxes, co-ordinate Systems, drawing line, circle, arc, rectangle, ellipse, polygons

2 EDITING SKETCHED OBJECTS

Editing sketches, moving, copying, pasting, offsetting, scaling, chamfering, trimming, mirroring, filleting, sketched objects

3 DIMENSIONING

Giving dimensions and annotations to drawings, creating linear, rotated, angular, aligned, base line dimensions, modifying dimensions, showing surface roughness symbols, weld symbols, dimensional tolerances, geometric tolerances

4 PLOTTING

Plotting the drawings in AutoCAD, plotting drawing using the plot dialog box, adding plotters and using plot styles, plotting sheets

5 DRAWING EXERCISES WITH AUTOCAD

Orthographic drawing and Isometric drawing of objects, drawing of machine parts, detail and assembly drawing of machines

6 3D MODELING

Creating a 3D model of any object using AutoCAD, generating drawings from the 3D model.

TEXT / REFERENCE BOOK

1. Machine Drawing, K. L. Narayana, P. Kannaiah, K. Venkata Reddy, 3rd edition, New age international (P) Ltd.
2. Machine Drawing, Basudeb Bhattacharyya, Oxford University Press
3. Machine Drawing, N. D. Junnarkar, Pearson Education Pvt. Ltd
4. Machine Drawing - P.S. Gill, S.K. Kataria & Sons New Delhi.
5. Machine Drawing - N. Sidheshwar, P. Kannaiah. McGraw-Hill India.
6. Engineering Drawing Practice for Schools and Colleges SP 46: 2003- BIS (Bureau of Indian Standards).
7. AutoCAD 2017 for Engineers & Designers- Prof. Sham Tickoo. Dreamtech Press.
8. Design of Machine Elements - V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd.
9. A text book of Machine Design - P. C. Sharma, D. K. Aggarwal, S. K. Kataria & Sons.
10. PSG Design data book.

B. TECH. SEMESTER – IV

SUBJECT: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Teaching Scheme (Hours/week)					Examination Scheme				
Lect	Tut	Prac	Total	Credits	Ext	Sess.	TW	Prac	Total
1	0	2	3	2	0	0	100*	0	100

No Reference Code

*TW marks include Viva based on TW

DETAILED SYLLABUS:

1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Meaning and definition of artificial intelligence, Physical Symbol System Hypothesis, production systems, Characteristics of production systems; Breadth first search and depth first search techniques. Heuristic search Techniques: Hill Climbing, Iterative deepening DFS, bidirectional search.

2 KNOWLEDGE REPRESENTATION

Knowledge Representation, Problems in representing knowledge, knowledge representation using propositional and predicate logic, logical consequences, syntax and semantics of an expression. Forward and backward reasoning. Proof methods, substitution and unification, conversion to clausal form, normal forms, resolution, refutation, deduction.

3 NATURAL LANGUAGE PROCESSING & VISUAL PERCEPTION

Language & its comprehension, reading, understanding conversation and essays. Language context, language in a social context, Introduction to problem solving, decision making and reasoning, Visual perception from sensation to representation, approaches to perception, perception of object sand forms, role of environment in seeing, deficits in perception, and perception in practice. Automatic and controlled processes in attention.

4 INTRODUCTION TO MACHINE LEARNING

Preliminaries, what is machine learning; varieties of machine learning, learning input/output functions, sample application. Boolean functions and their classes, CNF, DNF, decision lists. Version spaces for learning, version graphs, learning search of a version space, candidate elimination methods

TEXT / REFERENCE BOOK

1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-GrawHill
2. Introduction to AI & Expert System: Dan W.Patterson, PHI
3. Introduction to Machine learning, Nils J.Nilsson
4. Introduction to Machine Learning with Python A guide for data scientists, Andreas, C. Muller & Sarah Guido, O'Reilly
5. Artificial Intelligence by Luger (Pearson Education)
6. Machine learning for dummies, IBM Limited ed, by Judith Hurwitz and Daniel Kirsch
7. Russel & Norvig, Artificial Intelligence: A Modern Approach, Pearson Education.

B. TECH. SEMESTER – IV
SUBJECT: UNIVERSAL HUMAN VALUES

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

Reference Code HSMC-02

DETAILED SYLLABUS:

1 COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION

Purpose and motivation for the course, recapitulation from Universal Human Values-I, self-Exploration-what is it?-Its content and process; 'Natural Acceptance' and experiential validation-as the process for self-exploration, continuous happiness and prosperity-A look at basic human aspirations, right understanding, relationship and physical facility-the basic requirements for fulfillment of aspirations of every human being with their correct priority, understanding happiness and prosperity correctly-a critical appraisal of the current scenario, method to fulfill the above human aspirations: understanding and living in harmony at various levels

2 UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', understanding the needs of Self ('I') and 'Body'- happiness and physical facility, understanding the body as an instrument of 'I' (I being the doer, seer and enjoyer), understanding the characteristics and activities of 'I' and harmony in 'I', understanding the harmony of I with the body: sanyam and health; correct appraisal of physical needs, meaning of prosperity in detail, programs to ensure sanyam and health

3 UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN- HUMAN RELATIONSHIP

Understanding values in human-human relationship; meaning of justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; trust and respect as the foundational values of relationship, understanding the meaning of trust; difference between intention and competence, understanding the meaning of respect, difference between respect and differentiation; the other salient values in relationship, understanding the harmony in the society (society being an extension of family): resolution, prosperity, fearlessness (trust) and co-existence as comprehensive human goals, visualizing a universal harmonious order in society- undivided society, universal order- from family to world family

4 UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

Understanding the harmony in the nature, interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in

nature, understanding existence as co-existence of mutually interacting units in all pervasive space, holistic perception of harmony at all levels of existence, include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

5 IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

Natural acceptance of human values, definitiveness of ethical human conduct, basis for humanistic education, humanistic constitution and humanistic universal order, competence in professional ethics: a. ability to utilize the professional competence for augmenting universal human order b. ability to identify the scope and characteristics of people friendly and eco-friendly production systems c. ability to identify and develop appropriate technologies and management patterns for above production systems, case studies of typical holistic technologies, management models and production systems, strategy for transition from the present state to universal human order: a. at the level of individual: as socially and ecologically responsible engineers, technologists and managers b. at the level of society: as mutually enriching institutions and organizations

TEXT / REFERENCE BOOK

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan
3. Human Values, A.N. Tripathi, New Age Intl. Publishers

DHARMSINH DESAI UNIVERSITY, NADIAD
FACULTY OF TECHNOLOGY

COURSE STRUCTURE REVISION FOR B. TECH. PROGRAM

1. NEED FOR REVISION OF COURSE STRUCTURE FOR B. TECH. PROGRAM

- a. AICTE has directed to revise in curriculum for the B. Tech. Program. It has provided detailed guidelines in the form Model Curriculum for all branches.
- b. Current CBCS course structure at FoT-DDU has been adopted based on previous AICTE/UGC guidelines. It has 220 credits and 32-34 hours per week of contact hours. However, it was felt that CBCS format allowed less room to students for peripheral developmental activities.
- c. FoT-DDU dropped the exercise of revision of curriculum undertaken in May-2020 because of New Education Policy (NEP) introduced by Government of India.
- d. Time line for NEP is not defined. Therefore, a revised course structure is proposed to remain update in present context This will also help to incorporate the advantages of AICTE guidelines judiciously to fulfill the Vision and Mission set by DDU.

2. GUIDELINES FOR REVISION PROCESS:

Desciption	CBSE-FoT-DDU	AICTE Guideline	Adopted Guidelines
Total Credit	215-220	160	180-185
Contact Hrs/Week	32-34	24-28	26-30
First Year Course Structure	Uniform All Branches	Branch Specific	Two Groups ICT and Non-ICT
Basic Sc. And Humanities	To be updated keeping Infra structure and HR in view.		

- a. Credit allocation as per AICTE guidelines. Lecture and Tutorials 1 credit per hour and practical 0.50 credit per Hr.
- b. There is no practical exam for subjects of first year. Instead, it shall be considered as Term-work including Viva (Total 50 marks).
- c. Internal exams are considered for subjects with credit ≥ 4 .
- d. External Assessment shall be considered for Semester 5 onwards.
- e. It is proposed to develop and organize computing and networking facility to conduct online exams for internal and/or one section of external examination.

3. METHODOLOGY

A course structure revision committee is formed with following members for Initial development of B. Tech. First Year course structure grouped for ICT and Non-ICT branches.

Coordinator:

Prof. K. N. Sheth - Dean, FoT

Members:

CE: Dr. C. K. Bhensdadia, Dr. B. S. Bhatt

CH: Dr. M. S. Rao, and Prof. M. P. Shah

CL: Dr. R. K. Sheth, Prof.(Ms) A. D. Parekh

EC: Dr. P. D. Dalal, Dr. V. M. Thummar

IC: Dr. V. A. Shah, Prof. H. R. Patel, Prof. T. J. Patel

IT: Dr. V. K. Dabhi, Dr. H. B. Prajapati

MH: Dr. G. D. Bassan, Prof. R. M. Joshi

Departments shall evolve proposed overall course structure of the program while defining course structure for first year.




4. CONCLUSION AND RECOMMENDATIONS

A concluding meeting was held at the office of the Dean, FoT on date 19-02-2021. Based on the accepted guidelines, the committee has unanimously arrived at the course structure for first year B. Tech. ICT (CE, EC and IT) programs as well as B. Tech. Non-ICT (CH, CL, IC and MH) programs, the same is attached as appendix.

Based on this, Departments shall develop overall course structure through their Boards of Studies and submit to the Academic Council for approval.

B. Tech. (CE) program has already introduced a new course structure from 2020-21. The same has been adopted for ICT programs. The syllabus part for some subjects in B. Tech. Sem II is to some extent altered to fit common needs. It shall also be implemented w. e. from even semester 2020-21 in anticipation, having approval from the Vice Chancellor.

All other B. Tech. Program to implement the new course structure w. e. from year 2021-22.


(Prof. K. N. Sheth)
Dean, FoT

Submitted to:
The Vice Chancellor for approval

approved
[Signature]
20/2/21

ICT: final Course str
B.Tech. first
year.

Dharmsinh Desai University, Nadiad
Faculty of Technology,

Course Structure for B. Tech. Sem I & II (for ICT Programs)

Sem	Course Title	Subject Category	AICTE Code (Ref)	Parent Dept.	Teaching Scheme				Credit	Examination Scheme			
					Th	Tut	Prac	Total		Th Ext	Th Int	TW+Viv	Total
I	Mathematics I	BSC	BSC102	Maths	3	1	0	4	4.0	60	40	-	100
	Basic Electrical Engineering	ESC	ESC101	EC	3	1	2	6	5.0	60	40	50	150
	Programming for Problem Solving I	ESC	ESC201	Dept.	4	0	3	7	5.5	60	40	50	150
	Engineering Graphics & Design	ESC	ESC102	MECH	1	0	4	5	3.0	-	-	100	100
	Software Workshop	ESC	ESC202	Dept.	0	0	2	2	1.0	-	-	50	50
					11	2	11	24	18.5	180	120	250	550
II	Mathematics II	BSC	BSC301	Maths	3	1	0	4	4.0	60	40	-	100
	Programming for Problem Solving II	ESC	ESC201	Dept	4	0	3	7	5.5	60	40	50	150
	Physics	BSC	BSC101	Dept	3	1	2	6	5.0	60	40	50	150
	Hardware Workshop	ESC	ESC202	Dept	0	0	4	4	2.0	-	-	100	100
	English	HMSS	HSMC201	English	2	0	2	4	3.0	40	-	50	90
	Environmental Studies	ndatory Cou	MC-II	Chem	2	0	0	2	0.0	40	-	-	40
					14	2	11	27	19.5	260	120	250	630

EXTERNAL EXAM MARKS/DURATION :

THEORY 3 HRS OR MORE 60 MARKS WITH 3 HRS DURATION


THEORY 2 HRS 40 MARKS WITH 2 HRS DURATION

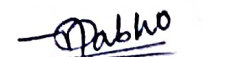
THEORY 1 HR : No Theory Exam

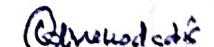
BSC : Basic Science

ESC : Engineering Science

HMSS : Humanity and Social Science


(P. D. Datta)
EC


19/12/2021
IT Dept.


19/12/21


19/12/21

Final Course Struct - Non-ICT
B.Tech First Year

Dharmsinh Desai University, Nadiad
Faculty of Technology,

Course Structure for B. Tech. Sem I & II (Non-ICT Programs)

Sem.	Course Title	Subject Category	AICTE Code	Parent Dept.	Teaching Scheme					Examination Scheme			
					Th	Tut	Prac	Total	Credits	Th Ext	Th Int	TW+Viva	Total
I	Mathematics -I	Basic Sc.- Core	BSC103	Maths	3	1	0	4	4.0	60	40	0	100
	Thermodynamics	Engg Sc. - Core	ESC209	Mech	3	0	2	5	4.0	60	40	50	150
	Elements of Electrical Engg.	Basic Sc.- Core	ESC101	EC	3	0	2	5	4.0	60	40	50	150
	Mechanics	Basic Sc.- Core	BSC101	Civil	3	1	0	4	4.0	60	40	0	100
	Computer Programming	Engg Sc. - Core	ESC103	Dept.	2	0	3	5	3.5	40	0	50	90
	Environmental Studies	Mandatory Course	MC-II	Chem	2	0	0	2	0.0	40	0	0	40
	Workshop Practice - I	Engg Sc. - Core	ESC104a	Mech	0	0	2	2	1.0	0	0	50	50
					16	2	9	27	20.5	320	160	200	680
II	Mathematics-II	Basic Sc.- Core	BSC104	Maths	3	1	0	4	4.0	60	40	0	100
	Engineering Graphics	Engg Sc. - Core	ESC102	Mech	3	0	3	6	4.5	60	40	50	150
	Basic Electronics	Engg Sc. - Core	ESC201	EC	3	0	2	5	4.0	60	40	50	150
	Mechanics of Solids	Engg Sc. - Core		Civil	3	0	2	5	4.0	60	40	50	150
	Chemistry	Basic Sc.- Core	BSC102	Chem	3	0	0	3	3.0	60	0	0	60
	Workshop Practice - II	Engg Sc. - Core	ESC104b	Mech	0	0	3	3	1.5	0	0	50	50
					15	1	10	26	21	300	160	200	660

EXTERNAL EXAM MARKS/DURATION :

THEORY 3 HRS OR MORE 60 MARKS WITH 3 HRS DURATION

THEORY 2 HRS 40 MARKS WITH 2 HRS DURATION

THEORY 1 HR : No Theory Exam

19/12/2021

19/12/2021

19/12/2021

19/12/21

Date: 09 / 04 / 2022

A Board of Studies meeting was held (offline as well as online mode) in Mechanical Board room on 09-04-2022 with the following important agenda.

1. To approve Vision and Mission statements of the department, Program Educational Objective (PEO) and Program Specific Outcome (PSO) for B.Tech. Mechanical Engineering Program.
2. To approve the Course Outcomes for all the subjects as per the Accreditation requirements.
3. To approve revision in course structure for B.Tech.(Mechanical) Program by incorporating recommendations of Dean, FoT & Team Academics.
4. To approve the Syllabus of the subjects for Semester III and IV.
5. To approve the list of Professional Elective Courses and Open Elective Courses.

(1) Prof. (Dr.) G. D. Bassan	Chairman & Head, Mechanical Engineering	-OFFLINE
(2) Prof. R. M. Joshi	Associate Professor, Mechanical Engg. Dept.	-OFFLINE
(3) Prof. P. V. Dixit	Assistant Professor, Mechanical Engg. Dept.	-OFFLINE
(4) Dr. N. S. Patel	Assistant Professor, Mechanical Engg. Dept.	-OFFLINE
(5) Dr. D. P. Vakharia	Professor, Mechanical Engg. Dept., SVNIT, Surat	-
ONLINE		
(6) Dr. P. M. George	Professor & Head, Mechanical Engg., BVM, VV Nagar	-OFFLINE
(7) Dr. R. N. Patel	Director (I/C), Institute of Tech. Nirma University	-OFFLINE
(8) Mr. Sitanshu Bhatt	Director, Linde Ltd, Vadodara	-OFFLINE
(9) Mr. H. K. Khatwani	Sr. GM. Bluestar Ltd, Mumbai/Ahmedabad	-ONLINE

Following discussions and resolutions were made in view of the agenda items.

Agenda Item 1

The Mission, Vision, Program Educational Objective (PEO) and Program Specific Outcome (PSO) for B.Tech. Mechanical Engineering program are prepared during pre-BoS meet at the department. The online feedback of distinguished stake holders on the same is obtained and suggestions obtained are duly incorporated in the statements (**Annexure A**).

Resolution:

The statements are confirmed by all Board of Studies members.

Agenda Item 2

Considering the requirements of various accreditation agencies, the Course Outcomes for each subjects being taught to the B.Tech. (Mechanical) students are reviewed based on the discussion during pre-BoS meet at the department. Dr. G. D. Bassan, Head of the department presented the activities initiated by the department for ensuring attainment of Course Outcomes using the present Teaching-Learning & Evaluation practices adopted by the department.

Resolution:

The proposed Course Outcomes based on current teaching – learning – evaluation methods are accepted for inclusion.

Agenda Item 3

After incorporating recommendations of Dean, FoT & Team Academics, the course structure for B.Tech.(Mechanical) Program with effect from Admission Year 2021-2022 is presented. The following revisions in the existing structure were suggested and discussed.

- Discussion regarding the course structure of B.Tech. Semester III to VIII as per AICTE structure which is to be implemented w.e.f. 2022-23 (**Annexure B**).
- Credit of all the semesters would be approximately same and so Industrial Management and Economics is shifted from semester IV to V.
- For fast learners, a separate provision can be made for credit transfer of semester VIII subjects by successfully completing equivalent NPTEL courses during B.Tech. program. Also, for fast learners, duration of industrial training may be extended for whole semester in lieu of subjects.
- For uniform distribution of marks, credits and contact hours, seminar would be shifted from semester VI to VII and project would be shifted from semester VII to VIII.
- To inculcate latest technology, IOT and industry 4.0 subject shall be introduced in semester IV with structure 1-0-2.
- As per industry requirement, soft skill development courses should be implemented during entire B.Tech. program.
- Application part should be introduced in program specific subjects.
- Separate project laboratory should be developed in the department where students can work round the clock.

- Subject evaluation method should reflect and cover all CO's to comply with accreditation requirements. Accordingly, required modification may be done in existing evaluation pattern.

Resolution

It is resolved that all such modifications as suggested by the members shall be incorporated and the final course structure shall be sent to the Academic Council & Governing Body of the University for approval.

Agenda Item 4

The detailed Syllabus of the 2nd Year subjects for B.Tech. (Mechanical) program was presented. The discussion on the technical content was held in view of Course Objectives, Course Outcomes and the Number of teaching hours (**Annexure C**).

Resolution

Detailed discussion was done on all second year subject. The members given their valuable inputs for the addition of some important topics in various subjects. All members agreed and resolved to send it to the Academic Council & Governing Body of the University for approval.

Agenda Item 5

Detailed list of Professional Elective Courses and Open Elective Courses was presented. Discussion was made for the addition / alteration in the list based on current industry need.

Resolution

List of Professional Elective Courses and Open Elective Courses were included. Members were of the opinion for having more clarification is implementation of Open elective (inclusion / exclusion of own branch students).

The meeting ended with vote of thanks to the chair.

Enclosures;

Annexure A : Vision, Mission, PEOs, POs & PSOs statements

Annexure B : Teaching Scheme w.e.f. from AY 2022-2023

Annexure C : Detailed syllabus with revisions as above.

TEACHING SCHEME FOR THE COURSE
B. TECH., MECHANICAL ENGINEERING
 (Admission Year_2021)

SEMESTER I

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	MATHEMATICS -I	3	1	0	60	40	0	0	100	4.0
2	THERMODYNAMICS	3	0	2	60	40	50	0	150	4.0
3	BASIC ELECTRICAL ENGG.	3	0	2	60	40	50	0	150	4.0
4	MECHANICS	3	0	2	60	40	0	0	100	4.0
5	COMPUTER PROGRAMMING	2	0	3	40	0	0	50	90	3.5
6	ENVIRONMENTAL STUDIES	2	0	0	40	0	0	0	40	0.0
7	WORKSHOP PRACTICE - I	0	0	2	0	0	50	0	50	1.0
									680	20.5

SEMESTER II

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	MATHEMATICS-II	3	1	0	60	40	0	0	100	4.0
2	ENGINEERING GRAPHICS	3	0	3	60	40	50	0	150	4.5
3	BASIC ELECTRONICS	3	0	2	60	40	50	0	150	4.0
4	MECHANICS OF SOLIDS	3	0	2	60	40	50	0	150	4.0
5	CHEMISTRY	3	0	0	60	0	0	0	60	3.0
6	WORKSHOP PRACTICE - II	0	0	3	0	0	0	50	50	1.5
									660	21

SEMESTER III

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	NUMERICAL TECHNIQUES	3	0	2	60	40	25	25	150	4.0
2	ELECTRICAL MACHINES AND DRIVES	3	0	2	60	40	25	25	150	4.0
3	FLUID MECHANICS	3	0	2	60	40	25	25	150	4.0
4	MATERIAL SCIENCE AND METALLURGY	3	0	2	60	40	25	25	150	4.0
5	KINEMATICS OF MACHINES	3	1	2	60	40	25	25	150	5.0
6	ENGLISH	2	0	2	40	0	0	50	90	3.0
									840	24.0

SEMESTER IV

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	APPLIED THERMODYNAMICS	3	0	2	60	40	25	25	150	4.0
2	ADVANCE SOLID MECHANICS	3	0	2	60	40	25	25	150	4.0
3	MANUFACTURING TECHNOLOGY - I	3	0	4	60	40	25	25	150	5.0
4	DYNAMICS OF MACHINES	3	1	2	60	40	25	25	150	5.0
5	MACHINE DRAWING & INDUSTRIAL DRAFTING	0	0	4	0	0	25	25	50	2.0
6	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	1	0	2	0	0	0	100	100	2.0
7	UNIVERSAL HUMAN VALUES	3	0	0	60	0	0	0	60	3.0
									810	25.0

SEMESTER V

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	MEASUREMENT AND METROLOGY	3	0	2	60	40	25	25	150	4.0
2	HEAT AND MASS TRANSFER	3	0	2	60	40	25	25	150	4.0
3	MANUFACTURING TECHNOLOGY - II	3	0	4	60	40	25	25	150	5.0
4	MACHINE DESIGN - I	3	1	2	60	40	25	25	150	5.0
5	OPEN ELECTIVE - I	3	0	0	60	0	0	0	60	3.0
6	INDUSTRIAL MANAGEMENT & ECONOMICS	2	0	2	40	0	0	50	90	3.0
7	MENDATORY COURSE - 2 (CONSTITUTION OF INDIA OR ESSENCE OF INDIAN KNOWLEDGE TRADITION)	2	0	0	40	0	0	0	40	2.0
									790	26.0

SEMESTER VI

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	MACHINE DESIGN - II	3	1	2	60	40	25	25	150	5.0
2	FLUID MACHINES	3	0	2	60	40	25	25	150	4.0
3	COMPUTER AIDED DESIGN & MANUFACTURING	3	0	2	60	40	25	25	150	4.0
4	PROFESSIONAL ELECTIVE - I	3	0	2	60	40	25	25	150	4.0
5	PROFESSIONAL ELECTIVE - II	3	0	2	60	40	25	25	150	4.0
6	OPEN ELECTIVE - II	3	0	0	60	0	0	0	60	3.0
									810	21

SEMESTER VII

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	FINITE ELEMENT ANALYSIS	3	0	2	40	0	0	50	90	4.0
2	PROFESSIONAL ELECTIVE - III	3	0	2	60	40	25	25	150	4.0
3	PROFESSIONAL ELECTIVE - IV	3	0	2	60	40	25	25	150	4.0
4	OPEN ELECTIVE - III	3	0	0	60	0	0	0	60	3.0
5	OPERATION RESEARCH	3	0	2	60	40	25	25	150	4.0
6	EFFECTIVE TECHNICAL COMMUNICATION	3	0	0	60	0	0	0	60	3.0
7	SEMINAR	0	0	2	0	0	0	100	100	1.0
									760	23.0

SEMESTER VIII

	Subject Title	Teaching Scheme & Credit			Examination Scheme					
		Lect	Tut	Prac	TH	Sess	Prac	TW	Total	Credit
1	PROFESSIONAL ELECTIVE - V	2	0	3	40	0	25	25	90	3.5
2	PROFESSIONAL ELECTIVE - VI	2	0	3	40	0	25	25	90	3.5
3	PROFESSIONAL ELECTIVE - VII	2	0	3	40	0	25	25	90	3.5
4	PROJECT	0	0	4	0	0	0	100	100	2.0
5	INDUSTRIAL TRAINING (8 Weeks)	0	3	12	0	0	150	100	250	9.0
									620	21.5