



Sanjivani Rural Education Society'

Sanjivani College of Pharmaceutical Education and Research,

Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule University Pune)

(Approved by AICTE, PCI New Delhi)

NBA and NAAC 'A' Accredited, CII Platinum & NIRF Rank

Detailed Syllabus structure and Syllabus for the Second Year B. Pharm

(w.e.f. 2023-24)

Choice Based Credit System (CBCS)

SEMESTER III

SUBJECT: BP301T. PHARMACEUTICAL ORGANIC CHEMISTRY-II (THEORY 45 HOURS)

Teaching Scheme

Lectures: 03Hr/Week

Practical:

Tutorials: 01Hr/Week

Credits: 4

Examination Scheme:

In SEM Exam:25 Marks

End SEM Exam:75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

Scope

This course 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

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds,
4. prepare organic compounds

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	The students should be able to understand the details about Benzene and its derivatives	1	Remember
CO 2	The students should be able to acquire the knowledge of Phenols, aromatic amines and aromatic acids	2	Understand
CO 3	The students should be able to acquire the knowledge and understanding of the concept of Fats and oils	3	Apply
CO 4	The students should be able to acquire knowledge of Analytical constants used for the analysis of Fats and oils	3	Apply
CO 5	The students should be able to understand the class of Polynuclear Hydrocarbons	3	Apply
CO 6	The students should be able to understand the detailed about cycloalkanes	3	Apply

Mapping of Course Outcomes to Program Outcomes:

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

COURSE CONTENTS

Unit	Details	Hours	End Sem (% weightage)
1	<p>Benzene and its derivatives</p> <p>A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule</p> <p>B. Reactions of benzene - nitration, sulphonation, halogenation reactivity, Friedel crafts alkylation- reactivity, limitations, Friedel crafts acylation.</p> <p>C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction</p> <p>D. Structure and uses of DDT, Saccharin, BHC and Chloramine</p> <p>D. Introduction to Pericyclic reactions</p>	10	22.22
2	<p>Phenols - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols</p> <p>□ Aromatic Amines - Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts</p> <p>□ Aromatic Acids –Acidity, effect of substituents on acidity and important reactions of benzoic</p> <p>An Insight on Alpha Carbon Chemistry of Amines and Acids</p>	10	22.22
3	<p>Fats, Oils and Lipids (Structure of Biologically Important Lipids)</p> <p>a. Fatty acids – reactions.</p> <p>b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils</p> <p>c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.</p>	10	22.22
4	<p>Polynuclear hydrocarbons:</p> <p>a. Synthesis, reactions Naphthalene, Phenanthrene, Anthracene</p>	8	17.78

	b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives		
5	Cyclo alkanes Naming Simple Monocyclic Bicyclic and Multicyclic Compounds 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	15.56
	TOTAL	45	

Foreign University Syllabus referred

- a. New York University
- b. Uppsala University
- c. Loyola University, Chicago
- d. Capilano University

References

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar , Volume-I

SUBJECT: BP302T. PHYSICAL PHARMACEUTICS-I (THEORY 45 HOURS)

Teaching Scheme	Examination Scheme:
Lectures: 03Hr/Week	In SEM Exam:25 Marks
Practical:	End SEM Exam:75 Marks
Tutorials: 01Hr/Week	Continuous Assessment: 10 Marks
Credits: 4	Total Marks: 100 Marks

Scope

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

Course Objectives:

Upon completion of the course a student shall be able to understand:

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To explain the solubility behavior of drugs and the laws explaining them	2	Explain ideas or concept
CO 2	To explain the physical states of matter/molecules and determination of their properties.	2	Explain ideas or concept
CO 3	To describe the importance of surface and interfacial phenomenon in the pharmaceutical formulations.	3	Apply
CO 4	To explain the process of complexation and protein binding	1	Recall facts & basic concept
CO 5	To describe the role of buffers in pharmaceutical and biological systems.	2	Explain ideas or concept
CO 6	To understand the basic concepts involved in Co-solubility	3	Apply

Mapping of Course Outcomes to Program Outcomes:

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

COURSE CONTENTS**RED –Least importance****Green –New Addition**

Sr no	UNIT	Hours
1.	Solubility of drugs:	10
	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, Ficks laws of diffusion . Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions), Distillation of binary solutions , Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications, Solubility enhancement techniques . Distribution law, its limitations and applications. Brief introduction of BCS classification.	
2.	States of Matter and properties of matter: Binding Forces Between Molecules, State of matter- solid, liquid, gas and plasma , changes in the state of matter, latent heats, vapour pressure, Clapeyron-Clausius equation , sublimation critical point, eutectic mixtures, gases, aerosols– inhalers, relative humidity, liquid complexes, liquid	10

	crystals, glassy states, supercritical fluids , solid- crystalline, amorphous & polymorphism, Gibbs phase rule . Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications	
3.	Surface and interfacial phenomenon:	08
	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. Co-solubility Examples of pharmaceutically acceptable surfactants, applicability and categorization.	
4.	pH, buffers and Isotonic solutions:	07
	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. Buffers in dissolution testing and similarity with body fluids.	
5.	Complexation and protein binding:	08
	Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Determination of drug binding to proteins , Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.	

Reference Books (Latest Editions to be adopted):

<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Martin A, Swarbrick. J, Cammarata A, Physical Pharmacy: Physical Chemical Principles in the Pharmaceutical Sciences, 3rd edition, BI Waverly. Pvt. Ltd, New Delhi, 1993. 2. Sinko PJ, Singh Y. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences, 6 th edition, Walter Kluer, Philadelphia, 2011 3. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, 6th edition, CBS Publications, New Delhi, 2005 4. Cooper and Gun pharmaceuticals. 5. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms—tablets, Vol.1,2,3/edited by Herbert A. Lieberman, Leon Lachman, Joseph B. Schwartz, 2nd edition, Marcel Dekker Inc., Newyork,1990. 6. C.V.S. Subramanyam, J. Thimma settee, Laboratory Manual of Physical Pharmaceutics, 2nd edition, Vallabh Prakashan, Delhi, 2014.
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7. C.V.S. Subrahmanyam, Textbook of Physical Pharmaceutics, 3rd edition, Vallabh Prakashan, Delhi, 2015
8. C.V.S. Subrahmanyam, Essentials of Physical Pharmaceutics, 2 nd edition, Vallabh Prakashan, Delhi, 2017
9. Bahl A, Bahl B. S, Tuli G. D, Essentials of Physical Chemistry, 28th edition, S Chand Publications, New Delhi, 2000.
10. Physical Pharmaceutics Shotton, E, London oxford university press.
11. **Solid State Properties of Pharmaceutical Materials- Author(s): Stephen R Byrn, George Zografi, Xiaoming (Sean) Chen**

**SUBJECT: BP 303 T. PHARMACEUTICAL MICROBIOLOGY
(THEORY 45 HOURS)**

Teaching Scheme	Examination Scheme:
Lectures: 03Hr/Week	In SEM Exam:25 Marks
Practical:	End SEM Exam:75 Marks
Tutorials: 01Hr/Week	Continuous Assessment: 10 Marks
Credits: 4	Total Marks: 100 Marks

Scope: The course aims to provide students with a foundational understanding of microorganisms, sterility, and the industrial applications of pharmaceutical microbiology.

Course Objectives: Upon completion of the subject student shall be able to

1. Understand methods of identification, cultivation and preservation of various Microorganisms
2. To understand the importance and implementation of sterilization in pharmaceutical processing and industry
3. Learn sterility testing of pharmaceutical products.
4. Carried out microbiological standardization of Pharmaceuticals.
5. Understand the cell culture technology and its applications in pharmaceutical industries.
6. Understand the importance of Pharmaceutical Microbiology in Pharmaceutical Industries.

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To, Understand the morphology, biochemical nature and growth pattern of Prokaryotic and Eukaryotic cells.	2	Explain ideas or concept
CO 2	To, understand the principle of microscopy and staining.	3	Explain ideas or concept
CO 3	To, understand the importance of control of microorganisms.	3	Apply
CO 4	To, understand the principle and techniques associated with isolation of microorganisms.	3	Recall facts and basic concept
CO 5	To, understand the design and importance of aseptic techniques in pharmaceutical microbiology.	2	Explain ideas or concept

CO 6	To, understand the principle associated pharmaceutical microbiology in association with industries.	3	Apply
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Mapping of Course Outcomes to Program Outcomes:

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

Course content:

Sr. No	UNIT	Hours
1	Introduction, history of microbiology, its branches, scope and its importance. Introduction to Prokaryotes and Eukaryotes Study of ultra-structure 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 phases contrast microscopy, dark field microscopy and electron microscopy. Definition and examples of Probiotics and Prebiotics	10
2	Identification of bacteria using staining techniques (simple, Gram's & Acid-fast staining) and biochemical tests (IMViC). Definition of D value & Z value and its significance. 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
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
4	Designing of aseptic area, laminar flow equipment's; 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
5	Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage. Preservation of pharmaceutical	07

	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.	
6	Pharmaceutical Microbiology in Industrial Applications Introduction to industrial microbiology in the pharmaceutical industry, Good Manufacturing Practices (GMP) in pharmaceutical microbiology, Microbial contamination control in manufacturing processes, Validation of microbiological methods, Microbial quality assurance in pharmaceutical products	05

Recommended Books

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell
2. Scientific publications, Oxford London.
3. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers&Distributors, Delhi.
4. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
5. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
6. Rose: Industrial Microbiology.
7. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
8. Pharmaceutical Microbiology: Essentials for Quality Assurance and Quality Control" by Tim Sandle
9. Microbiological Quality Assurance in Pharmaceuticals, Cosmetics, and Toiletries" by R. Baird
10. Microbial Limit and Bioburden Tests: Validation Approaches and Global Requirements" by Lucia Clontz
11. Sterility, Sterilisation and Sterility Assurance for Pharmaceuticals: Technology, Validation and Current Regulations edited by Tim Sandle
12. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control from Manufacturer to Consumer" by Sidney H. Willig and James R. Stoker

SUBJECT: BP304T PHARMACEUTICAL ENGINEERING (THEORY 45 HOURS)

Teaching Scheme

Lectures: 04Hr/Week
Practical:
Tutorials: 00Hr/Week
Credits: 4

Examination Scheme:

In SEM Exam:25 Marks
End SEM Exam:75 Marks
Continuous Assessment: 10 Marks
Total Marks: 100 Marks

Scope

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

Course Objectives:**Upon completion of the course a student shall be able to understand:**

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

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To understand mechanism of fluid flow and heat transfer and its applications	2	Explain ideas or concept
CO 2	To understand basic principles involved in various unit operation.	2	Explain ideas or concept
CO 3	To understand significance of material handling system for optimum use of resources.	3	Apply
CO 4	To appreciate the various preventive methods used for corrosion control in pharmaceutical industry	1	Recall facts & basic concept
CO 5	To understand material plant construction for better operation.	2	Explain ideas or concept
CO 6	To perform various unit operations involved in pharmaceutical manufacturing process.	3	Apply

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	3	4	5	6	7	8	9	10	11
CO2	3	2	3	1	-	1	1	-	2	2	1
CO3	3	2	3	3	-	-	-	-	2	-	1
CO4	3	2	3	3	-	3	1	-	2	2	1
CO5	3	2	3	2	-	1	1	-	2	2	1
CO6	3	2	3	2	-	1	1	-	2	2	1

COURSE CONTENTS**RED –Least importance****Green –New Addition**

Unit	Details	Hours
1	<ul style="list-style-type: none"> 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. 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. 	09

	<ul style="list-style-type: none"> • 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. 	
2	<ul style="list-style-type: none"> • Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers. • 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. • Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation 	09
3	<ul style="list-style-type: none"> • Drying: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer. • 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 	09
4	<ul style="list-style-type: none"> • 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 	08
5	<ul style="list-style-type: none"> • 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 nonmetals, basic of material handling systems. 	03

6	<ul style="list-style-type: none"> Hazards and safety in the Pharmaceutical Industry: Introduction, Hazardous Area Classification in Pharmaceutical Industry, chemical hazards including flammability, toxicity, chemical reactivity and environmental impact. Tools and techniques for identifying hazards and reducing risk. 	07
	TOTAL	45

Reference Books (Latest Editions to be adopted):

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson- Latest edition.
3. Unit operation of chemical engineering – McCabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy- Martin, Latest edition.
6. Theory and practice of industrial pharmacy by Lachmann., Latest edition.
7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.
9. A.R. Paradkar, Introduction To Pharmaceutical Engg. 6th edition, Nirali Prakashan, 2004
10. Ayman D. Allian, Nisha P. Shah, Antonio C. Ferretti, Derek B. Brown, Stanley P. Kolis, and Jeffrey B. Sperry. Process Safety in the Pharmaceutical Industry—Part I: Thermal and Reaction Hazard Evaluation Processes and Techniques Organic Process Research & Development 2020 24 (11), 2529-2548 DOI: 10.1021/acs.oprd.0c00226
11. V Vipin Dev, Dr Raja K, PL Rupesh, D Surya Prakash. Hazardous Area Classification In A Pharmaceutical Industry To Identify Major Hazards. International Journal of Advanced Research and Publications. Volume 5 Issue 2, February 2022, 1-3.
12. Meenu Chaudhary and Priya. Hazard analysis and critical control points as a quality risk management tool in the pharmaceutical industry: A systematic review. Journal of Drug Delivery & Therapeutics. 2021; 11(5-S):167-175

BP305P: PHARMACEUTICAL ORGANIC CHEMISTRY-II (PRACTICAL)

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
	After completion of the course the students should be able to understand		
CO 1	The basic laboratory techniques like Recrystallization, Steam distillation	1	Remember
CO 2	The determination of Physical constants of Fats, Oils and Lipids	2	Understand
CO 3	The Principle, reaction, Mechanism involved in the synthesis of Benzanilide and Acetanilide	3	Apply
CO 4	The Principle, reaction, Mechanism involved in the synthesis of 2, 4, 6-TribromoAniline and P-bromoacetanilide	3	Apply
CO 5	The Principle, reaction, Mechanism involved in the synthesis of Benzil and Dibenzal Acetone	3	Apply
CO 6	The computational chemistry software's for the determination of QSAR parameters.	3	Apply

Mapping of Course Outcomes to Program Outcomes:

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

Sr. no.	Topic	Hrs/ Week	End sem (% weightage)
1.	Experiments involving laboratory techniques Recrystallization	4	6.66
2.	Experiments involving laboratory techniques Steam Distillation	4	6.66
3.	Determination of Acid Value	4	6.66
4.	Determination of Saponification Value	4	6.66
5.	Determination of iodine Value	4	6.66
6.	To synthesize and submit Acetanilide	4	6.66
7.	To synthesize and submit Benzanilide	4	6.66
8.	To synthesize and submit 2,4,6-Tribromo aniline	4	6.66
9.	To synthesize and submit para bromoacetanilide	4	6.66
10.	To synthesize and submit Benzil	4	6.66
11.	To synthesize and submit Dibenzal acetone	4	6.66
12.	To determine QSAR parameter of Imidazole derivatives	4	6.66
13.	To determine QSAR parameter of Benzimidazole derivatives	4	6.66
14.	To determine QSAR parameter of Quinolone derivatives	4	6.66
15.	To determine QSAR parameter of Pyrazole derivatives	4	6.66

References

1. Vogel's text book of Practical Organic Chemistry
2. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

BP306P – PHYSICAL PHARMACEUTICS-I (Practical)
4 Hours/week

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To understand the significance of physical properties such as solubility, surface tension, partition coefficient and pKa in the design of dosage forms	2	Explain ideas or concept
CO 2	To explain adsorption isotherms and determine Freundlich-Langmuir constant using activated charcoal.	2	Explain ideas or concept
CO 3	To study effect of co solvents on solubility of benzoic acid in water	3	Apply
CO 4	To determine the surface tension of sample liquids by drop count and drop weight methods	3	Apply
CO 5	To deduce the HLB value and critical micellar concentration of a surfactant	3	Apply
CO 6	To estimate the stability constants of complexes by solubility and pH titration methods.	3	Apply

Mapping of Course Outcomes to Program Outcomes:

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

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 CCl₄ 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.

Reference Books (Latest Editions to be adopted):

1. Physical Pharmacy by Alfred Martin
2. Tutorial Pharmacy by Cooper and Gunn.
3. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
4. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
5. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
6. Physical Pharmaceutics by Ramasamy C and ManavalanR.
7. Physical Pharmaceutics by C.V.S. Subramanyam
8. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar.
9. Practical Pharmaceutics-An International Guideline for the Preparation, Care and Use of Medicinal Products- Editors: Yvonne Bouwman-Boer, V'Iain Fenton-May, Paul Le Brun

**SUBJECT: BP 307P. PHARMACEUTICAL MICROBIOLOGY
(PRACTICAL 45 HOURS)**

Teaching Scheme	Examination Scheme:
Lectures: 0	In SEM Exam:25 Marks
Practical: 04Hr/Week	End SEM Exam:75 Marks
Tutorials: 00Hr/Week	Continuous Assessment: 10 Marks
Credits: 4	Total Marks: 100 Marks

Scope: The scope of laboratory practical sessions is to provide students with hands-on experience and practical skills necessary for the industrial microbiology needs. The laboratory practical aim to bridge the gap between theoretical knowledge and its application in real-world scenarios.

Course Objectives: Upon completion of the subject student shall be able to

1. Understand the application and working of equipment required in pharmaceutical microbiology laboratory.
2. Perform the isolation and identification of pure culture.
3. Perform various microbiological testing required at industry level.
4. Perform microbiological laboratory practice as per GMP requirements.
5. Perform estimation of potency of substances by various sensitivity assays.

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To, learn practical aspects of aseptic techniques.	2	Explain ideas or concept
CO 2	To, Perform Isolation and identification of microorganism.	3	Explain ideas or concept
CO 3	To, learn and perform techniques for control of microorganisms and its testing.	3	Apply
CO 4	To, perform different physical and chemical methods for isolation of pure culture.	3	Recall facts and basic concept
CO 5	To, learn and perform GMP requirements as per industry needs.	2	Explain ideas or concept
CO 6	To, learn and perform validation of microbiological methods.	3	Apply

Mapping of Course Outcomes to Program Outcomes:

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

COURSE CONTENT

1. Introduction and study of different equipment's and processing, e.g., B.O.D. incubator, laminar flow or 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, Gram's 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. Microbiological assay of antibiotics by one and two level.
8. Motility determination by Hanging drop method and stab method.
9. Sterility testing of pharmaceuticals (Any two samples).
10. Bacteriological analysis of water
11. Biochemical test of any one microorganism.
12. Identification of microbial colony observed in environmental monitoring, Personnel monitoring and water samples
13. To, perform Preservative Efficacy Testing for given preservatives.
14. Provide practical training on GMP requirements, including cleanroom behavior, gowning procedures, and aseptic processing techniques
15. To, carry out Validation of Microbiological Methods.

Recommended Books

1. Benson's Microbiological Applications, Laboratory Manual in General Microbiology,
2. Laboratory Exercise in Microbiology by Harley Presort.
3. Laboratory Exercises in Microbiology, 12th Edition, by Nathan Rigel and Javier Izquierdo
4. Pharmaceutical Microbiology: A Practical Approach" by Tim Sandle and Madhu Raju Saghee
5. Practical Pharmaceutical Microbiology" by Diane S. Learney and Chris D. Collins
6. Microbiology and Sterility Assurance in Pharmaceuticals and Medical Devices" by Madhu Raju Saghee, Tim Sandle, and Edward C. Tidswell
7. Laboratory Exercises in Microbiology: Discovering the Unseen World Through Hands-On Investigation" by John P. Harley
8. Pharmaceutical Microbiology: Quality Assurance, Control, and Validation" by W. Michael Waites, Ivan J. Lappin, and Andrew A. S. Smith
9. Pharmaceutical Microbiology: Essentials for Quality Assurance and Quality Control" by Tim Sandle
10. Microbiological Examination Methods of Food and Water: A Laboratory Manual" by Neusely da Silva, Marta Hirotomi Taniwaki, Valéria Christina de Oliveira Silva, and John I. Pitt
11. Microbiology with Diseases by Body System" by Robert W. Bauman
12. A Practical Guide to Contamination Control in Pharmaceuticals and Medical Devices" by Anne Marie Dixon and Tim Sandle
13. Pharmaceutical Microbiology: Fundamentals and Applications" by W. Michael Waites, Lynne Turner, and David K. Greenwood
14. Microbiology: A Laboratory Manual" by James G. Cappuccino and Natalie Sherman

BP308P - PHARMACEUTICAL ENGINEERING (Practical)
4 Hours/week

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To study factors affecting on rate of Filtration and Evaporation	2	Explain ideas or concept
CO 2	Construction, working, applications of Pharma equipment	2	Explain ideas or concept
CO 3	Determination of Humidity of Air (WBT & DBT)	3	Apply
CO 4	To study factors affecting on crystallization	3	Apply
CO 5	To study rate of drying, CMC, EMC, LOD and %MC	3	Apply
CO 6	To determine heat transfer efficiency & their applications	3	Apply

[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 Machinery such as rotary tablet machine, **Spray dryer, Extruder & Spheronizer**, fluidized bed coater, fluid energy mill, de humidifier.

[8] Size analysis by sieving – To evaluate size distribution of tablet granulations – Construction of various size frequency curves including arithmetic and logarithmic probability plots.

[9] **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.**

[10] Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.

[11] Factors affecting Rate of Filtration and Evaporation (Surface area, Concentration and Thickness/ viscosity)

[12] To study the effect of time on the Rate of Crystallization.

[13] To calculate the uniformity Index for given sample by using Double Cone Blender.

[14] **Study the effect of filter aid on rate of Filtration**

Recommended Books: (Latest Editions) for new practicals

1. **Dr. Munira Momin, Dr. Tejal Mehta, Practical manual of pharmaceutical Engineering, B.S. Shah Prakasan, Latest edition.**

SEMESTER IV

SUBJECT: BP401T. PHARMACEUTICAL ORGANIC CHEMISTRY-III (THEORY 45 HOURS)

Teaching Scheme	Examination Scheme:
Lectures: 03Hr/Week	In SEM Exam:25 Marks
Practical:	End SEM Exam:75 Marks
Tutorials: 01Hr/Week	Continuous Assessment: 10 Marks
Credits: 4	Total Marks: 100 Marks

Scope

This course deals with the 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

Course Objectives:

Upon completion of the course a student shall be able to understand

- 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

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	The students should be able to understand the basic concepts of stereoisomers and cyclic stereo control	1	Remember
CO 2	To acquire the knowledge of geometrical isomers and Acyclic stereo control	2	Understand
CO 3	To acquire the knowledge and understanding of the basic experimental principles of heterocyclic chemistry.	3	Apply
CO 4	To draw the structures and synthesize simple pharmaceutically active organic compounds having five and six membered heterocyclic compounds.	3	Apply
CO 5	To clarify different terms associated with synthesis of heterocyclic compounds	3	Apply
CO 6	To understand the detailed mechanisms for common naming reactions	3	Apply

Mapping of Course Outcomes to Program Outcomes:

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

COURSE CONTENTS

Unit	Details	Hrs	References
1	<p>Stereo isomerism Optical isomerism –</p> <ul style="list-style-type: none"> • 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 (Stereospecific and stereoselective reactions) • Racemic modification and resolution of racemic mixture. • Asymmetric synthesis: partial and absolute 	08	<ol style="list-style-type: none"> 1. Stereochemistry of Organic Compounds” by E L Eliel 2. Stereochemistry of Carbon Compounds (Advanced Chemistry)” by Ernest L Eliel
2	<p>Geometrical isomerism</p> <ul style="list-style-type: none"> • 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. 	08	<ol style="list-style-type: none"> 1. Introduction to Stereochemistry” by Kurt Mislow
3	<p>Heterocyclic compounds:</p> <ul style="list-style-type: none"> • 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 	09	<ol style="list-style-type: none"> 1. Heterocyclic Chemistry by T.L. Gilchrist 2. “Heterocyclic Chemistry” by J A Joule and K Mills 3. Heterocycles in Life and Society: An Introduction to Heterocyclic Chemistry and Biochemistry and the Role of Heterocycles” by Alexander F Pozharskii and Anatoly T Soldatenkov
4	<ul style="list-style-type: none"> • Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine • Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives • Structure and medicinal uses of 	7+ 1	<ol style="list-style-type: none"> 1. Name Reactions in Heterocyclic Chemistry” by Jie Jack Li 2. Advances in Heterocyclic Chemistry” by Alan R Katritzky

	benzo-fused heterocyclic compounds as benzimidazole, benzthiazole, benzopyran		
5	Reactions of synthetic importance <ul style="list-style-type: none"> • Metal hydride reduction (NaBH₄ and LiAlH₄), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. • Oppenauer-oxidation and Dakin reaction. • Beckmanns rearrangement and Schmidt rearrangement. • Claisen-Schmidt condensation • Pinacol-Pinacolone, Hofmann, Baeyer-Villiger oxidation, Benzilic acid rearrangement reaction, Suzuki reaction 	6+1	1. organic chemistry by clayden, greeves and Warren, carruthers, zweifel, carey & Sundberg 2. Advanced organic chemistry Part A and B by Carey and Sundberg 3. Principles of Org. Synthesis (Science Paperbacks) by R. O. C. Norman
6	Green synthesis chemistry General synthesis methods of green chemistry Green synthesis of organic, labelled and hybrid compounds, Metal salts, complexes and Metal Organic Frameworks (MOFs)	05	
	TOTAL	45	

**SUBJECT: BP402T. MEDICINAL CHEMISTRY – I
(THEORY 45 HOURS)**

Teaching Scheme

Lectures: 03Hr/Week

Practical:

Tutorials: 01Hr/Week

Credits: 4

Examination Scheme:

In SEM Exam: 25 Marks

End SEM Exam: 75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

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.

Course Objectives:

Upon completion of the course a student shall be able to understand -

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 (SAR) of different class of drugs.

Write the chemical synthesis of some drugs.

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor

CO 1	To remember the various pharmaceutical component classes	2	Recall facts & basic concept
CO 2	To describe the physicochemical properties, steric aspects of drugs and their metabolic pathways	2	Explain ideas or concept
CO 3	To identify the structural requirements of drugs to elicit biological response	3	Apply
CO 4	To categorize the drugs based on their mechanism of action and clinical uses	3	Apply
CO 5	To design the synthetic routes for medicinal compounds.	3	Apply
CO 6	To choose the appropriate medicinal compound for treatment of disease or disorder	3	Apply

Mapping of Course Outcomes to Program Outcomes:

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

COURSE CONTENTS

Note: Study of the development of the following classes of drugs, classification, mechanism of action, Structure activity relationship, uses of drugs mentioned in the course. The synthesis of drugs mentioned in bracket [] only needs to be covered.

Unit	Details	Hours	References
1.1	UNIT-I Introduction to Medicinal Chemistry a) History and development of medicinal chemistry b) Physicochemical properties in relation to biological action Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism. Ferguson principle c) Drug metabolism Drug metabolism principles - Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects. Drug absorption; distribution, metabolism and elimination, Protein binding, Blood brain barrier	6	1. Wilson and Grisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry by John H. Block, John M. Beale, 7th edition, Lippincott Williams and Wilkins, 2004, Ch.2 and 3 2. Foye's Principles of Medicinal Chemistry, Thomas L. Lemke, David. A. Williams, Wolters Kluwer, 2008, 6th edition, Ch.2, 3, 4 and 10. 3. An Introduction to Medicinal Chemistry, Graham L. Patrick, 3rd edition, Oxford University press, part A-2.
1.2	Receptors: Types of receptors, Types of forces involved in drug receptor interaction; intracellular cyclic nucleotides and other mediators of biological response, Transduction mechanism.	5	An Introduction to Medicinal Chemistry, Graham L. Patrick, 3rd edition, Oxford University press, part C-20.

2	<p>UNIT-II</p> <p>Drugs acting on Autonomic Nervous System</p> <p>Adrenergic Neurotransmitters:</p> <ul style="list-style-type: none"> • Biosynthesis and catabolism of catecholamine. • Adrenergic receptors (Alpha & Beta) and their distribution. <p>Sympathomimetic agents: SAR of Sympathomimetic agents</p> <ul style="list-style-type: none"> • Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline. • Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. • Agents with mixed mechanism: Ephedrine, Metaraminol. Amphetamine <p>Adrenergic Antagonists:</p> <p>Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.</p> <p>Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.</p>	9	<p>1. Wilson and Grisvold's textbook of organic medicinal and pharmaceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and wilkins, 2004, Ch.15 and 16</p> <p>2. Foye's principles of medicinal chemistry, Thomas L.Lemke, David.A. Williams, Wolters Kluwer, 2008, 6th edition, Ch.13.</p> <p>3. An introduction to medicinal chemistry, Graham L.Patrick, 3rd edition, Oxford University press, part C-20.</p>
3	<p>UNIT-III</p> <p>Cholinergic neurotransmitters: 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, Isoflurophate, Echothiophate iodide, Parathione, 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>	9	<p>1.Wilson and Grisvold's textbook of organic medicinal and pharmaceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and wilkins, 2004, chapter.17.</p> <p>2.Foye's principles of medicinal chemistry, Thomas L.Lemke, David.A.Williams, Wolters Kluwer, 2008, 6th edition, chapter.12.</p> <p>3.An introduction to medicinal chemistry, Graham L.Patrick, 3rd edition, Oxford University press, part chapter.19.</p>

4	<p>UNIT-IV Drugs acting on Central Nervous System A. Sedatives and Hypnotics: Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem</p> <p>Barbiturtes: 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 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. Fluro buterophenones: Haloperidol, Droperidol, Risperidone. Beta amino ketones: Molindone hydrochloride. Benzamides: Sulpieride.</p> <p>C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action</p> <p>Barbiturates: Phenobarbitone, Methabarbitol.</p> <p>Hydantoin: Phenytoin*, Mephenytoin, Ethotoin</p> <p>Oxazolindione: Trimethadione, Paramethadione</p> <p>Succinimides: Phensuximide, Methsuximide, Ethosuximide*</p> <p>Urea and monoacylureas: Phenacemide, Carbamazepine*</p> <p>Benzodiazepines: Clonazepam</p> <p>Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate</p>	9	<p>1. Wilson and Grisvold's textbook of organic medicinal and pharmaceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and Wilkins, 2004, chapters 14 and 15.</p> <p>2. Foye's principles of medicinal chemistry, Thomas L.Lemke, David.A.Williams, Wolters Kluwer, 2008, 6th edition, chapters 19, 20, 22 and 25.</p>
5	<p>UNIT-V Drugs acting on Central Nervous System General anesthetics: Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.</p> <p>Ultra short acting barbiturates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.</p> <p>Dissociative anesthetics: Ketamine hydrochloride.*</p> <p>Narcotic and non-narcotic analgesics Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.</p>	7	<p>1. Wilson and Grisvold's textbook of organic medicinal and pharmaceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and Wilkins, 2004, chapters.14, 15, 20 and 22.</p> <p>2. Foye's principles of medicinal chemistry, Thomas L.Lemke, David.A.Williams, Wolters Kluwer, 2008, 6th edition, chapters.18 and 24.</p> <p>3. An introduction to medicinal chemistry, Graham L. Patrick,</p>

	Narcotic antagonists: Nalorphine hydrochloride, Levallorphan tartarate, Naloxone hydrochloride. Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepirac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.		3rd edition, Oxford University press, part D-21.
	TOTAL	45	

**SUBJECT: BP403T PHYSICAL PHARMACEUTICS-II
(THEORY 45 HOURS)**

Teaching Scheme	Examination Scheme:
Lectures: 04Hr/Week	In SEM Exam:25 Marks
Practical:	End SEM Exam:75 Marks
Tutorials: 00Hr/Week	Continuous Assessment: 10 Marks
Credits: 4	Total Marks: 100 Marks

Scope

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

Course Objectives:

Upon completion of the course a student shall be able to understand:

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing and determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To Explain the concept of colloidal dispersions and general properties dispersed systems	2	Explain ideas or concept
CO 2	To Describe the rheological properties of newtonian systems and non newtonian systems and emulsions	2	Explain ideas or concept
CO 3	To Explain the stability of flocculated and deflocculated suspensions, emulsions and preservation of emulsions.	3	Apply
CO 4	To Describe the concept of particle size and distribution, derived properties, porosity, packing arrangement, densities, bulkiness & flow properties of powders	1	Recall facts and basic concept
CO 5	To Explain the stability of drug, factors influencing the chemical degradation of pharmaceutical dosage forms.	2	Explain ideas or concept
CO 6	To understand the Effect of various types of solid deformation on formulation design	3	Apply

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	-	-	2	-	-	2	-	3
CO2	2	2	2	2	-	1	-	-	1	-	3

CO3	3	1	2	-	-	-	-	-	-	-	3
CO4	2	1	2	-	-	2	-	-	-	-	2
CO5	3	2	3	-	-	-	1	-	-	-	1
CO6	3	2	1	2	-	1	1	-	1	-	2

COURSE CONTENTS

RED –Least importance

Green –New Addition

SRNO	UNIT	HOURS
1.	Colloidal dispersions	05
	<p>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.</p> <p>Intrinsic solubility, phase solubility, solid solutions/ dispersions and application in research.</p>	
2.	Rheology	10
	<p>Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation and its measurement, determination of viscosity, capillary, falling Sphere, rotational viscometers, Effect of viscosity/ flow on drug formulations</p> <p>Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus, Effect of various types of solid deformation on formulation design</p>	
3.	Coarse dispersion:	10
	<p>Suspension, interfacial properties of suspended particles, Classification of suspending agents and commonly used suspending agents industrially, settling in suspensions, formulation of flocculated and deflocculated suspensions, Controlled Flocculation. Emulsions and theories of emulsification, Classification of emulsifying agents and commonly used emulsifying agents industrially, microemulsion, nanoemulsion and multiple emulsions-An overview; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.</p> <p>Stability of emulsions and factors affecting it. Different stability concerns in emulsions.</p>	

4.	Micromeretics:	10
	<p>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. Advantages and disadvantages of particle size modification of drugs. Importance of molecular size in Pharmaceutical Formulations, Particle size of drugs and electrostatic properties, Particle size of drugs and electrostatic properties.</p>	
5.	Drug stability:	10
	<p>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. ICH guidelines for stability studies, Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention. Different types of packing and containers and closures to improve drug stability. Effect of processing time (Duration of manufacturing) on drug stability.</p>	

Reference Books (Latest Editions to be adopted):

<p>Reference Books:</p> <ol style="list-style-type: none"> 12. Martin A, Swarbrick. J, Cammarata A, Physical Pharmacy: Physical Chemical Principles in the Pharmaceutical Sciences, 3 rd edition, BI Waverly. Pvt Ltd, New Delhi, 1993. 13. Sinko PJ, Singh Y. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences, 6 th edition, Walter Kluer, Philadelphia, 2011 14. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, 6th edition, CBS Publications, New Delhi, 2005 15. Cooper and Gun pharmaceuticals. 16. Lieberman HA, Lachman L, Schwartz JB. Pharmaceutical dosage forms—tablets, Vol.1,2,3/edited by Herbert A. Lieberman, Leon Lachman, Joseph B. Schwartz, 2nd edition, Marcel Dekker Inc., Newyork,1990. 17. C.V.S. Subramanyam, J. Thimma settee, Laboratory Manual of Physical Pharmaceutics, 2nd edition, Vallabh Prakashan, Delhi, 2014. 18. C.V.S. Subrahmanyam, Textbook of Physical Pharmaceutics, 3rd edition, Vallabh Prakashan, Delhi, 2015

19. C.V.S. Subrahmanyam, Essentials of Physical Pharmaceutics, 2 nd edition, Vallabh Prakashan, Delhi, 2017
20. Bahl A, Bahl B. S, Tuli G. D, Essentials of Physical Chemistry, 28th edition, S Chand Publications, New Delhi, 2000.
21. Physical Pharmaceutics Shotton, E, London oxford university press.
22. Solid State Properties of Pharmaceutical Materials- Author(s):Stephen R Byrn, George Zografi, Xiaoming (Sean) Chen

BP403T SUBJECT: PHARMACOLOGY- I

Teaching Scheme

Lectures: 03Hr/Week

Practical: 03Hr/Week

Tutorials: 01Hr/Week

Credits: 4

Examination Scheme:

In SEM Exam:25 Marks

End SEM Exam:75 Marks

Continuous Assessment: 10 Marks

Total Marks: 100 Marks

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, 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 route of administration of different classes of drugs.

Course Objectives:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	Understand the history of pharmacology, the different types of receptors and the action potential involved	1	Recall facts and basic concept of Pharmacology
CO 2	The students able to understand the Pharmacokinetics and Pharmacodynamics in pharmacology	1,3	Recall facts and basic concept of inflammation and Apply
CO 3	The students able to understand the basic pharmacological knowledge in the prevention and treatment of ANS diseases	1,3,5,	Recall facts and basic concept of inflammation, apply Evaluating
CO 4	The students able to understand the different neurotransmitters responsible for CNS,	1,3,5	Recall facts and basic concept of inflammation, apply & Evaluating
CO 5	The students able to understand the basic concepts of using anesthesia in different conditions	1,3,5	Recall facts and basic concept of inflammation, apply & Evaluating
CO 6	The students able to understand the concepts opioids, drug tolerance and drug abuse	3	Recall facts and basic concept of inflammation, apply & Evaluating

Mapping of Course Outcomes to Program Outcomes:

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

COURSE CONTENTS (THEORY)

Unit	Details	Hours
1	<p>General Pharmacology</p> <p>a. History of the pharmacy Introduction to Pharmacology Definition, Historical landmarks and scope of pharmacology, Nature and source of drugs, classical methods of drug research, Laws and regulations, Essential drugs concept and Routes of drug administration, Agonists, antagonists (competitive and noncompetitive), spare receptors</p> <p>b. Pharmacokinetics Membrane transport, Absorption, Distribution, Metabolism and Excretion of drugs. Enzyme induction, Enzyme inhibition, Introduction to kinetics of elimination.</p>	8+3
2	<p>General Pharmacology</p> <p>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 receptors, Trans-membrane enzyme linked receptors, JAK-STAT binding receptors and receptors that regulate transcription factors, Dose response relationship, Therapeutic index, Agonists, Antagonists (competitive and non-competitive), Combined effects of drugs and Factors modifying drug action.</p> <p>b. Adverse drug reactions: Addiction, Tolerance, Dependence, Tachyphylaxis, Idiosyncrasy, Allergy (explain with suitable examples). Topics related with demonstration of pharmacokinetics and Pharmacodynamics parameters in detail</p> <p>c. Drug interactions: Pharmacokinetic and pharmacodynamic drug interactions, concept of pharmacogenomics/-genetics in drug action</p> <p>d. Drug discovery and clinical evaluation of new drugs: Introduction to drug discovery, Preclinical evaluation and Clinical trials, Introduction to Pharmacovigilance, role of pharmacovigilance activity in ADR monitoring, ADR Form filling</p>	10+6
3	<p>Pharmacology of drugs acting on Peripheral Nervous System Introduction to Autonomic Nervous System, Parasympathomimetics, Parasympatholytics, Sympathomimetics and Sympatholytics. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral). Local anaesthetic agents. Drugs used in myasthenia gravis and glaucoma</p>	10

4	Pharmacology of drugs acting on central nervous system Neurohumoral transmission in the C.N.S.- Special emphasis to be given on importance of various neurotransmitters like with GABA, Glutamate, Glycine, Serotonin, Dopamine. General anaesthetics and pre-anaesthetics Sedatives, Hypnotics and Centrally acting muscle relaxants Anti-epileptics Alcohol and Disulfiram	10
5	Pharmacology of drugs acting on Central Nervous System Psychopharmacological agents: Antipsychotics, Antidepressants, Anti-anxiety agents, anti-manics and Hallucinogens Drugs used in Parkinson's disease and Alzheimer's disease CNS stimulants and Nootropics Opioid analgesics and antagonists (including addiction, abuse, tolerance and dependence)	7
	TOTAL	45+9 =54

REFERENCES:

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology, Churchill Livingstone Elsevier.
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews-Pharmacology
6. K.D.Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R. Craig & Robert,
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata. 56
10. Barar, F.S.K., Essentials of Pharmacotherapeutics; S. Chand and Company, New Delhi.
11. A textbook of Pathophysiology, Bodhankar, SL and Vyawahare, NS, NiraliPrakashan, Pune.
12. Das, M. M. and Dutta S. K. : R. Ghosh,s Modern Concepts on pharmacology and Therapeutics, (HILTON and Co. Calcutta)
13. Satoskar, R.S. and Bhandarkar S.D. Pharmacology and Pharmacotherapeutics (Popular Prakashan, Bombay).
14. Craig, C.R. and Stitzel, B.E.; Modern Pharmacology, Little Brown and Co, Boston.

15. James Crossland. Lewis, s Pharmacology Basis of Therapeutics, Pergamon Press, New York.
16. Harrison's Principle and Practice of Medicine, 18th Edition, Churchill, Livingston, London.
17. Roger and Walker. Clinical Pharmacy and Therapeutics, Churchill, Livingston, London.
18. Dipiro Joseph L. A pathphysiological Approach, Elsevier.
19. Davidson's Principle of Internal Medicine, McGraw-Hill companies.
20. Guyton AC. Textbook of medical Physiology. W. B. Sanders CO., Philadelphia, USA.
21. Chatterjee, C.C., Human Physiology. Medical Allied Agency, Kolkata.
22. Ganong, W.F., Review of Medical Physiology. Prentice-Hall International, London

**SUBJECT: BP405T. Pharmacognosy and Phytochemistry-I (Theory)
(THEORY 45 HOURS)**

Teaching Scheme	Examination Scheme:
Lectures: 03Hr/Week	In SEM Exam:25 Marks
Practical:	End SEM Exam:75 Marks
Tutorials: 01Hr/Week	Continuous Assessment: 10 Marks
Credits: 4	Total Marks: 100 Marks

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.

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

1. To know the techniques in the cultivation and production of crude drugs
2. To know the crude drugs, their uses and chemical nature
3. To know the evaluation techniques for the herbal drugs
4. To carry out the microscopic and morphological evaluation of crude drugs
5. To know the about the metabolites
6. To know about marine drugs and their importance

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To know the techniques in the cultivation and production of crude drugs	2	Apply
CO 2	To know the crude drugs, their uses and chemical nature	3	Explain ideas or concept
CO 3	To know the evaluation techniques for the herbal drugs	3	Apply
CO 4	To carry out the microscopic and morphological evaluation of crude drugs	2	Apply
CO 5	To know the about the metabolites	1	To understand and use
CO 6	To know about marine drugs and their importance	2	Apply

Mapping of Course Outcomes to Program Outcomes:

	1	2	3	4	5	6	7	8	9	10	11
CO1	3	2	2	3					2	2	3

CO2	3		1						1		3
CO3	3		1	3					2		3
CO4	3			2					2		3
CO5	3		1	2					2		3
CO6	3		1	2					2		3

COURSE CONTENTS

Unit	Details	Hours
1	<p>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).</p> <p>Classification of drugs: Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs</p> <p>Quality control of Drugs of Natural Origin:</p> <ul style="list-style-type: none"> • 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. • Deterioration of crude drugs, its eradication and prevention. • Macro- and microscopic identification, therapeutic value, toxicity, contra-indications, drug- • Herb interactions. • Herbal Monographs. <p>(Philadelphia University Faculty of pharmacy Department of pharmaceutical science First semester.)</p>	10+3= 13
2	<p>Cultivation, Collection, Processing and storage of drugs of natural origin:</p> <ul style="list-style-type: none"> • 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 <p>Conservation of medicinal plants</p>	10-2= 08
3	<p>Plant tissue culture: Biotechnology in pharmaceutical Sciences perspective: Biology in drug discovery:</p> <p>Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Traditional drug discovery vs rational drug discovery; rational drug discovery pipeline</p>	07

	<ul style="list-style-type: none"> • Natural product Fermentation, isolation and analysis • Applications of plant tissue culture in pharmacognosy. • Edible vaccines 	
4	<p>Plant description, morphology and anatomy: Leaves, Roots, Barks, Wood, Flowers, Fruits, Seeds, subterranean organs</p> <p>Introduction to secondary metabolites: Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins</p>	09
5	<p>Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs</p> <p>Plant Products:</p> <ul style="list-style-type: none"> • Fibers - Cotton, Jute, Hemp • Hallucinogens, Teratogens, Natural allergens <p>Primary metabolites: History of biosynthetic study on natural products</p> <p>General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used 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): General methods of extraction of lipids. Castor oil, Chaulmoogra oil, Shark liver oil and Cod liver oil, Wool Fat, Bees Wax</p> <p>Marine Drugs: Novel medicinal agents from marine sources a) Cardiovascular agents and b) Anti cancer agents</p>	08
	TOTAL	45

BP406P. MEDICINAL CHEMISTRY – I (Practical)
4 Hours / Week
(PRACTICAL 60 HOURS)

Teaching Scheme	Examination Scheme:
Lectures:	In SEM Exam:15 Marks
Practical: 04Hr/Week	End SEM Exam:35 Marks
Tutorials:	Continuous Assessment:
Credits: 2	Total Marks: 50 Marks

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To recall the basic requirements for synthesis and assay of drugs	2	Recall facts and basic concept
CO 2	To explain the techniques involved in isolation and purification of drugs and intermediates	2	Explain ideas or concept

CO 3	To synthesize, characterize and purify medicinal compounds and intermediates	3	Apply
CO 4	To analyze the selected drugs present in dosage forms and to determine the percentage purity	2	Apply
CO 5	To determine the physicochemical property of drugs and draw its importance	2	Apply
CO 6		3	Apply

Mapping of Course Outcomes to Program Outcomes:

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

COURSE CONTENT

Sr. No.	Name of Experiment	Duration	References
I Preparation of drugs/ intermediates			
1	1,3-pyrazole	4	Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5th edition, Pearson Publishing House, India, 1989 Finar I. L., Organic Chemistry, Vol. II, 4 th edition, Pearson Publishing House, Longman, 1963
2	1,3-oxazole	4	Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5th edition, Pearson Publishing House, India, 1989 Finar I. L., Organic Chemistry, Vol. II, 4 th edition, Pearson Publishing House, Longman, 1963
3	Benzimidazole	4	Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5 th edition, Pearson Publishing House, India, 1989
4	Benztriazole	4	Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5 th edition, Pearson Publishing House, India, 1989
5	2,3- diphenyl quinoxaline	4	Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5 th edition, Pearson Publishing House, India, 1989 Finar I. L., Organic Chemistry, Vol. II, 4 th edition, Pearson Publishing House, Longman, 1963
6	Benzocaine	4	Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5th edition, Pearson Publishing House, India, 1989
7	Phenytoin	4	Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5th edition, Pearson Publishing House, India, 1989

8	Phenothiazine	4	Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5th edition, Pearson Publishing House, India, 1989
9	Barbiturate	4	Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5th edition, Pearson Publishing House, India, 1989
II Assay of drugs			
	Chlorpromazine	3	Indian Pharmacopia, 2018, Vol.II, Pg.No.1599 -1601
	Phenobarbitone	3	Indian Pharmacopia, 2018, Vol.II, Pg.No.2899 -2902
	Atropine	3	Indian Pharmacopia, 2018, Vol.II, Pg.No.1296-1300
	Ibuprofen	3	Indian Pharmacopia, 2018, Vol.II, Pg.No.2261-2265
	Aspirin	3	Indian Pharmacopia, 2018, Vol.II, Pg.No.1277
	Furosemide	3	Indian Pharmacopia, 2018, Vol.II, Pg.No.2133 -2135
III	Determination of Partition coefficient for any two drugs	6	Wilson and Grisvold's textbook of organic medicinal and pharmaceutical Chemistry by John H.Block, John M.Beale, 7th edition, Lippincott Williams and Wilkins, 2004
IV	TLC technique for monitoring the reaction and purification of synthesized compounds	4	Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5th edition, Pearson Publishing House, India, 1989
	Total	60	

Reference Books (Latest Editions to be adopted):

1. Beale J. M., Block J. H., Wilson and Gisvold's Textbook of Organic medicinal and Pharmaceutical Chemistry, 20th edition, Lippincott Williams & Wilkins Publishers, 2004.
2. Lemke T. L., Williams D. A., Roche V. F., Zito., S. W., Foye's Principles of Medicinal Chemistry, 7 th edition, Lippincott Williams and Wilkins Publishers, 2001
3. Abraham D. J., Burger's Medicinal Chemistry and Drug Discovery, Vol I to IV, 6th edition, John Wiley and Sons, Inc., Publication, 2003
4. Smith H. J., Smith and Williams' Introduction to Principles of Drug Design and Action, 4 th edition, Taylor and Francis Publications, CRC Press, 2005
5. Remington, The Science and Practice of Pharmacy, 21st edition, Lippincott Williams and Wilkins Publication, 2005
6. Martindale: The Extra Pharmacopoeia, Pharmaceutical Press, 2008
7. Finar I. L., Organic Chemistry, Vol. II, 4 th edition, Pearson Publishing House, Longman, 1963
8. Lednicer D., The Organic Chemistry of Drug Synthesis, Vol. 1-5, Wiley-Interscience, 2007
9. Indian Pharmacopoeia
10. Vogel A.I., Vogel's textbook of Practical Organic Chemistry, 5th edition, Pearson Publishing House, India, 1989

Note: Green color indicate the additional point in syllabus.

BP 407P -PHYSICAL PHARMACEUTICS-II(Practical)

4 Hours/week

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To choose a good suspending agent to formulate a stable suspension	2	Explain ideas or concept
CO 2	To interpret the shelf life of a given formulation by accelerated stability studies	2	Explain ideas or concept
CO 3	To make use of derived and flow properties of powders to ensure a stable solid formulation.	3	Apply
CO 4	To determine the reaction rate constant of first order.	3	Apply
CO 5	To determine the viscosity using viscometer	3	Apply
CO 6	To determine the reaction rate constant of second order.	3	Apply

Mapping of Course Outcomes to Program Outcomes:

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

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 single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant of first order.
10. Determination of reaction rate constant of second order

Reference Books (Latest Editions to be adopted):

1. Physical Pharmacy by Alfred Martin
2. Tutorial Pharmacy by Cooper and Gunn.
3. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
4. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
5. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.

6. Physical Pharmaceutics by Ramasamy C and ManavalanR.
7. Physical Pharmaceutics by C.V.S. Subramanyam
8. Test book of Physical Pharmacy, by Gaurav Jain & Roop K. Khar.
9. Practical Pharmaceutics-An International Guideline for the Preparation, Care and Use of Medicinal Products- Editors: Yvonne Bouwman-Boer, V'Iain Fenton-May, Paul Le Brun

BP 408P PHARMACOLOGY-I (Practical)
4 Hours / Week (PRACTICAL 60 HOURS)

Teaching Scheme	Examination Scheme:
Lectures:	In SEM Exam:15 Marks
Practical: 04Hr/Week	End SEM Exam:35 Marks
Tutorials:	Continuous Assessment:
Credits: 2	Total Marks: 50 Marks

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	To study about the Introduction to experimental pharmacology, commonly used instruments in experimental pharmacology, Study of common laboratory animals.	1	Recall facts and basic concept
CO 2	To study about the Maintenance of laboratory animals as per CPCSEA guidelines, Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies, Study of different routes of drugs administration in mice/rats.	2	Explain ideas or concept
CO 3	To study about the Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice, Effect of drugs on ciliary motility of frog oesophagus, Effect of drugs on rabbit eye.	3	Explain ideas or concept
CO 4	To study about the Effects of skeletal muscle relaxants using rota-rod apparatus, Effect of drugs on locomotor activity using actophotometer, Anticonvulsant effect of drugs by MES and PTZ method	3	Explain ideas or concept
CO 5	Study of stereotype and anti-catatonic activity of drugs on rats/mice, Study of anxiolytic activity of drugs using rats/mice.	3	Explain ideas or concept
CO 6	Study of local anesthetics by different methods	3	Explain ideas or concept

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	2	-	-	-	-	-	-	3
CO2	3	-	-	2	-	-	-	-	-	-	3
CO3	3	-	-	2	-	-	-	-	-	-	3
CO4	3	-	-	2	-	-	-	-	-	-	3
CO5	3	-	-	2	-	-	-	-	-	-	3
CO6	3	-	-	2	-	-	-	-	-	-	3

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, anesthetics 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 anesthetics by different methods

Reference Books (Latest Editions to be adopted):

1. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan. Burn JH.
Practical Pharmacology Blackwell Scientific, Oxford London.
2. Jaju BP. Pharmacology: A Practice Exercise Book, Jaypee Brothers, New Delhi.
3. Sheth UK, Dadkar NK and Kamat UG. selected topics in experimental pharmacology,
(Kothari Book Depot, Mumbai)
4. Perry W.L.M. Pharmacological Experiments on Isolated Preparation, E&S Livingstone,
London.
5. Goyal R. K., Practicals in Pharmacology, B. S. Shah Prakashan, Ahemadabad

**BP409P PHARMACOGNOSY AND PHYTOCHEMISTRY-I (Practical)
(PRACTICAL 60 HOURS)**

Teaching Scheme	Examination Scheme:
Lectures:	In SEM Exam: 15 Marks
Practical: 04Hr/Week	End SEM Exam: 35 Marks
Tutorials:	Continuous Assessment:
Credits: 2	Total Marks: 50 Marks

Scope

The subject involves the fundamentals of Pharmacognosy and phytochemistry-I like chemical test, leaf const, microscopic particle size measurement, ash value, extractive value, moisture content

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

1. To perform chemical test
2. To know leaf constant
3. To determine size of microscopic particle
4. To determine ash value

5. To determine extractive value
6. To determine moisture content

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level I	Descriptor
CO 1	To perform chemical test	1	Recall facts and basic concept
CO 2	To know leaf constant,	2	Explain ideas or concept
CO 3	To determine size of microscopic particle	3	Apply
CO 4	To determine ash value, moisture content, extractive value	2	Apply
CO 5	To Prepare TLC	2	Apply
CO 6	To know various type of treatment and its uses and application	3	Explain ideas or concept

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3										3
CO2	3			2							3
CO3	3			2							3
CO4	3										3
CO5	3										3
CO6	3			2							3

COURSE CONTENT

Sr. No.	Name of Experiment	Duration
1.	Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii) Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil	4
2.	Determination of stomatal number and index	4
3.	Determination of vein islet number, vein islet termination and palisade ratio.	4
4.	Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer	4
5.	Determination of Fiber length and width	4
6.	Determination of number of starch grains by Lycopodium spore method	4
7.	Determination of Ash value	4
8.	Determination of Extractive values of crude drugs	4
9.	Determination of moisture content of crude drugs	4
10.	Determination of swelling index and foaming index	4

11.	Preparative TLC	4
12.	Demonstration of HPTLC	4
13.	Demo of Panchakarma treatment (Ayurvedic treatment Hospital visit)	4

BP207MLC – FUNCTIONAL ENGLISH II
(Total No. of Hours: 50) Total No. of Hours: 50

Teaching Scheme	Examination Scheme
Lectures: 03 hrs. per week	Term End Exam: 25 Marks
Practical: 00 hrs. per week	Continuous Internal Assessment: 75 Marks
Credit: 0	Total: 100 Marks

Course Objectives:

- to enable the learner to communicate effectively and appropriately in real-life situations
- to develop and integrate the use of listening, speaking, reading and writing skills in reality
- to enrich receptive and productive skills of the learners

Course Outcomes (CO's):

The Advanced Learners will be able to:

CO's	Course Outcomes	Bloom's Taxonomy	
		Level	Descriptor
CO 1	✓ apply the linguistic parameters learnt through listening skill activities effectively	3	Apply
CO 2	✓ critically listen and interpret ideas or perspectives	3	Apply
CO 3	✓ make effective presentation and participate in discussions	3	Apply
CO 4	✓ read, understand, communicate and respond to a message promptly	3	Apply
CO 5	✓ analyse, prepare, plan and describe through written form accurately	3	Apply
CO 6	✓ evaluate listening, speaking, reading and writing skills achieved respectively	3	Apply

Course Content:

Unit	Content	No. of hrs.
1.	Good Memories People; childhood; memories	03
2.	Life in the City Transportation; transportation problems; city services	03

3.	Making Changes Houses and apartments; lifestyle changes; wishes	03
4.	Have you ever tried it? Food; recipes; cooking instructions; cooking methods	03
5.	Hit the road! Travel; vacations; plans	03
6.	Sure! I'll do it. Complaints; household chores; requests; excuses; apologies	03
7.	What do you use this for? Technology; instructions	03
8.	Time to celebrate! Holidays; festivals; customs; celebrations	04
9.	Only time will tell. Life in the past, present, and future; changes and contrasts; consequences	03
10.	I like working with people. Abilities and skills; job preferences; personality traits; careers	03
11.	It's really worth seeing! Landmarks and monuments; world knowledge	03
12.	It's a long story. Storytelling; unexpected recent past events	03
13.	That's entertainment! Entertainment; movies and books; reactions and opinions	03
14.	Now I get it! Nonverbal communication; gestures and meaning; signs; drawing conclusions	03
15.	I wouldn't have done that. Money; hopes; predicaments; speculations	03
16.	Making excuses Requests; excuses; invitations	04
Total no. of training hours:		50

Prescribed Text Book:

S. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jack C Richards with Jonathan Hull and Susan Proctor –1	Interchange (Book 2)	Cambridge University Press, Fifth Edition	2019

Reference Books:

S. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jack C. Richards	Interchange (Book 2)	Cambridge University Press	2015
2.	Raymond Murphy	Essential English Grammar	Cambridge University Press, Second Edition	2016
3.	Jack C. Richards	Interchange (Book 2)	Cambridge University Press	2016
4.	Barun K Mitra	Effective Technical Communication	Oxford University Press	2017
5.	University of Cambridge	BEC Preliminary 1 (Exam Papers with answers)	Cambridge University Press	2010
6.	Lin Lougheed	Barron's all-books-in-one IELTS Superpack	Barrons Educational Services, Fifth Edition	2020

Web URL's for reference:

1. www.onestopenglish.com
2. www.britishcouncil.org
3. www.learnenglishtoday.com
4. www.talkenglish.com
5. www.bogglesworldesl.com
6. www.learnenglish.britishcouncil.org/skills/listening/b1-listening
7. www.englishcentral.com/browse/videos?setLanguage=en
8. www.dialectsarchive.com/

Evaluation Criteria:**Continuous Internal Assessment: 75 Marks****CIA I: Listening Skill Rubrics**

Comprehension	Note-making	Responding	Concentration	Feedback	Total Marks
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5	5	5	5	5	25
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CIA II: Speaking Skill Rubrics

Pronunciation	Fluency	Vocabulary	Grammar	Interaction	Total Marks
5	5	5	5	5	25

CIA III: Reading Skill Rubrics

Comprehension	Vocabulary	Inference	Speed	Critical thinking	Total Marks
5	5	5	5	5	25

Term End Exam: 25 Marks

Writing Skill Rubrics

Spelling	Punctuation	Grammar	Organization	Creativity	Total Marks
5	5	5	5	5	25

YOGA PROGRAMME (SEM III)

(30 HOURS, 2hr/week)

Teaching Scheme

Lectures: 01Hr/Week
Practical: 01 Hr/Week

Credits: 2

Examination Scheme:

In SEM Exam: 25 Marks
End SEM Exam: 25 Marks
Continuous Assessment: 10 Marks
Total Marks: 50 Marks

Course Objectives:

Upon completion of the course a student shall be able to understand –

- To provide the necessary knowledge of the theory and practice of yoga and its nature scope so that the students learn to practice yoga to for promoting their health.
- To provide the necessary knowledge of nature, characteristics and development of Indian philosophy.
- To give them a basic understanding of Definition of psychology, Methods of psychological sciences like Introspection method, Observation method, Case study method and Observation method.
- To aware about Scope and substance of Indian Psychology, Cognitive process like Sensation, Perception, Attention, Memory, Language, Thinking, Concept formation

and creativity, Extra sensory perception, Fundamentals of Attitudes, learning, motivation and emotion and aware of Yoga Psychology and Definition& characteristics of Personality and Indian approaches to Personality.

- To provide the necessary knowledge of Kriyas, Asanas, Mudras, Bandas, Pranayama and meditative postures.

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	The student can understand about the theory and practice of Yoga and its nature and scope.	1	Recall facts and basic concept
CO 2	Student can understand different types of yoga like Karma Yoga, Bhakti Yoga, Jnana Yoga, Raja yoga, Hatha yoga and Mantra Yoga, Meditation and Its nature and scope.	2	Recall facts and basic concept
CO 3	The student can understand human anatomy & physiology of Cell structure. Systems in the body like Skeletal system, Muscular system, Digestive system.	3	Explain ideas or concept
CO4	The student can understand the nature ,characteristics and development of Indian philosophy .The Patanjali Yoga Darsana and Mimamsa Darsana ,Jainism ,Buddhism Sankara , Visistadvaita Vedanta of Ramanuja and Dvaita Vedanta of Madhvacharya.	2	Apply
CO 5	The student can understand about basics of psychology, Methods of psychological sciences like Introspection method, Observation method, Case study method and Observation method.	4	Apply

Mapping of Course Outcomes to Program Outcomes:

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

COURSE CONTENTS

Unit	Details	Hours
I.	Yoga: Theory and practice of Yoga and its nature and scope, Different types of yoga like Karma Yoga, Bhakti Yoga, Jnana Yoga, Raja yoga, Hatha yoga and Mantra Yoga, Meditation and Its nature and scope.	3
II.	Human anatomy & physiology. Systems in the body like Skeletal system, Muscular system, Digestive system,.	3
III.	Nature ,characteristics and development of Indian philosophy .The Patanjali Yoga Darsana and Mimamsa Darsana ,Jainism ,Buddhism Sankara , Visistadvaita Vedanta of Ramanuja and Dvaita Vedanta of Madhvacharya.	2

IV.	Basics of psychology, Methods of psychological sciences like Introspection method, Observation method, Case study method and Observation method.	7
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Reference books:

1. Chatterjee S.C. & Datta D.M. (1968). An Introduction to Indian philosophy. 7 th ed. Calcutta: University of Calcutta.
2. Georg Feuerstein (2002) The Yoga Tradition: Its History, Literature, Philosophy and Practice. New Delhi. Bhavana Books & Prints.
3. Hiriyana, M (1932/2000) Outlines of Indian Philosophy. Delhi, Motilal Banarasidas
4. Hume, R.E. (ed.) (1921). The Thirteen Principal Upanishads. London: Oxford University Press.
5. Joshi, K.S. (1985) Yoga in daily life, Delhi : Orient paper backs
6. Mahesh Yogi,(1963). Transcendental meditation. New York: New American library.
7. Naranjo, C and Ornstein, R.E. (1974) on the psychology of meditation, New York: Viking press.
8. Rama, Swami (1992) Meditation and its practice. Honesdale : Himalayan International Institute of Yoga Science and Philosophy of USA.
9. Ramarao, R.(2006) Journey to Real self, Yoga chiatanya publications & Yoga consciousness trust, Vijnigiri, VZM.
10. Rao, P.V.K. (1999). Dhyanam. Nava Sahiti Book House, Vijayawada

YOGA PROGRAMME (SEM IV)

(15 HOURS, 1hr/week)

Teaching Scheme	Examination Scheme:
Lectures: 01Hr/Week	In SEM Exam:25 Marks
Practical:01 Hr/Week	End SEM Exam:25 Marks
	Continuous Assessment: 10 Marks
Credits: 1	Total Marks: 50 Marks

Course Objectives :

Upon completion of the course a student shall be able to understand –

- Relation between the yoga and health ,its use in preventive health care and diet management and how to apply this knowledge for memory dvelopment and maintain emotional balance also for stress management
- To provide the necessary knowledge of the various asana for disease and disorder management.
- To give them a basic understanding of yogic asna practice and panchkarma paractices.

- To use this knowledge for personality development and help to society to meet individual need.
- What are the teaching methods of yoga and how to be a trained yoga teacher.

Course Outcomes:

CO's	Course Outcomes	Bloom Taxonomy	
		Level	Descriptor
CO 1	Student able to understand the relation between Yoga and health, definition and importance of health, health according to WHO Dimensions of health, Mental, social and spiritual. Yogic concept of health and diseases.	1	Expalin reation between two concepts.
CO 2	Student able to understand Management of disease through yogic practice-Asanas like shatkarmas, pranayama, meditation, Yama and niyama: stress (emotions management) life style. Moderation in ahara, vihara, achara, vichara. Some system which can be cure by yogic kriyas- respiratory disorder - cardiovascular disorder.	2	Explain ideas or concept
CO 3	Student able to understand the Shatkarma techniques and their practice- Dhuti (kunjajal), Vajrasana, Danda dhuti, laghoo and poorna sankhaprakshalana, neti (sutra and jala) kapalbhati, agnisara, nauli. Panchakarma: Basti-Herbalized oil enemas, Nasya: Nasal irrigation, Vamana: Therapeutic vomiting, Virechana: Purgation Raktamokshana: Bloodletting.	2	Apply
CO 4	Student able to understand Suryanamaskar basics and how to practice it traditionally and variations in suryanamaskar based on patients, various benefits of suryanamaskars. Pranayama: Different types of pranayam and their practice. Practice of Meditation and different Mudras.	2	Apply
CO 5	Student able to understand various asanas (yogic postures) Standing Postures Ardha Chakrasana, Hastapadasana, Ardha Chakrasana, Trikonasana, Parivritta trikonasana, Parsvakonasana, Veersana, Sitting postures Paschimottanasana	6	Apply
CO 6	Student able to understand Methods of Teaching Yoga, Principles, Levels and Phases of Teaching, Quality of perfect Yoga Meaning and scope of Teaching methods, and factors influencing them; Role of Yoga Teachers in Individualized and group teaching; Techniques of mass instructions; Organization of teaching (Time Management, Discipline etc) The student will have demonstrations and training in the above mentioned aspects of teaching methods.	2	Apply

Mapping of Course Outcomes to Program Outcomes:

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

COURSE CONTENTS

Unit	Details	Hours
V.	Yoga and health: definition and importance of health, health according to WHO Dimensions of health, Mental, social and spiritual. Yogic concept of health and diseases.	1
VI.	Management of disease through yogic practice-Asanas like shatkarmas, pranayama, meditation, Yama and niyama: stress (emotions management) life style. Moderation in ahara, vihara, achara, vichara. Some system which can be cured by yogic kriyas- respiratory disorder - cardiovascular disorder etc	2
VII.	Practice of Shatkarma: Dhuti (kunjala), Vastra dhuti, danda dhuti, laghoo and poorna sankhaprakshalana, neti (sutra and jala) kapalabhati. Panchakarma: Basti-Herbalized oil enemas, Nasya: Nasal irrigation, Vamana: Therapeutic vomiting, Virechana: Purgation Raktamokshana: Bloodletting	2
VIII.	Suryanamaskar basics, Pranayama, Meditation and mudras, various asanas (yogic postures) Standing Postures Ardha Chakrasana, Hastapadasana, Ardha Chakrasana, Trikonasana, Parivritta trikonasana, Parsvakonasana, Veersana, Sitting postures Paschimottasana	8
IX.	Methods of Teaching Yoga, Principles, Levels and Phases of Teaching, Quality of perfect Yoga Meaning and scope of Teaching methods, and factors influencing them; Role of Yoga Teachers in Individualized and group teaching; Techniques of mass instructions; Organization of teaching (Time Management, Discipline etc)	2

Note: The student will have demonstrations and training in the above mentioned aspects of teaching methods

Reference books:

1. Chatterjee S.C. & Datta D.M. (1968). An Introduction to Indian philosophy. 7th ed. Calcutta: University of Calcutta.
2. Georg Feuerstein (2002) The Yoga Tradition: Its History, Literature, Philosophy and Practice. New Delhi. Bhavana Books & Prints.
3. Hiriyana, M (1932/2000) Outlines of Indian Philosophy. Delhi, Motilal Banarasidas
4. Hume, R.E. (ed.) (1921). The Thirteen Principal Upanishads. London: Oxford University Press.
5. Joshi, K.S. (1985) Yoga in daily life, Delhi: Orient paper backs
6. Mahesh Yogi, (1963). Transcendental meditation. New York: New American library.

7. Naranjo, C and Ornstein, R.E. (1974) on the psychology of meditation, New York: Viking press.
8. Rama, Swami (1992) Meditation and its practice. Honesdale : Himalayan International Institute of Yoga Science and Philosophy of USA.
9. Ramarao, R.(2006) Journey to Real self, Yoga chiatanya publications &Yoga consciousness trust, Vijinigiri, VZM.
10. Rao, P.V.K. (1999). Dhyanam. Nava Sahiti Book House, Vijayaw