SHRI SHANKARACHARYA TECHNICAL CAMPUS
SHRI SHANKARACHARYA GROUP OF INSTITUTION
Faculty of Pharmaceutical Sciences
(An Autonomous Institution)
SCHEME OF TEACHING AND EXAMINATION (Effective from 2020 – 2021 Batch)
Courses of Study and Scheme of Examination of Pharmacy
Bachelor in Pharmacy (Third Semester)

Sl. No.	Board of Studies (BOS)	Course Code	Courses	Internal Assessment				End Semester		Total Marks	Credit
				TA	Sessional		Total	Marks	Duration		
					CA	Durati					
1.	Pharmacy	PH108301	Pharmaceutical Organic Chemistry – II – Theory (BP301T)	10	15	1 Hr	25	75	3 Hrs	100	4
2.	Pharmacy	PH108302	Physical Pharmaceutics – I – Theory (BP302T)	10	15	1 Hr	25	75	3 Hrs	100	4
3.	Pharmacy	PH108303	Pharmaceutical Microbiology – Theory (BP303T)	10	15	1 Hr	25	75	3 Hrs	100	4
4.	Pharmacy	PH108304	Pharmaceutical Engineering – Theory (BP304T)	10	15	1 Hr	25	75	3 Hrs	100	4
5.	Pharmacy	PH108305	Pathophysiology	10	15	1 Hr	25	75	3 Hr	100	4
6.	Pharmacy	PH108391	Pharmaceutical Organic Chemistry – II – Practical (BP305P)	5	10	4 Hr	15	35	4 Hrs	50	2
7.	Pharmacy	PH108392	Physical Pharmaceutics – I – Practical (BP306P)	5	10	4 Hr	15	35	4 Hrs	50	2
8.	Pharmacy	PH108393	Pharmaceutical Microbiology – Practical (BP307P)	5	10	4 Hr	15	35	4 Hrs	50	2
9.	Pharmacy	PH108394	Pharmaceutical Engineering – Practical (BP308P)	5	10	4 Hr	15	35	4 Hrs	50	2
Total				**70**	**115**	**21**	**185**	**515**	**31Hrs**	**700**	**28**

L-Lecture T-Tutorial P-Practical
CT-Class Test TA-Teachers Assessment ESE-End Semester Exam

Subject Code PH108301	Pharmaceutical Organic Chemistry – II – Theory(BP301T)	L=3	T =1	P =	Credits= 4
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	75	15	10	100	3 Hours

Course Objectives	Course Outcomes
Upon completion of thiscourse the student Should be able to: • Write the structure, name and the type of isomerism of the organic compound. • Write the reaction, name the reaction and orientation of reactions. • Account for reactivity/stability of compounds. • Prepare organic compounds.	On successful completion of the course, the student will be able to: **CO1:**-Illustrate the structure, name and the type of reactions shown by Benzene, Phenols and Aromatic Amines. (Level 2) **CO2:**-Employ the reaction and analytical constants to classify the Fats and oils. (Level 3) **CO3:**-Deduce structure, synthesis and medicinal uses of polynuclear hydrocarbons. (Level 4) **CO4:**-Illustrate structure, theory and synthesis of cycloalkanes. (Level 4)

UNIT– I : **CO1**

- **Benzene and its derivatives**
  a) Analytical, synthetic and other evidence in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel'srule
  b) Reactions of benzene - nitration, sulphonation, halogenation-reactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation.
  c) Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction
  d) Structure and uses of DDT, Saccharin, BHC andChloramine**10 Hours**

UNIT– II : **CO2**

- **Phenols* -** Acidity of phenols, effect of substituents on acidity, qualitativetests, Structure and uses of phenol, cresols, resorcinol, naphthols
- **Aromatic Amines* -** Basicity of amines, effect of substituents on basicity,and synthetic uses of aryl diazoniumsalts.**10 Hours**

UNIT-III : **CO3**

- **Fats and Oils**
  a) Fatty acids –reactions.
  b) Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Dryingoils.
  c) Analyticalconstants–Acidvalue,Saponificationvalue,Estervalue,Iodinevalue, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination. **10 hours**

UNIT- IV: **CO4**

- **Poly-nuclear hydrocarbons:**
  a) Synthesis,reactions
  b) Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives **8 hours**

UNIT-V : **CO4**

- **Cyclo alkanes***

  Stabilities– Baeyer'sstrain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainlessrings), reactions of cyclopropane and cyclobutane only. **7 hours**

- **Endocrinesystem**
  Classification of hormones, mechanism of hormone action, structure and functions of the pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders. **7 hours**

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Subject Code PH108391	Pharmaceutical Chemistry – II – Practical (BP305P)	L =	T =	P = 4	Credits = 2
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	35	10	5	50	3 Hrs

List of Experiments

I Experiments involving laboratory techniques

- Recrystallization
- Steam distillation

II Determination of following oil values (including standardization ofreagents)

- Acid value
- Saponification value
- Iodine value

III Preparation of compounds

- Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol/Aniline by acylation reaction.
- 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/Acetanilide by halogenation (Bromination) reaction.
- 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid /Nitro benzene by nitration reaction.
- Benzoic acid from Benzyl chloride by theoxidation reaction.
- Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate byhydrolysis reaction.
- 1-Phenyl azo-2-napthol from Aniline by diazotization and couplingreactions.
- Benzil from Benzoin by theoxidation reaction.
- Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction
- Cinnammic acid from Benzaldehyde by Perkin reaction
- P-Iodo benzoic acid from P-amino benzoic acid.

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Organic chemistry	I.L Finar	Sixth	Pearson

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Organic chemistry	Morrison &boyd	sixth	Pearson
2	Text book of organic chemistry	B.S Bahl&ArunBahl	22nd	S.Chand

Physical Pharmaceutics I PH108302	Physical Pharmaceutics I – Theory(BP302T)	L=3	T =1	P =4	Credits= 4
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	75	15	10	100	3 Hours

Course Objective	Course Outcomes
Upon the completion of the course student shall be able to 1. Understand various physicochemical properties of drug molecules in the designing the dosage form 2. Know the principles of chemical kinetics & to use them in assigning expiry date for formulation 3. Demonstrate the use of physicochemical properties in the evaluation of dosage forms. 4. Appreciate physicochemical properties of drug molecules in formulation research and development	On successful completion of the course, the student will be able to: **CO1** Illustrate various theories related to the solubility expression and partition related to the drug. (Blooms Level- II Understanding) **CO2** Define and recall fundamental concept of buffer and physical theories of matter in the development of dosage forms. (Blooms Level- I Remembering) **CO3** Interpret the scientific concepts of micrometrics in connection with characterization and evaluation of dosage forms. (Blooms Level- III Applying) **CO4** Understand the significance of complexation in pharmaceutical products and interpret the properties of plasma proteins binding for the distributive properties of drugs in the body. (Blooms Level- II Understanding)

UNIT-I **CO 1**

The solubility of drugs: Solubility expressions, mechanisms of solute- solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, Dissolution & drug release, diffusion principles in biological systems. The solubility ofagas in liquids, the solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions, azeotropic mixtures, fractional distillation. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications **10 Hours**

UNIT- II **CO2**

States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols-inhalers, relative humidity, liquid

complexes, liquid crystals, glassy states, solid-crystalline, amorphous & polymorphism.

Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications **10 Hours**

UNIT-III **CO3**

Micromeretics: Particle size and distribution, average 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: like, porosity, packing arrangement, densities, bulkiness & flow properties. **10 Hours**

UNIT-IV **CO4**

Complexation and protein binding: Introduction, Classification of Complexation,Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

8 Hours

UNIT-V **CO2**

pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.

7 Hours

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Essentials of Physical Pharmaceutics	C V S Subramanyam	Third	CBS Publishers & Distributors
2	Physical Pharmacy	Manavalan.	Third	Vignesh Publishers

Reference books:

S. No.	Title	Authors	Edition	Publisher
1	Physical Pharmaceutics	Shotton, E	Third	London: Oxford University
2	Martin's Physical Pharmacy and Pharmaceutical Sciences	Sinko, Patric J	Third	Philadelphia: Lippincott

Physical Pharmaceutics I PH108392	Physical Pharmaceutics I – Theory(BP306P)	L=3	T =1	P =4	Credits= 2
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	35	10	5	50	4 Hours

PRACTICAL: **4 Hours/week**

1. Determination the solubility of drug at room temperature
2. Determination of pKa value by Half Neutralization/ Henderson Hassel Balch equation.
3. Determination of Partition co- efficient of benzoic acid in benzene and water
4. Determination of Partition co- efficient of Iodine in CCl_4 and water
5. Determination of % composition of NaCl in a solution using phenol-water system by CST method
6. Determination of particle size, particle size distribution using sieving method
7. Determination of particle size, particle size distribution using Microscopic method
8. Determination of bulk density, true density and porosity
9. Determine the angle of repose and influence of lubricant on angle of repose
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

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	Essentials of Physical Pharmaceutics	C V S Subramanyam	Third	CBS Publishers & Distributors
2	Experimental pharmaceutics	Eugene, Parott.	Third	Burgess Publisher
3	Laboratory manual of physical pharmaceutics	C.V.S. Subramanyam	First	CBS Publishers & Distributors

Reference books:

S. No.	Title	Authors	Edition	Publisher
1	Physical Pharmaceutics	Shotton, E	Third	London: Oxford University
2	Martin's Physical Pharmacy and Pharmaceutical Sciences	Sinko, Patric J	Third	Philadelphia: Lippincott

Subject Code PH108303	Pharmaceutical Microbiology – Theory (BP303T)	L=3	T =1	P =	Credits= 4
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	75	15	10	100	3 Hours

Course Objectives	Course Outcomes
Upon completion of this course, the student should be able to: • Importance of sterilization in microbiology. and pharmaceutical industry • Learn sterility testing of pharmaceutical products. • Microbiological standardization of Pharmaceuticals. • Understand cell culture technology and its applications in pharmaceutical industries.	On successful completion of the course, the student will be able to: **CO1:** Understand the scope, classification, historical developments, importance and application of microbiology in pharmaceutical sciences and environment. **CO2**: Explain the microbiology of bacteria, bacterial genetics and the etiology, pathophysiology, symptoms, prevention and treatment of diseases with their effect on the environment and society. **CO3:** Describe the microbiology of fungi and viruses and the etiology, pathophysiology, symptoms, prevention and treatment of viral diseases and fungal infections with their effect on the environment and society. **CO4:** Study and describe equipment's, preparation and sterilization of culture media, aseptic transfer techniques, streak plate, pour plate, spread plate, plate count and direct microscopy methods. **CO5:** Understand spoilage and cell culture technology and its applications in pharmaceutical industries.

UNIT– I: **CO1**

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 phase contrast microscopy, dark field microscopy and electron microscopy. **10 Hour**

UNIT-II : **CO2**

Identification of bacteria using staining techniques (simple, Gram's &Acid fast staining) and biochemical tests (IMViC). Study of principle, procedure, merits, demerits, and applications of the physical, chemical, and mechanical sterilization method. Evaluation of the efficiency of sterilization methods. Equipment's employed in large scale sterilization, sterility indicators. **10 Hour**

UNIT- III: **CO3**

Study of morphology, classification, reproduction/replication and cultivation of Fungi and Virus. 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. **10 hours**

UNIT-IV : **CO4**

Designing of aseptic area, laminar flow equipment; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification. Principles and methods of the different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids. Assessment of a new antibiotic and testing of antimicrobial activity of a new substance. General aspects-environmental cleanliness. **08 hours**

UNIT-V : **CO5**

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 products using antimicrobial agents, evaluation of microbial stability of formulations. Growth of animal cells in culture, the general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research. **07 Hour**

		October 2020	1.00	Applicable for AY 2020-21 Onwards
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Subject Code PH108393	Pharmaceutical Microbiology – Practical (BP307P)	L =	T =	P = 4	Credits = 2
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	35	10	5	50	3 Hrs

List of Experiments

1. Introduction and study of different types of equipment and processing, e.g., B.O.D. Incubator, Laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub-culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods- Simple, Grams staining and acid-fast staining (Demonstration with practical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test (IMViC reactions)
11. Revision Practical Class

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Pharmaceutical Microbiology	W.B. Hugo and A.D. Russel	First	Blackwell Scientific publications, Oxford London. .
2	Industrial Microbiology	Prescott and Dunn	Fourth	C.B.S. Publishers & Distributors, Delhi

3	Microbiology	Pelczar, Chan Kreig	Second	Tata McGraw Hill en
4.	Pharmaceutical Microbiology	N.K.Jain: Pharmaceutical	Five	Vallabh Prakashan, Delhi

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Pharmaceutical Microbiology	Malcolm Harris	First	Miamisburg, OH, U.S.A
2	Fundamentals of Microbiology	Probisher, Hinsdill et al. Fundamentals of	Ninth	Eastern press
3	Tutorial Pharmacy	Cooper and Gunn's	Eleventh	C.B.S. Publisher

Subject Code PH108304	Pharmaceutical Engineering – Theory (BP304T)	L=3	T =1	P =	Credits= 4
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	75	15	10	100	3 Hours

Course Objective	Course Outcomes
The graduates of the programme will demonstrate: 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 the significance of plant lay out a design for optimum use of resources. 6. To appreciate the various preventive methods used for corrosion control in Pharmaceutical industries.	After completion of the course, the students will be able to: 1. Illustrate the fluid flow with mixing of ingredients and explain the importance of size reduction and size separation in Pharmaceutical Industry. 2. Explain the concept of crystallization with role of evaporation, drying and heat transfer mechanisms in manufacturing of pharmaceutical dosage form. 3. Apply the filtration and centrifugation methods for separation of Ingredients. 4. Identify the materials used for the pharmaceutical plant construction with the factors of corrosion with hazards that affect the plant safety.

UNIT-I **CO1**

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.

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.

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 &Silver son Emulsifier.

10 Hours

UNIT-II **CO2**

Crystallization: Objectives, applications, & theory of crystallization. Solubility curves, principles, construction, working, uses, merits and demerits of the Agitated batch crystallizer, Swenson Walker Crystallizer, Krystal crystallizer, Vacuum crystallizer. Caking of crystals, factors affecting caking & prevention of caking.

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.

Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

10 Hours

UNIT- III **CO2**

Drying: Objectives, applications & mechanism of thedrying 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.

Distillation: Objectives, applications & types of distillation. principles, construction, working, uses, merits and demerits of (lab scale and industrial scale) Simple distillation, preparation of purified water and water for injection BP by distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation.

10 Hours

UNIT- IV **CO3**

Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. The principle Construction, Working, uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seidtz filter.

Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi-continuous centrifuge & super centrifuge.

8 Hours

UNIT- V **CO4**

Plant location, industrial hazards and plant safety: Plant Layout, utility and services, Mechanical hazards, Chemical hazards, Fire hazards, explosive hazards and their safety.
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 their prevention. Ferrous and nonferrous metals, inorganic and organic non-metals.
Material handling systems: Objectives & applications of Material handling systems, different types of conveyors such as belt, screw and pneumatic conveyors.

7 Hours

Recommended Books (Latest Editions)

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 – Mcabe 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.

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7. D. K. Tripathi, Industrial Pharmacy (A comprehensive Approach), PharmaMed Press, Hyderabad.

8. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.

9. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

Subject Code PH108394	Pharmaceutical Engineering – Practical (BP308P)	L =	T =	P = 4	Credits = 2
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	35	10	5	50	3 Hrs

PRACTICAL: **4 Hours/week**

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 the 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, 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 a 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.

Recommended Books (Latest Editions)

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 – Mcabe 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.

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8. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.

9. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Subject Code PH108305	Pathophysiology – Theory (BP204T)	L=3	T =1	P =	Credits= 4
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	75	15	10	100	3 Hours

Course Objectives	Course Outcomes
Upon completion of this course, the student should be able to: • Describe the etiology and pathogenesis of the selected disease states; • Name the signs and symptoms of the diseases; and • Mention the complications of the diseases.	On successful completion of the course, the student will be able to: **CO1:** Explain mechanisms involved in the process of inflammation and cell injury **CO2**Interpretating the pathophysiology of diseases of the cardiovascular, respiratory, renal, endocrine, nervous, haematological and gastrointestinal system **CO3:** Explain the pathophysiology of haematological, GIT, and nervous system diseases **CO4:** Study of the pathophysiology of inflammatory, Bone, Cancer and different infective diseases

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

UNIT– I: **CO1**

Basic principles of Cell injury and Adaptation:

Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury**,** Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage)**,** Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia)**,** Cell swelling, Intracellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis &Alkalosis, Electrolyte imbalance.

The basic mechanism involved in the process of inflammation and repair:

Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis

10 Hour

UNIT-II : **CO2**

- **Cardiovascular System:**
  Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis)
- **Respiratory system:** Asthma, Chronic obstructive airways diseases.
- **Renal system:** Acute and chronic renal failure

10 Hour

UNIT- III: **CO3**

- **Haematological Diseases:** Iron deficiency, megaloblastic anaemia (Vit B12 and folic acid), sickle cell anaemia, thalassemia, hereditary acquired anaemia, haemophilia
- **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones
- **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.
- **Gastrointestinal system:** Peptic Ulcer

10 hours

UNIT-IV : **CO4**

- Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.
- **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout
- **Principles of cancer:** classification, etiology and pathogenesis of cancer
- **Diseases of bones and joints:** Rheumatoid Arthritis, Osteoporosis, Gout

UNIT-V : **08 hours** **CO4**

- **Infectious diseases:** Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infection
- **Sexually transmitted diseases:** AIDS, Syphilis, Gonorrhea

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07 Hour

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Textbook of Pathology	Harsh Mohan	Tenth	Jaypee Publications
2	Goodman Gilman's The Pharmacological Basis of Therapeutics	Laurence B, Bruce C, Bjorn K	Twelfth	McGraw-Hill
3	Textbook of Medical Physiology	Guyton A, John. E Hall	First	WB Saunders Company

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Davidson's Principles and Practice of Medicine	Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston	Twenty-one	London; ELBS/Churchill Livingstone
2	Roger Walker, Clive Edwards	; Clinical Pharmacy and Therapeutics	Third	Churchill Livingstone publication
3	Textbook of Pathology	Harsh Mohan	Six	Jaypee Publications

Scheme of Teaching and Examination
Bachelor of Pharmacy (B. Pharmacy)
IV - Semester

S.N.	Board of Study	Subject Code	Name of the course with PCI Code	Internal Assessment				End Semester Exams		Total Marks	Credit
				Continuous Mode	Sessional Exams		Total	Marks	Duration		
					Marks	Duration					
1	Pharmacy	PH108401	Pharmaceutical Organic Chemistry – III – Theory (BP401T)	10	15	1 Hr	25	75	3 Hrs	100	4
2	Pharmacy	PH108402	Medicinal Chemistry – I – Theory (BP402T)	10	15	1 Hr	25	75	3 Hrs	100	4
3	Pharmacy	PH108403	Physical Pharmaceutics – II – Theory (BP403T)	10	15	1 Hr	25	75	3 Hrs	100	4
4	Pharmacy	PH108404	Pharmacology – I – Theory (BP404T)	10	15	1 Hr	25	75	3 Hrs	100	4
5	Pharmacy	PH108405	Pharmacognosy – I – Theory (BP405T)	10	15	1 Hr	25	75	3 Hrs	100	4
6	Pharmacy	PH108491	Medicinal Chemistry – I – Practical (BP406P)	5	10	4 Hr	15	35	4 Hrs	50	2
7	Pharmacy	PH108492	Physical Pharmaceutics – II – Practical (BP407P)	5	10	4 Hrs	15	35	4 Hrs	50	2
8	Pharmacy	PH108493	Pharmacology – I – Practical (BP408P)	5	10	4 Hrs	15	35	4 Hrs	50	2
9	Pharmacy	PH108494	Pharmacognosy –I – Practical (BP409P)	5	10	4 Hrs	15	35	4 Hrs	50	2
Total				**70**	**115**	**21 Hrs**	**185**	**515**	**31 Hrs**	**700**	**28**

		October 2020	1.00	Applicable for AY 2020-21 Onwards
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Subject Code PH108401	Pharmaceutical Organic Chemistry – III – Theory (BP401T)	L=3	T =1	P =	Credits= 4
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	75	15	10	100	3 Hours

Course Objectives	Course Outcomes
Upon completion of this course the student should be able to: Imparts knowledge on stereo-chemical aspects of organic compounds and organic reactions, important named reactions, the chemistry of important organic heterocyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.	On successful completion of the course, the student will be able to: **CO1:-** Discuss the methods of preparation and properties of organic compounds. **CO2:-** Explain the stereo chemical aspects of organic compounds and stereo chemical reactions. **CO3:-** Interpret the reactivity/stability of compounds. **CO4:-** List the medicinal uses and other applications of organic compound.

UNIT– I : **CO1 and CO2**

Stereo isomerism

Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds Elements of symmetry, chiral and achiral molecules, DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers, Reactions of chiral molecules, Racemic modification and resolution of aracemic mixture. Asymmetric synthesis: partial and absolute. **10 hours**

UNIT-II : **CO2 and CO3**

Geometrical isomerism, Nomenclature of geometrical isomers (Cis Trans, EZ, Syn Anti systems), Methods of determination of configuration of geometrical isomers. Conformational isomerism in Ethane, n-Butane and Cyclohexane. Stereo isomerism in biphenyl compounds (Atropisomerism) and conditions for optical activity. Stereospecific and stereoselective reactions. **10 hours**

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UNIT- III: **CO1, CO2, CO3 and CO4**

Heterocyclic compounds:

Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/ derivatives Pyrrole, Furan, and Thiophene –Relative aromaticity, reactivity and Basicity of pyrrole.

10 hours

UNIT-IV : **CO1, CO2 and CO4**

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.

8 hours

UNIT-V : **CO1, CO3 and CO4**

Reactions of synthetic importance

Metal hydride reduction ($NaBH_4$ and $LiAlH_4$), Clemmensen reduction, Birch reduction, Wolff Kishner reduction.Oppenauer-oxidation and Dakin reaction.Beckmanns rearrangement and Schmidt rearrangement.Claisen-Schmidt condensation

7 hours

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Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Advanced Organic Chemistry	Arun Bahl, B.S. Bahl.	-	S.Chand
2	Heterocyclic Chemistry	Raj K. Bansal	-	New Age Publication, Delhi
3	Stereochemistry:Conformation and Mechanism	P.S. Kalsi	Eight	New Age Publication, Delhi

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Organic chemistry Vol. 1 and 2	I.L. Finar	Sixth	Pearson
2	Heterocyclic Chemistry	T.L. Gilchrist	-	Pearson
3	Stereochemistry of Organic Compounds	Ernest L. Eliel, Samuel H. Wilen	Eleventh	Wiley

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Subject Code PH108402	Medicinal Chemistry – I – Theory (BP402T)	L=3	T =1	P =	Credits= 4
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	75	15	10	100	3 Hours

Course Objectives	Course Outcomes
Upon completion of this course the student should be able to: • understand the chemistry of drugs with respect to their pharmacological activity • understand the drug metabolic pathways, adverse effect and therapeutic valueof drugs • know the Structural Activity Relationship (SAR) of adifferent class of drugs • write the chemical synthesis of some drugs	On successful completion of the course, the student will be able to: **CO1:-** Outline the importance of physicochemical properties and metabolism of drugs. **CO2:-**Distinguish the drugs acting on adrenergic nervous system with respect to their chemistry, SAR and pharmacological activity. **CO3:-** Distinguish the drugs acting on cholinergic nervous system with respect to their chemistry, SAR and pharmacological activity. **CO4:-**Distinguish the drugs acting on CNS with respect to their chemistry, SAR and pharmacological activity.

UNIT– I : **CO1**

- Introduction to Medicinal Chemistry
- History and development of medicinal chemistry
- Physicochemical properties in relation to biological action
- Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.
- Drug metabolism

Drug metabolism principles- Phase I and Phase II. Factors affecting drug metabolism including stereo chemical aspects. **10 Hours**

UNIT-II : **CO1**

Drugs acting on Autonomic Nervous System

Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine, Methyldopa, Clonidine,

Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine, Propylhexedrine. Agents with mixed mechanism: Ephedrine,Metaraminol.

Adrenergic Antagonists:

Alpha adrenergic blockers: Tolazoline*, Phentolamine,Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.

- **Betaadrenergicblockers:** SAR of beta blockers, Propranolol*,Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Me toprolol, Labetolol, Carvedilol. **10 Hours**

UNIT- III: **CO2**

Cholinergic neurotransmitters:

Biosynthesis and catabolism of acetylcholine. Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents Direct acting agents: Acetylcholine, Carbachol*, Bethanechol,Methacholine, Pilocarpine.

Indirect acting/ Cholinesterase inhibitors (Reversible &Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.
Cholinesterase reactivator: Pralidoxime chloride.

Cholinergic Blocking agents: SAR of cholinolytic agents

Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyaminesulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.

Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolatehydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidinehydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT-IV : **CO3**

Drugs acting on Central Nervous System

A. Sedatives andHypnotics:

Benzodiazepines:SAR ofBenzodiazepines, Chlordiazepoxide, Diazepam*,Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturtes: SAR ofbarbiturates, Barbital*, Phenobarbital, Mephobarbital,Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous:

Amides & imides: Glutethmide.

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B. Antipsychotics

Phenothiazeines: SAR of Phenothiazeines– Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene,Loxapine succinate, Clozapine.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

C. **Anticonvulsants:** SARof Anticonvulsants**,** mechanism of anticonvulsantaction

Barbiturates: Phenobarbitone, Methabarbital.

Hydantoins: Phenytoin*, Mephenytoin, Ethotoin

Oxazolidine diones: Trimethadione, Paramethadione

Succinimides: Phensuximide, Methsuximide, Ethosuximide*

Miscellaneous: Primidone, Valproic acid , Gabapentin, Felbamate **10 hours**

UNIT-V : **CO4**

Drugs acting on Central Nervous System

General anaesthetics:

Inhalationanaesthetics: Halothane*, Methoxyflurane, Enflurane,Sevoflurane, Isoflurane, Desflurane.

Ultrashortactingbarbiturates: Methohexital sodium*, Thiamylalsodium, Thiopental sodium.

Dissociative anaesthetics: Ketamine hydrochloride.*

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphinesulphate, Codeine, Meperidine hydrochloride, Anileridinehydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartrate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphantartarate,Naloxone hydrochloride.

Anti-inflammatoryagents: Sodium salicylate, Aspirin, Mefenamic acid*,Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.**10 hours**

		October 2020	1.00	Applicable for AY 2020-21 Onwards
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Subject Code PH108491	Medicinal Chemistry – I – Practical (BP406P)	L =	T =	P = 4	Credits = 2
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	35	10	5	50	3 Hrs

List of Experiments
I Preparation of drugs/ intermediates • 1,3-pyrazole • 1,3-oxazole • Benzimidazole • Benzotriazole • 2,3- diphenyl quinoxaline • Benzocaine • Phenytoin • Phenothiazine • Barbiturate II Assay of drugs • Chlorpromazine • Phenobarbitone • Atropine • Ibuprofen • Aspirin • Furosemide III Determination of Partition coefficient for any two drugs

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Organic Chemistry Vol. II.	I.L. Finar,	fourth	LONGMANS, GREEN AND CO LTD
2	Organic medicinal and Pharmaceutical Chemistry	Wilson and Giswold's	12th	Lippincott Williams and Wilkins
3	Foye's Principles of Medicinal Chemistry	David A. Williams	7th	Lippincott Williams and Wilkins

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ReferenceBooks:

S. No.	Title	Authors	Edition	Publisher
1	The Organic Chemistry of Drug SynthesisVol. 1-5	Daniel Lednicer	2nd	Wiley
2	Text book of practical organic chemistry	A.I.Vogel.	5th	Pearson
3	Indian Pharmacopoeia		8th	IPC
4	Burger's Medicinal Chemistry, Vol I to IV	Donald J. Abraham (Editor), David P. Rotella (Editor)	7th	Wiley

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Physical Pharmaceutics I PH108403	Physical Pharmaceutics II – Theory(BP403T)	L=3	T =1	P =4	Credits= 4
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	75	15	10	100	3 Hours

Course Objective	Course Outcomes
Upon the completion of the course student shall be able to 1. Understand various physicochemical properties of drug molecules in the designing the dosage form 2. Know the principles of chemical kinetics & to use them in assigning expiry date for Formulation 3. Demonstrate the use of physicochemical properties in the evaluation of dosage 4. Appreciate physicochemical properties of drug Molecules in formulation research and Development course Content:	On successful completion of the course, the student will be able to: **CO-1** Execute the principles of chemical kinetics & to use them in assigning expiry date for Formulation. (Blooms Level-III applying) **CO-2** Compare and analyze disperse system in different pharmaceutical preparation and their stability. (Blooms Level-IV Analyzing) **CO-3** Measure the concept and fundamentals related to surface &interfacial tension behavior of pharmaceutical dosage form. (Blooms Level- V Evaluate) **CO-4** Measure the flow properties of liquids is important for pharmacist working in the manufacture of several dosage forms. (Blooms Level- V evaluation

UNIT-1 **CO 1**

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid-base catalysis, Simple numerical problems. Stabilization of medicinal agents against common reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention **10Hrs**

UNIT-2 **CO4**

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, on-Newtonian systems, pseudo plastic, dilatants, plastic, thixotropy, thixotropy in formulation,determination of viscosity, capillary, falling Sphere, rotational viscometers

Deformation of solids: Plastic and elastic deformation, Heckle equation, Stress, Strain ,elastic Modulus

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UNIT3 **CO2**

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Physical stability of emulsions, preservation of emulsions, rheological properties of emulsions, phase equilibria and emulsion formulation. **10Hrs**

UNIT-4 **CO3**

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surfaceactive agents, HLB Scale, solubilisation, detergency, adsorption at a solid interface.

8 Hrs

UNIT-5 **CO2**

Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties.Effect of electrolytes, coacervation, peptization& protective action

8 Hrs

Text Books:

S.No.	Title	Authors	Edition	Publisher
1	A Text book of Physical Pharmaceutics	C V S Subramanyam	Third	CBS Publishers & Distributors
2	Physical Pharmacy	Manavalan.	Third	Vignesh Publishers
3	Physical Pharmacy	Agarwal, S.P and Khanna, Rajesh	First	CBS Publishers & Distributors

Reference books:

S. No.	Title	Authors	Edition	Publisher
1	Physical Pharmaceutics	Shotton, E	Third	London: Oxford University
2	Martin's Physical Pharmacy and Pharmaceutical Sciences	Sinko, Patric J	Third	Philadelphia: Lippincott

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Physical Pharmaceutics II PH108492	Physical Pharmaceutics II – Theory(BP407P)	L=3	T =1	P =4	Credits= 2
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	35	10	5	50	4 Hours

Course Objective	Course Outcomes
Upon the completion of the course student shall be able to 1. Understand various physicochemical properties of drug molecules in the designing the dosage form 2. Know the principles of chemical kinetics & to use them in assigning expiry date for Formulation 3. Demonstrate the use of physicochemical properties in the evaluation of dosage 4. Appreciate physicochemical properties of drug Molecules in formulation research and Development course Content:	On successful completion of the course, the student will be able to: **CO-1** Execute the principles of chemical kinetics & to use them in assigning expiry date for Formulation. (Blooms Level-III applying) **CO-2** Compare and analyze disperse system in different pharmaceutical preparation and their stability. (Blooms Level-IV Analyzing) **CO-3** Measure the concept and fundamentals related to surface &interfacial tension behavior of pharmaceutical dosage form. (Blooms Level- V Evaluate) **CO-4** Measure the flow properties of liquids is important for pharmacist working in the manufacture of several dosage forms. (Blooms Level- V evaluation

PRACTICAL: **4 Hours/week**

1. Determination of surface tension of given liquids by drop count and drop weight method
2. Determination of HLB number of a surfactant by saponification method
3. Determination of Freundlich and Langmuir constants using activated char coal
4. Determination of critical micellar concentration of surfactants
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 first order.
10. Determination of reaction rate constant second order
11. To study about Accelerated stability studies

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Text Books:

S.No.	Title	Authors	Edition	Publisher
1	A text book of Physical Pharmaceutics	C V S Subramanyam	Third	CBS Publishers & Distributors
2	Experimental pharmaceutics	Eugene, Parott.	Third	Burgess Publisher
3	Laboratory manual of physical pharmaceutics	C.V.S. Subramanyam	First	CBS Publishers & Distributors

Reference books:

S. No.	Title	Authors	Edition	Publisher
1	Physical Pharmaceutics	Shotton, E	Third	London: Oxford University
2	Martin's Physical Pharmacy and Pharmaceutical Sciences	Sinko, Patric J	Third	Philadelphia: Lippincott

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Subject Code PH108404	Pharmacology – I – Theory(BP404T)	L=3	T =1	P =	Credits= 4
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	75	15	10	100	3 Hours

Course Objective	Course Outcomes
Upon completion of this course the student should be able to: • Understand the pharmacological actions of different categories of drugs. • Explain the mechanism of drug action at organ system/subcellular/ macromolecular levels. • Apply basic pharmacological knowledge in the prevention and treatment of various diseases. • Observe the effect of drugs on animals by simulated experiments. • Appreciate correlation of pharmacology with other biomedical sciences	On successful completion of the course, the student will be able to: **CO1:-** Discussion of basic principles of pharmacology. **CO2:-** Explain the principle of Pharmacokinetic and pharmacodynamic. **CO3:-** Classify recently available drugs; explain the mechanism of action, target receptors, adverse effects, drug interaction, contraindication and therapeutic uses of drugs in the autonomic nervous system. **CO4:-** Explain pharmacology of different drugs act in the central nervous system

UNIT-I **CO1**

General Pharmacology

a. **Introduction to Pharmacology-** Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists(competitive and non-competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.

b. **Pharmacokinetics-** Membrane transport, absorption, distribution, metabolism and excretion of drugs.Enzyme induction, enzyme inhibition, kinetics of elimination.

10 Hours

UNIT-II **CO2**

General Pharmacology

General Pharmacology

a. **Pharmacodynamics-** Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. Drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme-linked receptors, JAK-STAT binding receptor and receptors that regulate transcription factors transmembrane dose response relationship

b. Adverse drug reactions.

c. Drug interactions (pharmacokinetic and pharmacodynamic)

d. Drug discovery and clinical evaluation of new drugs –Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

12 Hours

UNIT-III **CO3**

Pharmacology of peripheral nervous system

a. Organization and function of ANS.

b. .Neurohumoral transmission,co-transmission and classification of neurotransmitters.

c. Parasympathomimetics, Parasympatholytics, Sympathomimetics, sympatholytics.

d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).

e. Local anaesthetic agents.

f. Drugs used in myasthenia gravis and glaucoma. **10 Hours**

UNIT-IV **CO4**

Pharmacology of central nervous system

a. Neurohumoral transmission in the C.N.S.special emphasis on theimportance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.

b. General anaesthetics and pre-anaesthetics**.**

c. Sedatives, hypnotics and centrally acting muscle relaxants.

d. Anti-epileptics

e. Alcohols and disulfiram. **8 Hours**

UNIT-V **CO4**

Pharmacology of central nervous system

a. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.

b. Drugs used in Parkinson's disease and Alzheimer’s disease.

c. CNS stimulants and nootropics.

d. Opioid analgesics and antagonists

e. Drug addiction, drug abuse, tolerance and dependence. **7 Hours**

		October 2020	1.00	Applicable for AY 2020-21 Onwards
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Subject Code PH108493	Pharmacology – I – Practical (BP408P)	L =	T =	P = 4	Credits = 2
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	35	10	5	50	3 Hrs

PRACTICAL:

- Introduction to experimental pharmacology.
- Commonly used instruments in experimental pharmacology.
- Study of common laboratory animals.
- Maintenance of laboratory animals as per CPCSEA guidelines.
- Common laboratory techniques. Blood withdrawal, serum and plasma separation, anaesthetics and euthanasia used for animal studies.
- Study of different routes of drugs administration in mice/rats.
- Study of theeffect 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.
- 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.
- Study of stereotype and anti-catatonic activity of drugs on rats/mice.
- Study of anxiolytic activity of drugs using rats/mice.
- Study of local anaesthetics by different methods

Text Books

S. No.	Title	Authors	Edition	Publisher
1	Essentials of Medical Pharmacology	KD.Tripathi	Six	Jaypeebrothers medical publishers, New Delhi.
2	Robbins &Cortan Pathologic Basis of Disease	Robbins Pathology	Nine	Elsevier
3	The Pharmacological Basis of Therapeutics	Goodman andGillman‘s	Second	Mcgraw Hill
4	Principles of Pharmacology, The Pathophysiologic basis of drug Therapy	Armen H, TashjianJr, EhrinJ,Armstrong, April W, Armstrong	First	Wolters, Kluwer-Lippincott Williams & WilkinsPublishers
5	Principles and Practice of Medicine	Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson’s	21st edition	ELBS/Churchill Livingstone
6	Handbook of Experimental Pharmacology	S.K. Kulkarni	First	VallabhPrakashan
7	Screening Methods in Pharmacology	RobertA.Turner	First	Elsevier
8	Practical Manual of Experimental and Clinical Pharmacology	BikashMedhi, Ajay Prakash	First	Jaypee brothers’ medical publishers Pvt.Ltd
9	Rodents for Pharmacological Experiments	Dr.Tapan Kumarchatterjee	Fifth	Pharmamed Press

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ReferenceBooks:

S. No.	Title	Authors	Edition	Publisher
1	The Pharmacological Basis of Therapeutics	Goodman andGillman's	Second	Mcgraw Hill
2	Principles of Pharmacology, The Pathophysiologic basis of drug Therapy	Armen H, TashjianJr, EhrinJ,Armstrong,	First	Wolters, Kluwer-Lippincott Williams & WilkinsPublishers

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Subject Code PH108405	Pharmacognosy – I – Theory (BP405T)	L=3	T =1	P =	Credits= 4
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	75	15	10	100	3 Hours

Course Objectives	Course Outcomes
This subject deal with the study of natural occurring crud drugs and their application in pharmaceutical industry.	On successful completion of the course, the student will be able to: **CO1-** Explain the term Pharmacognosy, its development, linkages to other branches of sciences & significance of study of natural products. **CO2-** Summarize the importance of "Plant tissue culture "in conservation of endangered species, improvement of crop and enhancement of secondary metabolites. **CO3-** Classify and articulate alternative medicine system & natural products with examples of alkaloids, glycosides, etc. **CO4-** Identify the natural fibers & primary metabolites including occurrence, chemistry, properties and estimation with various examples.

UNIT-I **CO1**

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 mucilage, oleoresins and oleo- gum -resins).

Classification of drugs:- Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

Quality control of Drugs of Natural Origin:- Adulteration of drugs of natural origin. Evaluation by Organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida. **10 Hours**

UNIT-II **CO1**

Cultivation, Collection, Processing and storage of drugs of natural origin:- Cultivation and Collection of drugs of natural origin, Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants **10 Hours**

UNIT-III **CO2**

Plant tissue culture:- Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines

7 Hours

UNIT-IV **CO3**

Pharmacognosy in various systems of medicine:- Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites:- Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins **10 Hours**

UNIT V **CO4**

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products:- Fibers - Cotton, Jute, Hemp, Hallucinogens, Teratogens, Natural allergens

Primary metabolites:- 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: **Carbohydrates:** Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain,serrati peptidase, urokinase, streptokinase, pepsin).

Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax **Marine Drugs:**Novel medicinal agents from marine sources **8 Hours**

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	

Subject Code PH108494	Pharmacognosy – I – Practical (BP408P)	L =	T =	P = 4	Credits = 2
Evaluation Scheme	ESE	CT	TA	Total	ESE Duration
	35	10	5	50	3 Hrs

List of Experiments
1. Analysis of crude drugs by chemical tests: (i) Tragacanth (ii) Acacia (iii)Agar (iv) Gelatin (v) starch (vi) Honey (vii) Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and paliside ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piecemicrometre
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Pharmacognosy and Pharmaco-biotechnology	Ashutosh Kar	5th	New Age International (P) Ltd., ©2007.
2	Textbook of Pharmacognosy and Phytochemistry	Jarald, Edwin E. and Edwin Jarald Sheeja	2nd	CBS Publishers & Distributors Pvt. Ltd
3	Shah and Qadry's Pharmacognosy	Qadry, J.S	17th	Eastern Publisher

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Pharmacognosy	Kokate C.K.,and Purohit. A.P.	40th	Nirali Prakashan, ©2008
2	Trease and Evans Pharmacognosy	Evans, W.C.	14th	Philadelphia : WB Saunders, ©1996
3	Text book of Pharmacognosy	Mohammed Ali	2nd	CBS Publishers & Distributors Pvt.
4	Cultivation of Medicinal Plants	Kokate, C.K.	2nd	Amazon Asia-Pacific Holdings Private Limited
5	Pharmacognosy and Phytochemistry -I	Rangari	1st	Career Publications
6	Pharmacognosy and Pharmaco biotechnology	Ashutosh Kar	2nd	New Age International (P) Ltd.

		October 2020	1.00	Applicable for AY 2020-21 Onwards
Chairman (AC)	Chairman (BoS)	Date of Release	Version	