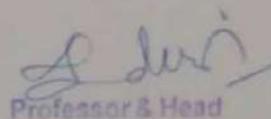


SRI PADMAVATI MAHILA VISVAVIDYALAYAM

INSTITUTE OF PHARMACEUTICAL TECHNOLOGY

COURSE OUTCOMES UG & PG



Professor & Head

Institute of Pharmaceutical Technology
Sri Padmavati Mahila Visvevidyalayam
(WOMEN'S UNIVERSITY)
Tirupati - 517 502

**INSTITUTE OF PHARMACEUTICAL TECHNOLOGY
SRI PADMAVATI MAHILA VISVVIDYALAYAM**

Accredited by NAAC with 'A' Grade

B. PHARMACY PROGRAM OUTCOMES

PO1:	Pharmacy Knowledge: Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.
PO2:	Planning Abilities: Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.
PO3:	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and elucidation of data and synthesis to provide valid conclusions.
PO4:	Problem analysis: Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions
PO5:	Modern tool usage: Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations
PO6:	Leadership skills: Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and wellbeing.
PO7:	Professional Identity: Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).
PO8:	Pharmaceutical Ethics: Honor personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.
PO9:	Communication: Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.
PO10:	The Pharmacist and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.
PO11:	Environment and sustainability: Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

B. PHARMACY COURSE OUTCOMES

SEMESTER: I

BP101T: Human Anatomy and Physiology – I

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

The outcomes of the course are

- Impart fundamental knowledge of the structure and functions of the various systems of the human body.
- Understand the various homeostatic mechanism of the human body.
- Understand the coordinated working pattern of different organs of systems viz., Cardio-vascular system, nervous system and skeletal system.

Would be able to perform the hematological tests like blood cell counts, hemoglobin estimation, bleeding/clotting time etc., and also record blood pressure, heart rate, pulse and respiratory volume

COURSE OUTCOMES

S. No.	Course Outcomes (CO)	Knowledge Level (Blooms Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Students would identify the gross morphology, structure and functions of cell, skeletal, muscular, cardiovascular system of the human body	L1: Remember L3: Apply
CO2	They would understand the various homeostatic mechanisms and their imbalances	L2: Understand L3: Apply L4: Analyse
CO3	Students would be able to identify the different types of bones in human body	L2: Understand L3: Apply L4: Analyse
CO4	Students would be able to analyse the various tissues of different systems of human body	L2: Understand L4: Analyse
CO5	Student will able to analyze the Cardiovascular system	L2: Understand L4: Analyse
CO6	They would have learnt various techniques like blood group determination, blood pressure measurement, blood cells counting	L2: Understand L4: Analyse

Bloom's Taxonomy: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5: Evaluate; L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

Course Outcomes	Program Outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	1	1	2	1	1	1	2	2
CO2	3	2	1	1	1	2	2	1	1	2	3
CO3	3	2	2	1	1	3	1	1	1	1	2
CO4	2	1	1	1	1	2	2	1	1	1	2
CO5	3	2	2	1	1	3	2	1	1	1	3
CO6	2	1	2	1	1	2	2	1	1	1	2
AVG	2.5	1.6	1.6	1	1	2.3	1.6	1	1	1.3	2.3

BP102T: PHARMACEUTICAL ANALYSIS – I

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

- This course deals with the fundamentals of analytical chemistry and principles of electrochemical analysis of drugs.
- Upon completion of the course student shall be able to
 - Understand the principles of volumetric and electro chemical analysis.
 - Carryout various volumetric and electrochemical titrations.
 - Gain skills in selecting analytical techniques for the estimation of drugs.
 - Understand the relevance and applications of analytical techniques in the pharmaceutical field.
 - Interpret choice of analytical techniques to perform the estimation of different categories of drugs.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	The fundamentals of pharmaceutical analysis, pharmacopoeia, volumetric analysis, sources and methods of minimizing errors, sources of impurities and methods to determine the impurities.	L1:Remember L2:Understand L3: Apply
CO2:	The need and basic principles of Acid-Base titrations and Non-aqueous titration their applications in pharmaceutical industry.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Concepts of complexometric titration, precipitation titrations, gravimetric analysis etc and their applications.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Concepts of oxidation and reduction, titrations involving them and their applications in pharmaceutical industry.	L3: Apply L4: Analyse L5: Evaluate
CO5:	The principle, types of electrodes, instrumentation and applications of Potentiometry, Conductometry and Polarography.	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	3	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	3	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student -teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	3	2	2	2	3	2	2	2	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	2	3	3	3	3	3	3	3	2	3
CO5	3	2	3	3	2	2	3	2	2	2	3	2
Avg	3	2.6	2.8	2.8	2.6	2.6	3	2.6	2.6	2.6	2.8	2.8

Course Content:

UNIT-I

10 Hours

(a) **Pharmaceutical analysis**- Definition and scope

i) Different techniques of analysis

ii) Methods of expressing concentration

iii) Primary and secondary standards.

iv) Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphate

(b)**Errors**: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.

(c)Pharmacopoeia, Sources of impurities in medicinal agents, limit tests.

UNIT-II

10 Hours

• **Acid base titration**: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves.

• **Non aqueous titration**: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl.

UNIT-III

10 Hours

• **Precipitation titrations**: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.

• **Complexometric titration**: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.

• **Gravimetry**: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.

• Basic Principles, methods and application of diazotisation titration.

UNIT-IV

08 Hours

Redox titrations

(a) Concepts of oxidation and reduction

(b) Types of redox titrations (Principles and applications) Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate

UNIT-V

07 Hours

• **Electrochemical methods of analysis**

• **Conductometry**- Introduction, Conductivity cell, Conductometric titrations, applications.

• **Potentiometry** - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.

- **Polarography** - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications.

BP108P. PHARMACEUTICAL ANALYSIS (Practical)

4 Hours / Week

I Limit Test of the following

- (1) Chloride
- (2) Sulphate
- (3) Iron
- (4) Arsenic

II Preparation and standardization of

- (1) Sodium hydroxide
- (2) Sulphuric acid
- (3) Sodium thiosulfate
- (4) Potassium permanganate
- (5) Ceric ammonium sulphate

III Assay of the following compounds along with Standardization of Titrant

- (1) Ammonium chloride by acid base titration
- (2) Ferrous sulphate by Cerimetry
- (3) Copper sulphate by Iodometry
- (4) Calcium gluconate by complexometry
- (5) Hydrogen peroxide by Permanganometry
- (6) Sodium benzoate by non-aqueous titration
- (7) Sodium Chloride by precipitation titration

IV Determination of Normality by electro-analytical methods

- (1) Conductometric titration of strong acid against strong base
- (2) Conductometric titration of strong acid and weak acid against strong base
- (3) Potentiometric titration of strong acid against strong base

Recommended Books: (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone, Press of University of London.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis.
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry.
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry.
5. John H. Kennedy, Analytical chemistry principles.
6. Indian Pharmacopoeia.

BP103T: PHARMACEUTICS-I

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L: T: P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

- Scope: This course is designed to impart a fundamental knowledge on the preparatory Pharmacy with arts and science of preparing the different conventional dosage forms.
- Upon completion of this course the student should be able to: Know the history of profession of pharmacy
- Understand the basics of different dosage forms, Pharmaceutical incompatibilities and pharmaceutical calculations
- Understand the professional way of handling the prescription
- Preparation of various conventional dosage forms

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Understand the Professional way of handling the prescription and describe the history of pharmacy, and pharmacy profession. posology & dose calculation of drug in children. Different types of dosage form	L1:Remember L2:Understand L3: Apply
CO2:	The formulation aspects of different dosage forms and do different pharmaceutical calculations, Understand basic requirement and formulation of powders and liquid dosage forms.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Understand basic requirement and formulation of liquid (monophasic& biphasic) dosage forms.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Will acquire knowledge in differentiating different dosage forms, pharmaceutical Incompatibilities. Learn basic requirement, formulation and evaluation of suppositories and pessaries.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Understand the mechanisms of drug penetration and also the factors influencing permeation through transdermal route Explain the formulation and evaluation of semisolid preparation such as ointment, gel cream etc.	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	1	2	2	2	2	1	2	1	2	2	1	2
CO4	1	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	1.6	1.4	1.8	1.8	2	1.4	1.8	1.4	2	1.8	1.6	2

Course Content:

UNIT-I

10 Hours

Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia. Dosage forms: Introduction to dosage forms, classification and definitions.

Prescription: Definition, Parts of prescription, handling of Prescription and Errors in prescription. Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

UNIT – II

10 Hours

Pharmaceutical calculations: Weights and measures – Imperial & Metric system, Calculations involving percentage solutions, allegation, proof spirit and isotonic solutions based on freezing point and molecular weight.

Powders: Definition, classification, advantages and disadvantages, Simple & compound powders – official preparations, dusting powders, effervescent, efflorescent and hygroscopic powders, eutectic mixtures. Geometric dilutions.

Liquid dosage forms: Advantages and disadvantages of liquid dosage forms.

Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques.

UNIT – III

08 Hours

Monophasic liquids: Definitions and preparations of Gargles, Mouthwashes, Throat Paint, Eardrops, Nasal drops, Enemas, Syrups, Elixirs, Liniments and Lotions.

Biphasic liquids: Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension & stability Problems and methods to overcome.

Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation & stability problems and methods to overcome.

UNIT – IV

08 Hours

Suppositories: Definition, types, advantages and disadvantages, types of bases, methods of preparations. Displacement value & its calculations, evaluation of suppositories. Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

UNIT – V.

07 Hours

Semisolid dosage forms: Definitions, classification, mechanisms and factors influencing dermal penetration of drugs. Preparation of ointments, pastes, creams and gels. Excipients used in semi solid dosage forms. Evaluation of semisolid dosages forms.

BP109P. PHARMACEUTICS I (Practical)

3 Hours / week

1. Syrups
 - a) Syrup IP'66
 - b) Compound syrup of Ferrous Phosphate BPC'68
2. Elixirs
 - a) Piperazine citrate elixir
 - b) Paracetamol pediatric elixir
3. Linctus
 - a) Terpin Hydrate Linctus IP'66
4. Solutions
 - b) Iodine Throat Paint (Mandles Paint)
 - a) Strong solution of ammonium acetate
 - b) Cresol with soap solution
 - c) Lugol's solution
5. Suspensions
 - a) Calamine lotion
 - b) Magnesium Hydroxide mixture
 - c) Aluminium Hydroxide gel
6. Emulsions
 - a) Turpentine Liniment
 - b) Liquid paraffin emulsion
7. Powders and Granules
 - a) ORS powder (WHO)
 - b) Effervescent granules
 - c) Dusting powder
 - d) Divided powders
8. Suppositories
 - a) Glycerol gelatin suppository
 - b) Cocoa butter suppository
 - c) Zinc Oxide suppository
9. Semisolids
 - a) Sulphur ointment
 - b) Non staining-iodine ointment with methyl salicylate
 - c) Carbopol gel
10. Gargles and Mouthwashes
 - a) Iodine gargles
 - b) Chlorhexidine mouthwash

Recommended Books: (Latest Editions)

1. H.C. Ansel et al., Pharmaceutical Dosage Form and Drug Delivery System, Lippincott Williams and Walkins, New Delhi.
2. Carter S.J., Cooper and Gunn's-Dispensing for Pharmaceutical Students, CBS publishers, Delhi.
3. M.E. Aulton, Pharmaceutics, The Science & Dosage Form Design, Churchill Livingstone, Edinburgh.
4. Indian pharmacopoeia.
5. British pharmacopoeia.
6. Lachmann. Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.
7. Alfonso R. Gennaro Remington. The Science and Practice of Pharmacy, Lippincott Williams, New Delhi.
8. Carter S.J., Cooper and Gunn's. Tutorial Pharmacy, CBS Publications, New Delhi.
9. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, English Language Book Society, Elsevier Health Sciences, USA.
10. Isaac Ghebre Sellassie: Pharmaceutical Pelletization Technology, Marcel Dekker, INC, New York.
11. Dilip M. Parikh: Handbook of Pharmaceutical Granulation Technology, Marcel Dekker, INC, New York.

BP104T: PHARMACEUTICAL INORGANIC CHEMISTRY**Credits: T- 4, P-2****Sessional Marks: 25 (T), 15(P)****L:T:P- 3:1:4****University Exams: 75 (T), 35(P)****Course Objectives**

To learn and understand the monographs of inorganic drugs and pharmaceuticals.

Upon completion of course student shall be able to

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

Course Outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Discuss Impurities in pharmaceutical substances, General methods of preparation, assay for the compounds,.	L1: Remember L2: Understand L3: Apply
CO2:	Acids, Bases and Buffers, Major extra and intracellular electrolytes: Functions of major physiological ions, Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc, eugenol cement.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Gastrointestinal agents, Acidifiers: Ammonium chloride, Cathartics, Antimicrobials: Mechanism, classification	L3: Apply L4: Analyse L5: Evaluate
CO4:	Expectorants, Emetics: Sodium potassium tartarate, Haematinics: Ferrous sulphate*, Ferrous gluconate, Poison and Antidote, Astringents	L3: Apply L4: Analyse L5: Evaluate
CO5:	Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α , β , γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I131	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	2	2	2	2	1	2	2
CO2	3	2	2	2	2	1	1	1	2	2	1	2
CO3	3	2	2	2	2	1	2	2	2	2	1	2
CO4	3	1	2	2	2	2	2	1	2	2	2	2
CO5	3	2	2	2	2	2	2	2	2	2	2	2
Avg	3	1.8	1.8	1.8	2	1.6	1.8	1.6	2	1.8	1.6	2

Course Content:

BP104T. PHARMACEUTICAL INORGANIC CHEMISTRY (Theory)

UNIT I

10 Hours

□ Impurities in pharmaceutical substances: History of Pharmacopoeia, Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphate

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

UNIT II

10 Hours

□ **Acids, Bases and Buffers**: Buffer equations and buffer capacity in general, buffers in pharmaceutical systems, preparation, stability, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

□ Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance.

□ Dental products: Dentifrices, role of fluoride in the treatment of dental caries, Desensitizing agents, Calcium carbonate, Sodium fluoride, and Zinc eugenol cement.

UNIT III

10 Hours

□ **Gastrointestinal agents**

Acidifiers: Ammonium chloride* and Dil. HCl Antacid: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture
Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

Antimicrobials: Mechanism, classification, Potassium permanganate, Boric acid, Hydrogen peroxide*, Chlorinated lime*, Iodine and its preparations

UNIT IV

08 Hours

□ **Miscellaneous compounds**

Expectorants: Potassium iodide, Ammonium chloride*. Emetics: Copper sulphate*, Sodium potassium tartarate Haematinics: Ferrous sulphate*, Ferrous gluconate Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite
Astringents: Zinc Sulphate, Potash Alum

UNIT V

07 Hours

□ **Radiopharmaceuticals**: Radio activity, Measurement of radioactivity, Properties of α , β , γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I131, Storage conditions, precautions & pharmaceutical application of radioactive substances.

BP110P. PHARMACEUTICAL INORGANIC CHEMISTRY (Practical)

4 Hours / Week

I Limit tests for following ions

Limit test for Chlorides and Sulphates

Modified limit test for Chlorides and Sulphates

Limit test for Iron

Limit test for Heavy metals

Limit test for Lead

Limit test for Arsenic

II Identification test

Magnesium hydroxide

Ferrous sulphate

Sodium bicarbonate

Calcium gluconate

Copper sulphate

III Test for purity

Swelling power of Bentonite

Neutralizing capacity of aluminum hydroxide gel

Determination of potassium iodate and iodine in potassium Iodide

IV Preparation of inorganic pharmaceuticals

Boric acid

Potash alum

Ferrous sulphate

Recommended Books (Latest Editions)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London, 4th edition.
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry, 3rd Edition
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand& Chatwal, Inorganic Pharmaceutical Chemistry
7. Indian Pharmacopoeia

BP105T.COMMUNICATION SKILLS (Theory)

Credits: T- 2, P-1

Sessional Marks: 15 (T), 10(P)

L:P- 2:2

University Exams: 35 (T), 15(P)

Course objectives

- This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.
- Upon completion of the course the student shall be able to
 - Understand the behavioral needs for a pharmacist to function effectively in the areas of pharmaceutical operation
 - Communicate effectively (Verbal and Nonverbal)
 - Effectively manage the team as a team player
 - Develop interview skills
 - Develop Leadership qualities and essentials

Course Outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to		
CO1:	Explain need of communication skills, barriers to communicate effectively.	L1:Remember L2:Understand L3: Apply
CO2:	Demonstrate perspectives of communication required to function effectively in areas of pharmaceutical operation	L3: Apply L4: Analyse L5: Evaluate
CO3:	Apply various elements, styles of communications, Basic listening skills, writing skills to communicate effectively and manage team as team player	L3: Apply L4: Analyse L5: Evaluate
CO4:	Apply Interview skills presentation skills and group discussion for development of leadership qualities and essentials	L3: Apply L4: Analyse L5: Evaluate
CO5:	Demonstrate and apply basic communication skills and advance learning skills	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	3	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	3	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student - teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	3	2	2	2	1	3	2	1	2
CO2	2	2	2	3	2	2	1	2	3	2	2	2
CO3	2	2	2	3	2	2	2	2	3	2	2	1
CO4	2	2	2	3	2	1	2	2	3	2	2	2
CO5	2	2	2	3	2	2	2	2	3	2	2	2
Avg	1.8	2	1.8	3	2	1.8	1.8	1.8	3	2	1.8	1.8

BP106RBT: REMEDIAL BIOLOGY

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

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

- Upon completion of the course student shall be able to
 - Cell biology (Basic Nature of Plant cell and Animal cell)
 - Classification System of both Plants & Animals
 - Various tissue system and organ system in plant and animals
 - Theory of evolution
 - Anatomy and Physiology of plants and animals

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Discuss characters of living organisms, Diversity in the living world, Binomial nomenclature, Five kingdoms of life and basis of classification. Salient features of Monera, Protista, Fungi, Animalia and Plantae, Virus,.	L1:Remember L2:Understand L3: Apply
CO2:	Composition of blood, blood groups, coagulation of blood, Composition and functions of lymph, Human circulatory system, Structure of human heart and blood vessels, Cardiac cycle, cardiac output and ECG, Digestion and Absorption, Breathing and respiration	L3: Apply L4: Analyse L5: Evaluate
CO3:	Excretory products and their elimination, Neural control and coordination, Chemical coordination and regulation, Endocrine glands and their secretions, Human reproduction	L3: Apply L4: Analyse L5: Evaluate
CO4:	Plants and mineral nutrition and Photosynthesis	L3: Apply L4: Analyse L5: Evaluate
CO5:	Plant respiration: Respiration, glycolysis, fermentation (anaerobic). Plant growth and development, Phases and rate of plant growth, Condition of growth, Introduction to plant growth regulators, Cell - The unit of life	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6:Create

How program outcomes are assessed:

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student -teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	2	2	2	1	2
CO4	1	1	2	2	2	2	2	1	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2
Avg	1.8	1.8	1.8	1.8	2	1.6	1.8	1.6	2	1.8	1.6	2

Course Content:

UNIT I

07 Hours

Living world:

- Definition and characters of living organisms
- Diversity in the living world
- Binomial nomenclature
- Five kingdoms of life and basis of classification. Salient features of Monera,
- Protista, Fungi, Animalia and Plantae, Virus, Classification of drugs:

Morphology of Flowering plants

- Morphology of different parts of flowering plants – Root, stem, inflorescence, flower, leaf, fruit, seed.
- General Anatomy of Root, stem, leaf of monocotyledons & Dicotyledons.

UNIT II

07 Hours

Body fluids and circulation

- Composition of blood, blood groups, coagulation of blood
- Composition and functions of lymph
- Human circulatory system
- Structure of human heart and blood vessels
- Cardiac cycle, cardiac output and ECG

Digestion and Absorption

- Human alimentary canal and digestive glands
- Role of digestive enzymes
- Digestion, absorption and assimilation of digested food

Breathing and respiration

- Human respiratory system
- Mechanism of breathing and its regulation
- Exchange of gases, transport of gases and regulation of respiration
- Respiratory volumes

UNIT III

07 Hours

Excretory products and their elimination

- Modes of excretion
- Human excretory system- structure and function
- Urine formation
- Renin angiotensin system

Neural control and coordination

- Definition and classification of nervous system
- Structure of a neuron
- Generation and conduction of nerve impulse
- Structure of brain and spinal cord
- Functions of cerebrum, cerebellum, hypothalamus and medulla oblongata

Chemical coordination and regulation

- Endocrine glands and their secretions
- Functions of hormones secreted by endocrine glands

Human reproduction

- Parts of female reproductive system
- Parts of male reproductive system
- Spermatogenesis and Oogenesis
- Menstrual cycle

UNIT IV 05 Hours

Plants and mineral nutrition:

- Essential mineral, macro and micronutrients
- Nitrogen metabolism, Nitrogen cycle, biological nitrogen fixation

Photosynthesis

- Autotrophic nutrition, photosynthesis, Photosynthetic pigments, Factors affecting
- photosynthesis.

UNIT V 04 Hours

Plant respiration: Respiration, glycolysis, fermentation (anaerobic).

Plant growth and development

- Phases and rate of plant growth, Condition of growth, Introduction to plant growth
- regulators

Cell - The unit of life

- Structure and functions of cell and cell organelles. Cell division

Tissues

- Definition, types of tissues, location and functions.

Text Books

- a. Text book of Biology by S. B. Gokhale
- b. A Text book of Biology by Dr. Thulajappa and Dr. Seetaram.

Reference Books

- a. A Text book of Biology by B.V. Sreenivasa Naidu
- b. A Text book of Biology by Naidu and Murthy
- c. Botany for Degree students By A.C. Dutta.
- d. Outlines of Zoology by M. Ekambaranatha ayyer and T. N. Ananthakrishnan.
- e. A manual for pharmaceutical biology practical by S.B. Gokhale and C. K. Kokate

BP112RBP.REMEDIAL BIOLOGY (Practical) 2 Hours/Week**Course outcomes**

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Study of Microscope, Section cutting techniques, Mounting and staining, Permanent slide preparation.	L1:Remember L2:Understand L3: Apply
CO2:	Study of cell and its inclusions,Determination of blood group	L3: Apply L4: Analyse L5: Evaluate
CO3:	Study of Stem, Root, Leaf, seed, fruit, flower and their modifications	L3: Apply L4: Analyse L5: Evaluate
CO4:	Detailed study of frog by using computer models	L2:Understand L3: Apply L4: Analyse
CO5:	Microscopic study and identification of tissues pertinent to Stem, Root,Leaf, seed, fruit and flower	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

EVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	1	2	2	2	2	2	1	2	2
CO2	1	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	1	2	2	1	2
CO4	1	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	1	2	2	2	2	2	2	2	2	2
Avg	1.6	1.4	1.8	1.8	2	1.4	1.8	1.4	2	1.8	1.6	2

Course Content

BP112RBP.REMEDIAL BIOLOGY

(Practical) 2 Hours/Week

1. Introduction to experiments in biology
 - a) Study of Microscope
 - b) Section cutting techniques
 - c) Mounting and staining
 - d) Permanent slide preparation
2. Study of cell and its inclusions
3. Study of Stem, Root, Leaf, seed, fruit, flower and their modifications
4. Detailed study of frog by using computer models
5. Microscopic study and identification of tissues pertinent to Stem, Root, Leaf, seed, fruit and flower
6. Identification of bones
7. Determination of blood group
8. Determination of blood pressure
9. Determination of tidal volume

Reference Books

1. Practical human anatomy and physiology. by S.R.Kale and R.R.Kale.
2. A Manual of pharmaceutical biology practical by S.B.Gokhale, C.K.Kokate and S.P.Shriwastava.
3. Biology practical manual according to National core curriculum .Biology forum of Karnataka. Prof .M.J.H.Shafi

Course objectives

- This is an introductory course in mathematics. This subject deals with the introduction to Partial fraction, Logarithm, matrices and Determinant, Analytical geometry, Calculus, differential equation and Laplace transform.
- Upon completion of the course the student shall be able to
 - Know the theory and their application in Pharmacy.
 - Solve the different types of problems by applying theory.
 - Appreciate the important application of mathematics in Pharmacy.
 - Apply mathematical concepts and principles to perform computations for Pharmaceutical Sciences.
 - To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to		
CO1:	Solve systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigen vectors.	L1: Remember L2: Understand L3: Apply
CO2:	Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Find partial derivatives numerically and symbolically and use them to analyse and interpret the way a function varies.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Acquire the Knowledge maxima and minima of functions of several variable.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Apply mathematical knowledge in solving Pharmacokinetic equations and chemical kinetics.	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	3	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	3	2	2	2	2	2	1	2	2
CO2	2	2	2	3	2	2	1	1	2	2	1	2
CO3	1	2	2	3	2	2	2	1	2	2	1	1
CO4	1	2	2	3	2	1	2	1	2	2	2	2
CO5	2	2	2	3	2	2	2	2	2	2	2	2
Avg	1.6	2	1.8	3	2	1.8	1.8	1.4	2	1.8	1.6	1.8

SEMESTER-II

BP201T: Human Anatomy and Physiology - II

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

The outcomes of the course are

- Impart fundamental knowledge on the structure and functions of the various systems of the human body.
- Understand the gross morphology, structure and functions of various organs systems of the human body.
- Understand the coordinated working pattern of different organs of systems viz., Cardio-vascular system, Gastro intestinal system, Endocrine system, Urinary and Respiratory system, Basic of genetics.
- Would be able to perform the haematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc., and also record blood pressure, heart rate, pulse and respiratory volume.

COURSE OUTCOMES:

S. No.	Course Outcomes (CO)	Knowledge Level (Blooms Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Students would learn the gross morphology, structure and functions of various organs of the human body.	L1: Remember L3: Apply
CO2	They would understand the various homeostatic mechanisms and their imbalances	L2: Understand L4: Analyse
CO3	Students would be able to Describe the various homeostatic mechanisms and their imbalance along with interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body	L2: Understand L4: Analyse
CO4	Students would be able to Explain the various tissues and organs of different systems of human body with coordinated working pattern of different organs of each system	L2: Understand L4: Analyse
CO5	Student will able to Describe the hematological tests like blood cell counts, haemoglobin estimation, bleeding/clotting time etc and also record blood pressure, heart rate, pulse and respiratory volume	L2: Understand L4: Analyse
CO6	They would have learnt physiology of cardiovascular, digestive, respiratory, urinary and reproductive system	L2: Understand

Bloom's Taxonomy: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5: Evaluate; L6: Create

Course Outcomes and Program Outcomes (CO-PO) Mapping:

Course Outcomes	Program Outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	1	1	2	1	1	1	2	2
CO2	3	2	1	1	1	2	2	1	1	2	3
CO3	3	2	2	1	1	3	1	1	1	1	2
CO4	2	1	1	1	1	2	2	1	1	1	2
CO5	3	2	2	1	1	3	2	1	1	1	3
CO6	2	1	2	1	1	2	2	1	1	1	2
AVG	2.6	2.5	1.8	2.7	1	2.4	2.8	2.5	2.8	1.3	2.4

BP202T : PHARMACEUTICAL ORGANIC CHEMISTRY –I

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Upon completion of this course, the student is able to -

- Write the structure and name of organic compounds.
- Compare the types of isomerism.
- Write the reaction and its orientation.
- Acquire Knowledge of functional groups with their reaction mechanisms.
- Expertise in the reactivity/stability of compounds.
- Demonstrate identification of the unknown organic compounds.

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	2	2	2	2	2	2
CO2	3	2	2	2	2	2	2	2	2	2	2	2
CO3	3	2	2	2	2	2	1	2	2	2	1	2
CO4	3	2	2	2	3	2	1	2	1	2	1	2
CO5	3	3	3	3	3	2	1	2	1	2	1	2
CO6	3	3	2	3	3	2	1	2	1	2	2	2
Avg	3	2.3	2.2	2.3	2.5	2	2	2	1.5	2	1.3	2

BP203T : BIOCHEMISTRY

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Upon completion of this course, the student is able to understand –

- The biochemical organization of cell.
- The structure and functions of macromolecules in a cell.
- Different metabolic pathways.
- The role of enzymes, their nomenclature, kinetics and functions.
- Biological significance of vitamins, co-enzymes and minerals.

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	2	2	2	2	2	2
CO2	3	2	2	2	2	2	2	2	2	2	2	2
CO3	3	2	2	2	2	2	1	2	2	2	1	2
CO4	3	2	2	2	3	2	1	2	1	2	1	2
CO5	3	3	3	3	3	2	1	2	1	2	1	2
CO6	3	3	2	3	3	2	1	2	1	2	2	2
Avg	3	2.3	2.2	2.3	2.5	2	2	2	1.5	2	1.3	2

BP204T: Pathophysiology

Credits: T- 4, P-2

Sessional Marks: 25 (T)

L:T:- 3:1

University Exams: 75 (T)

Course Objectives

- Study the etiology and pathogenesis of the selected disease states.
- Name the signs, symptoms and complications of the diseases.
- Get a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms.

COURSE OUTCOMES:

S. No.	Course Outcomes (CO)	Knowledge Level (Blooms Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Students would Describe the etiology and pathogenesis of the selected disease states	L1: Remember L3: Apply
CO2	They would understand the signs and symptoms of the diseases	L2: Understand L3: Apply
CO3	Students would be able to identify the complications of the diseases	L2: Understand L3: Apply L4: Analyse
CO4	Students would be able to analyse the etiology and pathogenesis of the selected disease states	L2: Understand L4: Analyse
CO5	Student will able to analyze the signs and symptoms of the diseases pertaining to CVS, Edocrine system, Nervous system, GI system, Respiratory system, Renal system, bones joints, cancer, Heametological diseases, sexually transmitted diseases, infectious diseases	L2: Understand
CO6	They would have learnt complications of the diseases	L2: Understand L4: Analyse

Bloom's Taxonomy: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5: Evaluate; L6: Create

Course Outcomes and Program Outcomes (CO-PO) Mapping:

Course Outcomes	Program Outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	1	1	2	1	1	1	2	2
CO2	3	2	1	1	1	2	2	1	1	2	3
CO3	3	2	2	1	1	3	1	1	1	1	2
CO4	2	1	1	1	1	2	2	1	1	1	2
CO5	3	2	2	1	1	3	2	1	1	1	3
CO6	2	1	2	1	1	2	2	1	1	1	2
AVG	2.5	1.6	1.6	1	1	2.3	1.6	1	1	1.3	2.3

BP205 T. COMPUTER APPLICATIONS IN PHARMACY (Theory)

Credits: T- 3, P-1

Sessional Marks: 25 (T), 10(P)

L:P- 3:2

University Exams: 50 (T), 15(P)

Course objectives

- This subject deals with the introduction Database, Database Management system, computer application in clinical studies and use of databases.
- Upon completion of the course the student shall be able to
 - know the various types of application of computers in pharmacy
 - know the various types of databases
 - know the various applications of databases in pharmacy

Course Outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	know the various types of application of computers in pharmacy	L1:Remember L2:Understand L3: Apply
CO2:	Understand Concept of Information Systems and Software, various types of databases like MYSQL, MS ACCESS, Pharmacy Drug database, Number systems, Web technologies and Bioinformatics	L3: Apply L4: Analyse L5: Evaluate
CO3:	Apply computer knowledge for Chromatographic data analysis(CDS), Laboratory Information management System (LIMS) and Text Information Management System(TIMs)	L3: Apply L4: Analyse L5: Evaluate
CO4:	Use MS Word, MS Access for designing questionnaire, form to record patient information, creating patient database, mailing labels, invoice table, and generate reports	L3: Apply L4: Analyse L5: Evaluate
CO5:	Create HTML web page, Export Tables, Queries, Forms and Reports to web pages and XML Pages	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	3	Assignments/ Internals
PO5:	Modern Tool Usage	3	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student - teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	3	2	2	2	1	1	2	1	2
CO2	2	2	2	3	2	2	1	2	2	2	2	2
CO3	2	2	2	3	2	2	2	2	2	2	2	1
CO4	2	2	2	3	2	1	2	2	2	2	2	2
CO5	2	2	2	3	2	2	2	2	2	2	2	2
Avg	1.8	2	1.8	3	2	1.8	1.8	1.8	1.8	2	1.8	1.8

BP 206 T. ENVIRONMENTAL SCIENCES (Theory)**Credits: T- 3****Sessional Marks: 25 (T)****L- 3****University Exams: 50 (T)****Course objectives**

- Environmental Sciences is the scientific study of the environmental system and the status of its inherent or induced changes on organisms. It includes not only the study of physical and biological characters of the environment but also the social and cultural factors and the impact of man on environment.
- Upon completion of the course the student shall be able to:
 - Create the awareness about environmental problems among learners.
 - Impart basic knowledge about the environment and its allied problems.
 - Develop an attitude of concern for the environment.
 - Motivate learner to participate in environment protection and environment improvement.
 - Strive to attain harmony with Nature.

Course Outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to		
CO1:	Understand Multidisciplinary nature of environmental studies Natural Resources Renewable and non-renewable resources, associated problems.	L1:Remember L2:Understand L3: Apply
CO2:	Understand, explain and Draw Structure and function of various ecosystem.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Understand Environmental Pollution and its remedial methods to reduce it.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Role of an individual in conservation of natural resources.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Acquire skills to help the concerned individuals in identifying and solving environmental problems.	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	3	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	3	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student - teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

○ Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	3	2	2	2	1	2	2	2	2
CO2	2	2	2	3	2	2	1	2	2	2	2	2
CO3	2	2	2	3	2	2	2	2	2	2	2	2
CO4	2	2	2	3	2	1	2	2	2	2	2	2
CO5	2	2	2	3	2	2	2	2	2	2	2	2
Avg	1.8	2	1.8	3	2	1.8	1.8	1.8	2	2	2	2

SEMESTER-III

BP301T : PHARMACEUTICAL ORGANIC CHEMISTRY –II

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

Upon completing the course, the student

- Shall be able to write the structure, name, synthesis, and the reactions of the aromatic compounds like benzene, naphthalene, anthracene, and cycloalkanes (cyclopropane and cyclobutane).
- Able to compare the reactivity of organic compounds.
- Understand the concept of resonance.
- Chemistry of fats and oils are also included and students will understand analytical constants' applications like acid value, saponification value, and ester value useful in the quality assurance of oils and fats.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	2	2	2	2	2	2	2
CO2	3	2	2	2	2	2	2	2	2	2	2	2
CO3	3	2	2	2	2	2	1	2	2	2	1	2
CO4	3	2	2	2	3	2	1	2	1	2	1	2
CO5	3	3	3	3	3	2	1	2	1	2	1	2
CO6	3	3	2	3	3	2	1	2	1	2	2	2
Avg	3	2.3	2.2	2.3	2.5	2	2	2	1.5	2	1.3	2

Course Outcomes and Program Outcomes (CO-PO) Mapping:

BP302T. PHYSICAL PHARMACEUTICS-I

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

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

Upon the completion of the course student shall be able to

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

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Understand the mechanisms of solute solvent interactions Study the limitations and applications of Distribution law	L1:Remember L2:Understand L3: Apply
CO2:	Study the use of physicochemical properties in formulation research and development	L3: Apply L4: Analyse L5: Evaluate
CO3:	Acquire skills and working knowledge of the principles and concepts of surface tension and its measurement	L3: Apply L4: Analyse L5: Evaluate
CO4:	Understand the various intermolecular forces involved in the formation of complexes and its applications.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Learn the steps involved in the preparation of pharmaceutical buffers and its importance	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	1	2	2	1	2
CO4	2	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	2	1.4	1.8	1.8	2	1.4	1.8	1.4	2	1.8	1.6	2

Course Content:

UNIT-I

10 Hours

Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications

UNIT-II

10Hours

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.

UNIT-III

08 Hours

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

UNIT-IV

08Hours

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.

UNIT-V

07 Hours

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.

BP306P. PHYSICAL PHARMACEUTICS – I (Practical)

1. Determination the solubility of drug at room temperature 4 Hrs/week
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 byCST method
6. Determination of surface tension of given liquids by drop count and drop weightmethod
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.

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Dispersesystems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

BP303T: PHARMACEUTICAL MICROBIOLOGY

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

- This course deals with the fundamentals of microbiology and methods of application of microbiology in pharmacy
- Upon completion of the course student shall be able to
 - Understand methods of identification, cultivation and preservation of various microorganisms
 - To understand the importance and implementation of sterilization in pharmaceutical processing and industry
 - Learn sterility testing of pharmaceutical products.
 - Carried out microbiological standardization of Pharmaceuticals.
 - Understand the cell culture technology and its applications in pharmaceutical industries..

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Students will be able to acquire, articulate, retain and apply specialized language and knowledge relevant to microbiology.	L1:Remember L2:Understand L3: Apply
CO2:	Students will acquire and demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Students will communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Students will demonstrate isolation of and identification of microbes.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Students can able to design microbiology laboratory considering all the aspects of safety	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6:Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	1	Assignments/ Internals
PO5:	Modern Tool Usage	3	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	1	2	2	2	1	2	2
CO2	2	2	2	2	1	1	1	1	2	2	1	2
CO3	1	2	2	2	2	1	2	1	2	2	1	2
CO4	1	1	1	2	2	1	2	1	1	2	2	2
CO5	2	1	2	1	2	2	2	2	2	2	2	2
Avg	1.5	1.4	1.7	1.8	2	1.4	1.8	1.5	2	1.8	1.6	2

Course Content:

Unit I

10 Hours

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.

Unit II

10 Hours

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

Unit III

10 Hours

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.

Unit IV

08 Hours

Designing of aseptic area, laminar flow equipments; 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.

Unit V

07Hours

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, general procedure for cell culture, Primary, established and transformed cell cultures. Application of cell cultures in pharmaceutical industry and research

BP 307P.

PHARMACEUTICAL MICROBIOLOGY (Practical) 4 Hrs/week

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

BP304: PHARMACEUTICAL ENGINEERING

Credits: T- 4

Sessional Marks: 25 (T)

L:T:P- 3:1:4

University Exams: 75 (T)

Course objectives

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

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

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

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to		
CO1:	Understand the concepts of Flow of fluids, Size reduction and size separation with importance of various equipment used in these Unit operations	L1:Remember L2:Understand L3: Apply
CO2:	Analyze and evaluate the fundamentals of Heat transfer and the basic concepts and equipment used for evaporation and distillation with their applications in pharmaceutical industry.	L2:Understand L4: Analyse L5: Evaluate
CO3:	Impart knowledge on various types of equipment and applications of Drying and Mixing operations in Pharmaceutical industry	L3: Apply L4: Analyse L5: Evaluate
CO4:	Understand and apply the concepts of centrifugation and filtration process and their applications in pharmaceutical industry.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Understands about different materials of construction, various types of corrosion and preventive methods used for Corrosion control in Pharmaceutical industries.	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	2	1	2	2	1	2
CO3	1	2	2	2	2	1	2	1	2	2	2	2
CO4	1	1	2	2	2	1	2	1	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2
Avg	1.6	1.6	1.8	1.8	2	1.4	2	1.4	2	1.8	1.8	2

SEMESTER -IV

BP401T: PHARMACEUTICAL ORGANIC CHEMISTRY - III

Credits: T- 4
L:T:P- 3:1

Sessional Marks: 25 (T)
University Exams: 75 (T)

Course Objectives

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

1. understand the methods of preparation and properties of organic compounds
2. explain the stereo chemical aspects of organic compounds and stereo chemical reactions
3. know the medicinal uses and other applications of organic compounds

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Stereo isomerism Optical isomerism –Optical activity, enantiomerism, diastereoisomerism, meso compounds, Elements of symmetry, chiral and achiral molecules, DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers, Reactions of chiral molecules, Racemic modification and resolution of racemic mixture. Asymmetric synthesis: partial and absolute	L1: Remember L2: Understand L3: Apply
CO2:	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	L3: Apply L4: Analyse L5: Evaluate
CO3:	Heterocyclic compounds: Nomenclature and classification Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrrole, Furan, and Thiophene Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene	L3: Apply L4: Analyse L5: Evaluate
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	L3: Apply L4: Analyse L5: Evaluate
CO5:	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	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	2	2	2	2	1	2	2
CO2	3	2	2	2	2	1	1	1	2	2	1	2
CO3	3	2	2	2	2	1	2	2	2	2	1	2
CO4	3	1	2	2	2	2	2	1	2	2	2	2
CO5	3	2	2	2	2	2	2	2	2	2	2	2
Avg	3	1.8	1.8	1.8	2	1.6	1.8	1.6	2	1.8	1.6	2

Course Content
Theory 45 Hrs.

UNIT-I 10Hours

Stereo isomerism, Optical isomerism – Optical activity, enantiomerism, diastereoisomerism, meso compounds

Elements of symmetry, chiral and achiral molecules

DL system of nomenclature of optical isomers, sequence rules, RS system of nomenclature of optical isomers, Reactions of chiral molecules, Racemic modification and resolution of racemic mixture.

Asymmetric synthesis: partial and absolute

UNIT-II 10Hours

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

UNIT-III 10Hours

Heterocyclic compounds:

Nomenclature and classification, Synthesis, reactions and medicinal uses of following compounds/derivatives

Pyrrole, Furan, and Thiophene, Relative aromaticity and reactivity of Pyrrole, Furan and Thiophene

UNIT-IV 8Hours

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

UNIT-V 07Hours

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

Recommended Books (Latest Editions)

1. Organic chemistry by I.L. Finar, Volume-I & II.
2. A text book of organic chemistry – Arun Bahl, B.S. Bahl.
3. Heterocyclic Chemistry by Raj K. Bansal
4. Organic Chemistry by Morrison and Boyd
5. Heterocyclic Chemistry by T.L. Gilchrist

BP402T: MEDICINAL CHEMISTRY-I

Credits: T- 4

Sessional Marks: 25 (T)

University Exams: 75 (T)

Course objectives

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

Objectives:

Upon completion of the course the student shall be able to

1. understand the chemistry of drugs with respect to their pharmacological activity
2. understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. know the Structural Activity Relationship (SAR) of different class of drugs
4. write the chemical synthesis of some drugs

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	The students will acquire wide knowledge on drug metabolic pathways (Phase-I and II) and factors effecting metabolism	L1: Remember L2: Understand L3: Apply
CO2:	To understand the different chemical aspects along with the synthesis, mode of action, medicinal benefits for Sympathomimetics and Sympatholytics.	L2: Understand L3: Apply
CO3:	The student shall understand the synthetic methods as well as the basic structural requirements, pharmacophoric features as well as the structural activity relationships for drugs acting on cholinergic system	L2: Understand L3: Apply
CO4:	The student shall understand the role of various drugs acting on Central nervous system. The students shall apply their knowledge in understanding the synthesis, SAR and medicinal benefits of Antiepileptics, Antipsychotics, sedatives and hypnotics.	L2: Understand L3: Apply
CO5:	The student shall understand the structural aspects and synthesis of various agents used as Narcotic and non narcotic analgesics, Non steroidal Antiinflammatory agents and drugs applied in Local anaesthesia.	L2: Understand L3: Apply

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	1	2	2	1	2
CO4	2	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	2	1.6	1.8	1.8	2	1.4	1.8	1.4	2	2	1.6	2

Course Content:

BP402T. MEDICINAL CHEMISTRY – I (Theory) 45 Hours

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

UNIT- I 10 Hours

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.

UNIT- II 10 Hours

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, 89 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. Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III 10 Hours

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, Isofluorophate, Echothiophate iodide, Parathione, Malathion. Cholinesterase reactivator: Pralidoxime chloride. Cholinergic Blocking agents: SAR of cholinolytic agents Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*. 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.

UNIT- IV 08 Hours

Drugs acting on Central Nervous System A. Sedatives and Hypnotics: Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem Barbiturates: SAR of barbiturates, Barbitol*, Phenobarbital, Mephobarbital, Amobarbital, Butobarbital, Pentobarbital, Secobarbital Miscellaneous: Amides & imides: Glutethimide. Alcohol & their carbamate derivatives: Meprobamate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde. B. Antipsychotics Phenothiazines: SAR of Phenothiazines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride. Ring Analogues of Phenothiazines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine. Fluorobutero-phenones: Haloperidol, Droperidol, Risperidone. Beta amino ketones: Molindone hydrochloride. Benzamides: Sulpiride. C. Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action Barbiturates: Phenobarbitone, Methobarbital. Hydantoins: Phenytoin*, Mephenytoin, Ethotoin Oxazolindiones: Trimethadione, Paramethadione Succinimides: Phensuximide, Methsuximide, Ethosuximide* Urea and monoacylureas: Phenacemide, Carbamazepine* Benzodiazepines: Clonazepam Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

UNIT – V 07 Hours

Drugs acting on Central Nervous System

General anesthetics: Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane. Ultra short acting barbiturates: Methohexital sodium*, Thiopental sodium. Dissociative anesthetics: Ketamine hydrochloride.* Narcotic and non-narcotic analgesics Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anileridine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate. 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.

BP406P. MEDICINAL CHEMISTRY – I (Practical) 4 Hours/Week I Preparation of drugs/intermediates 1 1,3-pyrazole 2 1,3-oxazole 3 Benzimidazole 4 Benzotriazole 5 2,3-diphenyl quinoxaline 6 Benzocaine 7 Phenytoin 8 Phenothiazine 9 Barbiturate II Assay of drugs 1 Chlorpromazine 2 Phenobarbitone 3 Atropine 4 Ibuprofen 5 Aspirin 6 Furosemide III Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

BP 403 T. PHYSICAL PHARMACEUTICS-II (Theory)

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

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

Pharmaceutical dosage forms.

Upon the completion of the course student shall be able to;

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

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Acquire working knowledge and understanding the concepts of colloids and its applications	L1:Remember L2:Understand L3: Apply
CO2:	Understand the flow behavior of fluids and also to identify suitable characteristics for each formulations	L3: Apply L4: Analyse L5: Evaluate
CO3:	Learn the formulation concepts of pharmaceutical suspensions and emulsions and their stability problems	L3: Apply L4: Analyse L5: Evaluate
CO4:	Explain the derived properties and flow properties of powders and its role in formulation development	L3: Apply L4: Analyse L5: Evaluate
CO5:	Study the reaction kinetics, reaction order, factors affecting the rate of the reactions	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	1	2	2	1	2
CO4	2	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	1	2	2	3	2	2	2
Avg	2	1.4	1.8	1.8	2	1.4	1.8	1.4	2.2	1.8	1.6	2

Course Content:

UNIT-I

10 Hours

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.

UNIT-II

10 Hours

Rheology: Newtonian systems, law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling Sphere, rotational viscometers. Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus

UNIT-III

10 Hours

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in Suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

UNIT-IV

10Hours

Micromeritics: 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.

UNIT-V

10 Hours

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.

BP 407P. PHYSICAL PHARMACEUTICS- II (Practical) 3 Hrs/week

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 first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott. 3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

BP404T : Subject: Pharmacology-I**Credits: T- 4, P-2****Sessional Marks: 25 (T), 15(P)****L:T:P- 3:1:4****University Exams: 75 (T), 35(P)****Course objectives**

The outcomes of the course are

- To understand the pharmacological actions of different categories of drugs
- Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
- The basic pharmacological knowledge will be applied in the prevention and treatment of various diseases.
- To observe the effect of drugs on animals by simulated experiments and gain skill.
- The correlation of pharmacology with other bio medical sciences is appreciated.

I. COURSE OUTCOMES:

S. No.	Course Outcomes (CO)	Knowledge Level (Blooms Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Students would understand the pharmacological actions of different categories of drugs	L1: Remember L3: Apply
CO2	They would study in detailed about mechanism of drug action at organ system/sub cellular/ macromolecular levels	L2: Understand L4: Analyse
CO3	Students would be able to understand the application of basic pharmacological knowledge in the prevention and treatment of various diseases	L2: Understand L4: Analyse
CO4	Students would be able to observe the effect of drugs on animals by simulated experiments	L2: Understand L4: Analyse
CO5	Student will able to Analyze the adverse drug reactions, drug interaction and drug toxicity	L2: Understand L4: Analyse
CO6	They would have learnt synthesis, storage, release, physiological and pathological role of autocooids, their antagonist and explain the rational drug treatment of geriatric, peditric, pregnancy and lactation patients	L2: Understand L4: Analyse

Bloom's Taxonomy: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5: Evaluate; L6: Create

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	1	1	2	1	1	1	2	2
CO2	3	2	1	1	1	2	2	1	1	2	2
CO3	3	2	2	1	1	3	1	1	1	1	2
CO4	2	1	1	1	1	2	2	1	1	1	2
CO5	3	2	2	1	1	3	2	1	1	1	3
CO6	2	1	2	1	1	2	2	1	1	1	2
AVG	2.8	2	2	2	1	2	1	1	1	2.4	2

BP405T: PHARMACOGNOSY AND PHYTOCHEMISTRY I

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

- 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.
- Upon completion of the course student shall be able to
 - know the techniques in the cultivation and production of crude drugs.
 - know the crude drugs, their uses and chemical nature.
 - know the evaluation techniques for the herbal drugs.
 - carry out the microscopic and morphological evaluation of crude drugs

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Discuss the definition, history, scope and development of pharmacognosy.	L1:Remember L2:Understand L3: Apply
CO2:	Cultivation of medicinal plants, identification and evaluation, uses of crude drugs and identification and estimation of phytochemicals.	L3: Apply L4: Analyse L5: Evaluate
CO3:	In vitro industrial production of secondary metabolites by plant tissue culture technique. Describe different types of primary and secondary metabolites, their general properties, classification, and their test for identification.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Describe novel medicinal agents from marine sources. Describe the role of Pharmacognosy in allopathy and traditional system of medicine.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Describe the sources, chemical constituents and uses of plants products containing plant fibers, hallucinogens teratogens, and natural allergens.	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6:Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	2	2	2	1	2
CO4	1	1	2	2	2	2	2	1	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2
Avg	1.8	1.8	1.8	1.8	2	1.6	1.8	1.6	2	1.8	1.6	2

Course Content:

UNIT-I

10 Hours

Introduction to Pharmacognosy:

- (a) Definition, history, scope and development of Pharmacognosy
- (b) Sources of Drugs – Plants, Animals, Marine & Tissue culture
- (c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

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

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II

10 Hours

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

UNIT-III

10 Hours

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

UNIT-IV

08 Hours

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

UNIT-V

07 Hours

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 Primarymetabolites:

Carbohydrates: Acacia, Agar, Tragacanth, Honey

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

Lipids(Waxes, fats, fixed oils) : Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Marine Drugs: Novel medicinal agents from marine sources

BP408 P. PHARMACOGNOSY AND PHYTOCHEMISTRY I (Practical)

4 Hours/Week

1. Analysis of crude drugs by chemical tests: (i)Tragaccanth (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 palisade ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), Ist Edn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs byM.A. Iyengar

SEMESTER – V

BP501T: MEDICINAL CHEMISTRY-II

Credits: T- 4

Sessional Marks: 25 (T)

University Exams: 75 (T)

Course objectives

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

Objectives:

Upon completion of the course the student shall be able to

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship of different class of drugs
4. Study the chemical synthesis of selected drug

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	To understand the classification, nomenclature and structure activity relationship with respect to their mechanism of actions of various anti histamines, proton pump inhibitors and anti neoplastic agents.	L1: Remember L2: Understand L3: Apply
CO2:	To understand the different chemical aspects along with the synthesis, mode of action, medicinal benefits for various classes of cardiovascular agents viz Diuretics, anti anginal, calcium channel blockers and other anti hypertensive agents	L2: Understand L3: Apply
CO3:	The student shall understand the synthetic methods as well as the basic structural requirements, pharmacophoric features as well as the structural activity relationships for various classes of medicinal agents used as anti arrhythmics, anti hyperlipidemics, coagulants and anticoagulants and drugs used in congestive heart failure.	L2: Understand L3: Apply
CO4:	The student shall understand the role of hormones, their structure, biological and therapeutic significance.	L2: Understand L3: Apply
CO5:	The student shall understand the structural aspects and synthesis of various agents used for the treatment of diabetes and drugs applied in Local anaesthesia.	L2: Understand L3: Apply

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	1	2	2	1	2
CO4	1	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	1.8	1.4	1.8	1.8	2	1.4	1.8	1.4	2	2	1.6	2

Course Content:

BP501T. MEDICINAL CHEMISTRY – II (Theory) 45 Hours

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

UNIT- I 10 Hours

Antihistaminic agents: Histamine, receptors and their distribution in the humanbody H1–antagonists: Diphenhydramine hydrochloride*, Dimenhydrinate, Doxylamines succinate, Clemastine fumarate, Diphenylpyraline hydrochloride, Tripelenamine hydrochloride, Chlorcyclizine hydrochloride, Meclizine hydrochloride, Buclizine hydrochloride, Chlorpheniramine maleate, Triprolidine hydrochloride*, Phenidamine tartarate, Promethazine hydrochloride*, Trimeprazine tartrate, Cyproheptadine hydrochloride, Azatidine maleate, Astemizole, Loratadine, Cetirizine, Levocetrazine Cromolyn sodium H2-antagonists: Cimetidine*, Famotidine, Ranitidin. Gastric Proton pump inhibitors: Omeprazole, Lansoprazole, Rabeprazole, Pantoprazole

Anti-neoplastic agents: Alkylating agents: Meclorethamine*, Cyclophosphamide, Melphalan, Chlorambucil, Busulfan, Thiotepea Antimetabolites: Mercaptopurine*, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Methotrexate*, Azathioprine Antibiotics: Dactinomycin, Daunorubicin, Doxorubicin, Bleomycin Plant products: Etoposide, Vinblastin sulphate, Vincristin sulphate Miscellaneous: Cisplatin, Mitotane.

UNIT – II 10 Hours

Anti-anginal: Vasodilators: Amyl nitrite, Nitroglycerin*, Pentaerythritol tetranitrate, Isosorbide dinitrite*, Dipyridamole. Calcium channel blockers: Verapamil, Bepridil hydrochloride, Diltiazem hydrochloride, Nifedipine, Amlodipine, Felodipine, Nocardipine, Nimodipine.

Diuretics: Carbonic anhydrase inhibitors: Acetazolamide*, Methazolamide, Dichlorphenamide. Thiazides: Chlorthiazide*, Hydrochlorothiazide, Hydroflumethiazide, Cyclothiazide, Loop diuretics: Furosemide*, Bumetanide, Ethacrynic acid. Potassium sparing Diuretics: Spironolactone, Triamterene, Amiloride. Osmotic Diuretics: Mannitol

Anti-hypertensive Agents: Timolol, Captopril, Lisinopril, Enalapril, Benazepril hydrochloride, Quinapril hydrochloride, Methyldopate hydrochloride,* Clonidine hydrochloride, Guanethidine monosulphate, Guanabenz acetate, Sodium nitroprusside, Diazoxide, Minoxidil, Reserpine, Hydralazine hydrochloride.

UNIT- III 10 Hours

Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide hydrochloride, Disopyramide phosphate*, Phenytoin sodium, Lidocaine hydrochloride, Tocainide hydrochloride, Mexiletine hydrochloride, Lorcaïnide hydrochloride, Amiodarone, Sotalol.

Anti-hyperlipidemic agents: Clofibrate, Lovastatin, Cholesteramine and Cholestipol

Coagulant & Anticoagulants: Menadione, Acetomenadione, Warfarin*, Anisindione, clopidogrel

Drugs used in Congestive Heart Failure: Digoxin, Digitoxin, Nesiritide, Bosentan, Tezosentan.

UNIT- IV 08 Hours

Drugs acting on Endocrine system Nomenclature, Stereochemistry and metabolism of steroids Sex hormones: Testosterone, Nandralone, Progesterones, Oestriol, Oestradiol, Oestrone, Diethyl stilbestrol. Drugs for erectile dysfunction: Sildenafil, Tadalafil. Oral contraceptives: Mifepristone, Norgestril, Levonorgestrol Corticosteroids: Cortisone, Hydrocortisone, Prednisolone, Betamethasone, Dexamethasone Thyroid and antithyroid drugs: L-Thyroxine, L-Thyronine, Propylthiouracil, Methimazole.

UNIT – V 07 Hours

Antidiabetic agents: Insulin and its preparations Sulfonyl ureas: Tolbutamide*, Chlorpropamide, Glipizide, Glimpiride. Biguanides: Metformin. Thiazolidinediones: Pioglitazone, Rosiglitazone. Meglitinides: Repaglinide, Nateglinide. Glucosidase inhibitors: Acarbose, Voglibose. Local Anesthetics: SAR of Local anesthetics Benzoic Acid derivatives; Cocaine, Hexylcaine, Meprylcaine, Cyclomethycaine, Piperocaine. Amino Benzoic acid derivatives: Benzocaine*, Butamben, Procaine*, Butacaine, Propoxycaine, Tetracaine, Benoxinate. Lidocaine/Anilide derivatives: Lignocaine, Mepivacaine, Prilocaine, Etidocaine. Miscellaneous: Phenacaine, Dipiperodon, Dibucaine.*

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1 to 5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

BP502T: INDUSTRIAL PHARMACY I

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

- Upon successful completion of the course, student able to follow theory do the practical's related to Industrial Pharmacy.
- This subject Course enables the student to understand and appreciate the influence of Pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.
- Upon completion of the course the student shall be able to know the various pharmaceutical dosage forms and their manufacturing techniques.
- Students will know about various considerations in development of pharmaceutical dosage forms.
- They acquire knowledge about Formulation of solid, liquid and semisolid dosage forms and their evaluation.

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	1	2	2	1	2
CO4	2	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	2	1.4	1.8	1.8	2	1.4	1.8	1.4	2	1.8	1.6	2

BP503T: PHARMACOLOGY II

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

The outcomes of the course are

- Understanding the mechanism of drug action and its relevance in the treatment of different diseases helping in making decisions in therapy.
- Develop skill to demonstrate isolation of different organs/tissues from the laboratory animals by simulated experiments.
- The various receptor actions using isolated tissue preparations were understood and applied.
- The correlation of pharmacology with other bio medical sciences is appreciated.

COURSE OUTCOMES:

S. No.	Course Outcomes (CO)	Knowledge Level (Blooms Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Students would explain the Neurotransmitters involved in the autonomic nervous system along with their synthesis and metabolism	L1: Remember L3: Apply
CO2	They would describe various adrenoreceptors and cholinceptor, their subtypes and the clinical spectrum of their general and selective agonist and antagonist	L2: Understand L3: Apply
CO3	Students would be able to Clarify the agents that stimulate or relax skeletal muscle, including the cholinergic neuromuscular agonists and antagonists as well as the neuromuscular agents acting at noncholinergic sites	L2: Understand L3: Apply
CO4	Students would be able to Explain the essential pharmacotherapy and pharmacological features of common and important drugs used in cardiovascular diseases and Respiratory Disorders	L2: Understand L4: Analyse
CO5	Student will able to describe various pharmacological agents	L2: Understand L4: Analyse
CO6	They would have explain the essential pharmacotherapy and pharmacological features of common and important drugs used in cardiovascular diseases and respiratory disorders	L2: Understand L4: Analyse

Bloom's Taxonomy: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5: Evaluate; L6: Create

- MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	1	1	2	1	1	1	2	2
CO2	3	2	1	1	1	2	2	1	1	2	3
CO3	3	2	2	1	1	3	1	1	1	1	2
CO4	2	1	1	1	1	2	2	1	1	1	2
CO5	3	2	2	1	1	3	2	1	1	1	3
CO6	2	1	2	1	1	2	2	1	1	1	2
AVG	2.5	1.6	1.6	1	1	2.3	1.6	1	1	1.3	2.3

BP504T: PHARMACOGNOSY AND PHYTOCHEMISTRY II

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

- The main purpose of subject is to impart the students the knowledge of how the secondary metabolites are produced in the crude drugs, how to isolate and identify and produce them industrially. Also this subject involves the study of producing the plants and phytochemicals through plant tissue culture, drug interactions and basic principles of traditional system of medicine
- Upon completion of the course, the student shall be able to
 - know the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents
 - understand the preparation and development of herbal formulation.
 - understand the herbal drug interactions
 - carryout isolation and identification of phytoconstituents.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Phytochemical production in medicinal plants, their extraction, isolation, identification, estimation and characterization.	L1:Remember L2:Understand L3: Apply L4: Analyse
CO2:	Herb drug-drug, food-herb interactions, basic principles of traditional systems of medicine, modern extraction techniques, preparation and development of herbal formulations.	L1:Remember L2:Understand L3: Apply L4: Analyse L5: Evaluate
CO3:	Identification and quality assessment of Crude drugs including detection of type of adulteration and type of adulterants in crude drugs.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Isolation, estimation and structure elucidation of phytochemicals of pharmaceutical significance by UV-VIS spectrometry, CC, HPTLC, HPLC, MS, IR, NMR.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Describe methods for industrial production, estimation and utilization of some therapeutically important phytoconstituents.	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate,

L6:Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	3	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	3	Group discussion / Role play
PO7:	Professional Identity	3	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	2	2
CO3	2	2	2	2	2	2	2	2	2	2	1	2
CO4	1	1	2	2	2	2	2	2	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2
Avg	1.8	1.8	1.8	1.8	2	1.8	1.8	1.8	2	1.8	1.8	2

Course Content:

UNIT-I

10 Hours

Metabolic pathways in higher plants and their determination

- a) Brief study of basic metabolic pathways and formation of different secondary metabolites through these pathways- Shikimic acid pathway, Acetate pathways and Amino acid pathway.
- b) Study of utilization of radioactive isotopes in the investigation of Biogenetic studies.

UNIT-II

10 Hours

General introduction, composition, chemistry & chemical classes, biosources, therapeutic uses and commercial applications of following secondary metabolites:

Alkaloids: Vinca, Rauwolfia, Belladonna, Opium,

Phenylpropanoids and Flavonoids: Lignans, Tea, Ruta

Steroids, Cardiac Glycosides & Triterpenoids: Liquorice, Dioscorea, Digitalis

Volatile oils: Mentha, Clove, Cinnamon, Fennel, Coriander,

Tannins: Catechu, Pterocarpus

Resins: Benzoin, Guggul, Ginger, Asafoetida, Myrrh, Colophony

Glycosides: Senna, Aloes, Bitter Almond

Iridoids, Other terpenoids & Naphthaquinones: Gentian, Artemisia, taxus, carotenoids

UNIT-III

10 Hours

Isolation, Identification and Analysis of Phytoconstituents

- a) Terpenoids: Menthol, Citral, Artemisin
- b) Glycosides: Glycyrrhetic acid & Rutin
- c) Alkaloids: Atropine, Quinine, Reserpine, Caffeine
- d) Resins: Podophyllotoxin, Curcumin

UNIT-IV

08 Hours

Industrial production, estimation and utilization of the following phytoconstituents:

Forskolin, Sennoside, Artemisinin, Diosgenin, Digoxin, Atropine, Podophyllotoxin, Caffeine, Taxol, Vincristine and Vinblastine

UNIT-V

07 Hours

Basics of Phytochemistry

Modern methods of extraction, application of latest techniques like Spectroscopy, chromatography and electrophoresis in the isolation, purification and identification of crude drugs.

BP508 P. PHARMACOGNOSY AND PHYTOCHEMISTRY II (Practical)

4 Hours/Week

1. Morphology, histology and powder characteristics & extraction & detection of:
Cinchona, Cinnamon, Senna, Clove, Ephedra, Fennel and Coriander
2. Exercise involving isolation & detection of active principles
 - a. Caffeine - from tea dust.
 - b. Diosgenin from Dioscorea
 - c. Atropine from Belladonna
 - d. Sennosides from Senna
3. Separation of sugars by Paper chromatography
4. TLC of herbal extract
5. Distillation of volatile oils and detection of phytoconstituents by TLC
6. Analysis of crude drugs by chemical tests: (i) Asafoetida (ii) Benzoin (iii) Colophony (iv) Aloes (v) Myrrh

Recommended Books: (Latest Editions)

1. W.C.Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Saunders & Co., London, 2009.
2. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
3. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
4. Herbal drug industry by R.D. Choudhary (1996), 1st Edn, Eastern Publisher, New Delhi.
5. Essentials of Pharmacognosy, Dr.SH.Ansari, 2nd edition, Birla publications, New Delhi, 2007
6. Herbal Cosmetics by H.Pande, Asia Pacific Business press, Inc, New Delhi.
7. A.N. Kalia, Textbook of Industrial Pharmacognosy, CBS Publishers, New Delhi, 2005.
8. R Endress, Plant cell Biotechnology, Springer-Verlag, Berlin, 1994.
9. Pharmacognosy & Pharmacobiotechnology. James Bobbers, Marilyn KS, VE Tylor.
10. The formulation and preparation of cosmetic, fragrances and flavours.
11. Remington's Pharmaceutical sciences.
12. Text Book of Biotechnology by Vyas and Dixit.
13. Text Book of Biotechnology by R.C. Dubey.

BP 505 T. PHARMACEUTICAL JURISPRUDENCE (Theory)

Credits: T- 4

Sessional Marks: 25 (T)

L:T- 3:1

University Exams: 75 (T)

Course objectives

- This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India.
- Upon completion of the course, the student shall be able to understand:
 - The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
 - Various Indian pharmaceutical Acts and Laws.
 - The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals.
 - The code of ethics during the pharmaceutical practice.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	The schedules and functioning of various committees in the Drug and Cosmetic Act and rules and Indian pharmaceutical Acts.	L1: Remember L2: Understand L3: Apply
CO2:	Know the regulatory authorities and agencies governing the manufacture and sale labelling requirements and packaging guidelines for drugs and cosmetics.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Know about narcotic and psychotropic drugs, its productions and drug abuse, its controlling.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Salient Features of Drugs and Magic Remedies Act and its Rules, Prevention of Cruelty to animals Act-1960 and National Pharmaceutical Pricing Authority	L3: Apply L4: Analyse L5: Evaluate
CO5:	Know code of ethics during the pharmaceutical practice and explain other laws as prescribed by the Pharmacy Council of India from time to time including International Laws.	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	3	Group discussion / Role play
PO7:	Professional Identity	3	Group discussion
PO8:	Pharmaceutical Ethics	3	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	3	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	2	2	2
CO2	3	2	2	2	2	3	2	3	2	2	2	2
CO3	3	2	2	2	2	3	2	2	2	2	2	2
CO4	3	3	2	2	2	3	2	3	2	2	2	2
CO5	3	3	2	2	2	2	2	2	2	2	2	2
Avg	3	2.6	2.2	2.2	2.2	2.6	2	2.4	2	2	2	2

Course Content
45 Hours

UNIT-I

10 Hours

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the Act and Rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties.

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs, Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II

10 Hours

Drugs and Cosmetics Act, 1940 and its rules 1945.

Detailed study of Schedule G, H, M, N, P,T,U, V, X, Y, Part XII B, Sch F & DMR (OA)

Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties Labeling & Packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, Licensing authorities, controlling authorities, Drugs Inspectors.

UNIT-III

10 Hours

- **Pharmacy Act –1948:** Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties
- **Medicinal and Toilet Preparation Act –1955:** Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.
- **Narcotic Drugs and Psychotropic substances Act-1985 and Rules:** Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

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UNIT-IV

08 Hours

- **Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties
- **Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties
- **National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

UNIT-V

07 Hours

- **Pharmaceutical Legislations** – A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee
- **Code of Pharmaceutical ethics** Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath
- **Medical Termination of Pregnancy Act**
- **Right to Information Act**
- **Introduction to Intellectual Property Rights (IPR)**

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh
2. Text book of Forensic Pharmacy by B.M. Mithal.
3. Hand book of drug law-byM.L. Mehra.
4. A text book of Forensic Pharmacy by N.K. Jain.
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication.
9. Bare Acts of the said laws published by Government. Reference books (Theory).

SEMESTER VI

BP601T: MEDICINAL CHEMISTRY-III

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasis on modern techniques of rational drug design like quantitative structure activity relationship (QSAR), Prodrug concept, combinatorial chemistry and Computer aided drug design (CADD). The subject also emphasizes on the chemistry, mechanism of action, metabolism, adverse effects, Structure Activity Relationships (SAR), therapeutic uses and synthesis of important drugs.

Upon completion of the course student shall be able to:

- Understand the importance of drug design and different techniques of drug design.
- Understand the chemistry of drugs with respect to their biological activity.
- Know the metabolism, adverse effects and therapeutic value of drugs.
- Know the importance of SAR of drugs.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	To understand the historical background of antibiotics, their nomenclature and chemical aspects. Apply the knowledge in understanding the structure activity relationship of beta lactam antibiotics with respect to their pharmacological actions.	L2:Understand L3: Apply
CO2:	To understand the different chemical aspects along with the metabolites and their pharmacological or adverse effects for various classes of antibiotics viz Macrolides, antimalarials and Chloramphenicol. The student needs to apply their knowledge to understand the basic concepts and applications of prodrugs.	L1: Remember L2:Understand L3: Apply
CO3:	The student shall understand the synthetic methods as well as the basic structural requirements, pharmacophoric features as well as the structural activity relationships for various classes of medicinal agents used in the treatment of Tuberculosis, Urinary tract infections and various viral diseases.	L2:Understand L3: Apply
CO4:	The student shall understand the role of various anti fungal, anti protozoal agents and sulphonamides. The students shall apply their knowledge in understanding the synthesis, SAR and medicinal benefits of these drugs.	L1: Remember L2:Understand L3: Apply
CO5:	The student shall understand and apply their knowledge in basic concepts of drug design like QSAR studies, Pharmacophore modeling and docking methods, applications of Combinatorial chemistry.	L3: Apply L4: Analyse

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate,

L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	2	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	1	2	2	2	2	1	2	1	2	2	1	2
CO4	1	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	1.6	1.4	1.8	1.8	2	1.4	1.8	1.4	2	2	1.6	2

Course Outcomes and Program Outcomes (CO-PO) Mapping:

Course Content:

BP601T. MEDICINAL CHEMISTRY – III (Theory) 45 Hours

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

UNIT – I 10 Hours

Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. β -Lactam antibiotics: Penicillin, Cephalosporins, β -Lactamase inhibitors, Monobactams Aminoglycosides: Streptomycin, Neomycin, Kanamycin Tetracyclines: Tetracycline, Oxytetracycline, Chlortetracycline, Minocycline, Doxycycline

UNIT – II 10 Hours

Antibiotics Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products of the following classes. Macrolide: Erythromycin Clarithromycin, Azithromycin. Miscellaneous: Chloramphenicol*, Clindamycin. Prodrugs: Basic concepts and application of prodrugs design. Antimalarials: Etiology of malaria. Quinolines: SAR, Quinine sulphate, Chloroquine*, Amodiaquine, Primaquine phosphate, Pamaquine*, Quinacrine hydrochloride, Mefloquine. Biguanides and dihydro triazines: Cycloguanil pamoate, Proguanil. Miscellaneous: Pyrimethamine, Artesunate, Artemether, Atovaquone.

UNIT – III 10 Hours

Anti-tubercular Agents Synthetic anti tubercular agents: Isoniazid*, Ethionamide, Ethambutol, Pyrazinamide, Para amino salicylic acid.* Anti tubercular antibiotics: Rifampicin, Rifabutin, Cycloserine Streptomycin, Capreomycin sulphate.

Urinary tract anti-infective agents Quinolones: SAR of quinolones, Nalidixic Acid, Norfloxacin, Enoxacin, Ciprofloxacin*, Ofloxacin, Lomefloxacin, Sparfloxacin, Gatifloxacin, Moxifloxacin Miscellaneous: Furazolidine, Nitrofurantoin*, Methanamine.

Antiviral agents: Amantadine hydrochloride, Rimantadine hydrochloride, Idoxuridine trifluoride, Acyclovir*, Gancyclovir, Zidovudine, Didanosine, Zalcitabine, Lamivudine, Loviride, Delavirding, Ribavirin, Saquinavir, Indinavir, Ritonavir.

UNIT – IV 08 Hours

Antifungal agents: Antifungal antibiotics: Amphotericin-B, Nystatin, Natamycin, Griseofulvin. Synthetic Antifungal agents: Clotrimazole, Econazole, Butoconazole, Oxiconazole Tioconazole, Miconazole*, Ketoconazole, Terconazole, Itraconazole, Fluconazole, Naftifine hydrochloride, Tolnaftate*.

Anti-protozoal Agents: Metronidazole*, Tinidazole, Ornidazole, Diloxanide, Iodoquinol, Pentamidine Isethionate, Atovaquone, Eflornithine. Anthelmintics: Diethylcarbamazine citrate*, Thiabendazole, Mebendazole*, Albendazole, Niclosamide, Oxamniquine, Praziquantal, Ivermectin.

Sulphonamides and Sulfones Historical development, chemistry, classification and SAR of Sulfonamides: Sulphamethizole, Sulfisoxazole, Sulphamethizine, Sulfacetamide*, Sulphapyridine, Sulfamethoxazole*, Sulphadiazine, Mefenide acetate, Sulfasalazine. Folate reductase inhibitors: Trimethoprim*, Cotrimoxazole. Sulfones: Dapsone*.

UNIT – V 07 Hours

Introduction to Drug Design Various approaches used in drug design. Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient, Hammett's electronic parameter, Taft's steric parameter and Hansch analysis.

Pharmacophore modeling and docking techniques.

Combinatorial Chemistry: Concept and applications chemistry: solid phase and solution phase synthesis.

BP607P. MEDICINAL CHEMISTRY- III (Practical) 4 Hours / week

I Preparation of drugs and intermediates

- 1 Sulphanilamide
- 2 7-Hydroxy, 4-methyl coumarin
- 3 Chlorobutanol
- 4 Triphenyl imidazole
- 5 Tolbutamide
- 6 Hexamine

II Assay of drugs

- 1 Isonicotinic acid hydrazide
- 2 Chloroquine
- 3 Metronidazole
- 4 Dapsone
- 5 Chlorpheniramine maleate
- 6 Benzyl penicillin

III Preparation of medicinally important compounds or intermediates by Microwave irradiation technique

IV Drawing structures and reactions using chem draw®

V Determination of physicochemical properties such as logP, clogP, MR, Molecular weight, Hydrogen bond donors and acceptors for class of drugs course content using drug design software Drug likeliness screening (Lipinski's RO5)

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic

BP602T: PHARMACOLOGY III

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

- Upon completion of this course the student should be able to understand the mechanism of drug action and its relevance in the treatment of different infectious diseases.
- Students shall be provided with imperative knowledge on the principles of toxicology and treatment of various poisonings.
- Course imparts awareness in students on correlation of pharmacology with related medical sciences.

COURSE OUTCOMES:

S. No.	Course Outcomes (CO)	Knowledge Level (Blooms Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Students would describe the pharmacology and pharmacotherapy of various general and local anesthetics	L1: Remember L3: Apply
CO2	They would understand the illustrate the appropriate drug therapy and management of patients with specific CNS disorders	L2: Understand L3: Apply L4: Analyse
CO3	Students would be able to explain the indications, mechanism of action, adverse effects and contraindications for the major classes of drugs used in the treatment of Parkinson's Disease, Migraine and Alzheimer's disease	L2: Understand L3: Apply L4: Analyse
CO4	Students would be able to describe Pharmacological features of different classes of NSAIDs and pharmacotherapy of Rheumatoid Arthritis, Osteoarthritis and Gout	L2: Understand L4: Analyse
CO5	Student will able to understand basic principles of bioassay, types of bioassay along with advantages and disadvantages	L2: Understand L4: Analyse
CO6	They would Study the preclinical screening of various drugs	L2: Understand L4: Analyse

Bloom's Taxonomy: L1: Remember; L2: Understand; L3: Apply; L4: Analyse; L5: Evaluate; L6: Create

II. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	1	1	2	1	1	1	2	2
CO2	3	2	1	1	1	2	2	1	1	2	3
CO3	3	2	2	1	1	3	1	1	1	1	2
CO4	2	1	1	1	1	2	2	1	1	1	2
CO5	3	2	2	1	1	3	2	1	1	1	3
CO6	2	1	2	1	1	2	2	1	1	1	2
AVG	2.5	1.6	1.6	1	1	2.3	1.6	1	1	1.3	2.3

BP603T: HERBAL DRUG TECHNOLOGY

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

Upon completion of course students will be equipped with following skills:

- Requirements to start an herbal drug industry, quality testing of raw materials, natural sweeteners and nutraceuticals, Good Agricultural Practices (GAP), organic farming and biopesticides for cultivation of medicinal plants, Good Manufacturing Practices (GMP), equipment, Standard Operating Procedures (SOPs), Documentation methods, Regulatory requirements for the production of herbal, Ayurvedic, Siddha and Unani formulations, patenting of herbal drugs, WHO and ICH guidelines for evaluation of herbal drugs. Formulation and evaluation of herbal medicines and Herbal cosmetics. Formulation, quality assessment of herbal drugs, novel herbal formulations such as Phytosomes and herbal cosmetics. Preparation and evaluation of Ayurvedic, Homeopathic formulations and their quality assessment. Alternative ways of health care management with Nutraceuticals and Indian systems of medicine.
- Students acquire Hands-on experience in Preliminary phytochemical screening of crude drugs, Estimation of the alcohol content of Asava and Arista, Evaluation of excipients of natural origin, formulation of herbal cosmetics like creams, lotions and shampoos and their evaluation, formulation of herbal syrups, mixtures and tablets and their evaluation as per Pharmacopoeial requirements. Monograph analysis of herbal drugs from recent Pharmacopoeias, Determination of Aldehyde content, total Phenols and total alkaloids in crude drugs.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Discuss the definition, history, scope and development of pharmacognosy.	L1:Remember L2:Understand L3: Apply
CO2:	Cultivation of medicinal plants, identification and evaluation, uses of crude drugs and identification and estimation of phytochemicals.	L3: Apply L4: Analyse L5: Evaluate
CO3:	In vitro industrial production of secondary metabolites by plant tissue culture technique. Describe different types of primary and secondary metabolites, their general properties, classification, and their test for identification.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Describe novel medicinal agents from marine sources. Describe the role of Pharmacognosy in allopathy and traditional system of medicine.	L3: Apply L4: Analyse L5: Evaluate

CO5:	Describe the sources, chemical constituents and uses of plants products containing plant fibers, hallucinogens teratogens, and natural allergens.	L3: Apply L4: Analyse L5: Evaluate
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BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6:Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	2	2	2	1	2
CO4	1	1	2	2	2	2	2	1	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2
Avg	1.8	1.8	1.8	1.8	2	1.6	1.8	1.6	2	1.8	1.6	2

BP604T: BIOPHARMACEUTICS AND PHARMACOKINETICS

Credits: T- 4

Sessional Marks: 25 (T)

L:T:- 3:1

University Exams: 75 (T)

Course objectives

After successful completion of the course student will be able to:

- Understand the concept of Absorption, Distribution, metabolism and elimination of drug in human body.
- Determine the various pharmacokinetic parameters from either plasma concentration or urinary excretion data for drug.
- Apply the various regulations related to developing Bio availability –Bio equivalence
- Study protocol for the new drug molecule.

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to		
CO1:	Understand the concepts and principles of Absorption, Distribution, Metabolism and Elimination of Drugs	L1:Remember L2:Understand L3: Apply
CO2:	Estimate various pharmacokinetic parameters of drugs following various compartment models with different routes of administration.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Understand the concepts of Design of Dosage Regimen	L3: Apply L4: Analyse L5: Evaluate
CO4:	Demonstrate the understanding of Bioavailability and Bioequivalence studies and the calculation	L3: Apply L4: Analyse L5: Evaluate
CO5:	Understand the basic pharmacokinetic parameters that describe drug absorption and distribution.	

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	2	1	2	2	2	1	2	2
CO2	2	1	2	2	1	1	2	1	2	2	2	2
CO3	2	2	2	2	2	1	2	1	2	2	1	2
CO4	2	1	1	2	2	2	2	1	1	1	2	2
CO5	2	1	2	2	2	2	2	2	2	2	1	2
Avg	2	1.4	1.7	2	2	1.5	2	1.5	2	1.7	1.7	2

BP605T: PHARMACEUTICAL BIOTECHNOLOGY

Credits: T- 4

L:T:- 3:1

Sessional Marks: 25 (T)

University Exams: 75 (T)

Course objectives

- This course deals with the fundamentals of pharmaceutical biotechnology and procedures for production of various pharmaceuticals related to biotechnology.
- Upon completion of the course student shall be able to
 - Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
 - Genetic engineering applications in relation to production of pharmaceuticals
 - Importance of Monoclonal antibodies in Industries
 - Appreciate the use of microorganisms in fermentation technology

○ Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Students will understand the various techniques used in modern biotechnology.	L1:Remember L2:Understand L3: Apply
CO2:	Students can design research strategy with step-by-step instructions to address a research problem	L3: Apply L4: Analyse L5: Evaluate
CO3:	Students can able to provide examples of current applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, plant, animal, and forensic	L3: Apply L4: Analyse L5: Evaluate
CO4:	Students can explain the concept and application of monoclonal antibody technology	L3: Apply L4: Analyse L5: Evaluate
CO5:	Students can demonstrate and Provide examples on how to use microbes and mammalian cells for the production of pharmaceutical products	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6:Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	1	Assignments/ Internals
PO5:	Modern Tool Usage	3	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	2	1	1	2	2	1	2	1
CO2	2	1	2	2	1	1	2	1	2	2	2	2
CO3	1	2	2	1	2	1	2	1	2	2	1	1
CO4	2	1	1	2	2	2	2	1	1	1	2	2
CO5	2	1	2	1	2	2	2	2	2	2	1	2
Avg	1.6	1.4	1.7	1.8	2	1.5	1.8	1.5	2	1.7	1.7	1.9

Course Content:

Unit I

10 Hours

- a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences.
- b) Enzyme Biotechnology- Methods of enzyme immobilization and applications.
- c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries.
- d) Brief introduction to Protein Engineering.
- e) Use of microbes in industry. Production of Enzymes- General consideration - Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase.
- f) Basic principles of genetic engineering.

Unit II

10 Hours

- a) Study of cloning vectors, restriction endonucleases and DNA ligase.
- b) Recombinant DNA technology. Application of genetic engineering in medicine.
- c) Application of r DNA technology and genetic engineering in the production of:
 - i) Interferon ii) Vaccines- hepatitis- B iii) Hormones-Insulin.
- d) Brief introduction to PCR

Unit III

10 Hours

Types of immunity- humoral immunity, cellular immunity

- a) Structure of Immunoglobulins
- b) Structure and Function of MHC
- c) Hypersensitivity reactions, Immune stimulation and Immune suppressions.
- d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity.
- e) Storage conditions and stability of official vaccines
- f) Hybridoma technology- Production, Purification and Applications
- g) Blood products and Plasma Substitutes.

Unit IV

08Hours

- a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting.
- b) Genetic organization of Eukaryotes and Prokaryotes
- c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons.
- d) Introduction to Microbial biotransformation and applications.
- e) Mutation: Types of mutation/mutants.

Unit V

07 Hours

- a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring.
- b) Large scale production fermenter design and its various controls.
- c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin,
- d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes.

BP606T: PHARMACEUTICAL QUALITY ASSURANCE (Theory)

Credits: T- 4

Sessional Marks: 25 (T)

L:T- 3:1

University Exams: 75 (T)

Course objectives

- This course deals with the various aspects of quality control and quality assurance aspects of pharmaceutical industries. It deals with the important aspects like cGMP, QC tests, documentation, quality certifications and regulatory affairs.
- Upon completion of the course student shall be able to:
 - understand the cGMP aspects in a pharmaceutical industry.
 - appreciate the importance of documentation.
 - understand the scope of quality certifications applicable to pharmaceutical industries.
 - understand the responsibilities of QA & QC departments.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Understand the aspects of quality assurance, total quality Management, ICH guidelines, QbD, relevant ISO and accreditation process in a pharmaceutical industry.	L1: Remember L2: Understand L3: Apply
CO2:	Describe the importance of organization, personnel, premises, equipment and raw material as per cGMP guideline.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Explain the quality control and GLP practices followed in Pharmaceutical Industry.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Appreciate the importance of documentation and complaint procedure.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Apply the principles of calibration and validation and follow good warehousing practices	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	3	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	3	Group discussion / Role play
PO7:	Professional Identity	3	Group discussion
PO8:	Pharmaceutical Ethics	3	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	3	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	2	3	3
CO2	2	3	2	2	2	3	2	3	3	2	3	3
CO3	3	3	2	2	2	3	2	2	3	2	3	3
CO4	3	3	2	2	2	3	2	3	3	2	2	3
CO5	3	3	2	2	2	2	2	2	2	2	2	3
Avg	2.8	3	2.2	2.2	2.2	2.6	2	2.4	2.6	2	2.6	3

Course Content

45 Hours

UNIT-I

10 Hours

Quality Assurance and Quality Management concepts: Definition and concept of Quality control, Quality assurance and GMP

Total Quality Management (TQM): Definition, elements, philosophies

ICH Guidelines: purpose, participants, process of harmonization, Brief overview of QSEM, with special emphasis on Q-series guidelines, ICH stability testing guidelines

Quality by design (QbD): Definition, overview, elements of QbD program, tools

ISO 9000 & ISO14000: Overview, Benefits, Elements, steps for registration

NABL accreditation: Principles and procedures

UNIT-II

10 Hours

Organization and personnel: Personnel responsibilities, training, hygiene and personal records.

Premises: Design, construction and plant layout, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, control of contamination.

Equipment and raw materials: Equipment selection, purchase specifications, maintenance, purchase specifications and maintenance of stores for raw materials.

UNIT-III

10 Hours

Quality Control: Quality control test for containers, rubber closures and secondary packing materials.

Good Laboratory Practices: General Provisions, Organization and Personnel, Facilities, Equipment, Testing Facilities Operation, Test and Control Articles, Protocol for Conduct of a Nonclinical Laboratory Study, Records and Reports, Disqualification of Testing Facilities.

UNIT-IV

08 Hours

Complaints: Complaints and evaluation of complaints, Handling of return good, recalling and waste disposal.

Document maintenance in pharmaceutical industry: Batch Formula Record, Master Formula Record, SOP, Quality audit, Quality Review and Quality documentation, Reports and documents, distribution records.

Hours

Calibration and Validation: Introduction, definition and general principles of calibration, qualification and validation, importance and scope of validation, types of validation, validation master plan. Calibration of pH meter, Qualification of UV-Visible spectrophotometer, General principles of Analytical method Validation.

Warehousing: Good warehousing practice, materials management

Recommended Books: (Latest Edition)

1. Quality Assurance Guide by organization of Pharmaceutical Products of India.
2. Good Laboratory Practice Regulations, 2nd Edition, Sandy Weinberg Vol. 69.
3. Quality Assurance of Pharmaceuticals- A compendium of Guide lines and Related materials Vol I WHO Publications.
4. A guide to Total Quality Management- Kushik Maitra and Sedhan K Ghosh
5. How to Practice GMP's – P P Sharma.
6. ISO 9000 and Total Quality Management – Sadhan G Ghosh
7. The International Pharmacopoeia – Vol I, II, III, IV- General Methods of Analysis and Quality specification for Pharmaceutical Substances, Excipients and Dosage forms
8. Good laboratory Practices – Marcel Dekker Series
9. ICH guidelines, ISO 9000 and 14000 guidelines

SEMESTER VII

BP701T. INSTRUMENTAL METHODS OF ANALYSIS (Theory)

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L:T:P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

- This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs and designed to impart a fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique.
- This also emphasizes on theoretical and practical knowledge on modern analytical instruments that are used for drug testing.
- Upon completion of the course the student shall be able to
 - Understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
 - Understand the chromatographic separation and analysis of drugs.
 - Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	The basic theoretical principles and instrumentation and applications of UV, IR, fluorimeter, flame photometer. Theoretically understand the aspects of estimation of multi components.	L1: Remember L2: Understand L3: Apply L4: Analyse L5: Evaluate
CO2:	The separation and identification of compounds by various chromatographic techniques. Principles, Instrumentation, separation and identification of compounds by TLC, column chromatography, paper chromatography and electrophoresis technique.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Explain theory and instrumentation of GC, HPLC, gel chromatography, ion exchange chromatography and affinity chromatography.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Learn applications of various chromatographic techniques for organic, inorganic and natural products.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Practical skills for the analysis of drugs and excipients using various instrumentation techniques.	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	3	Assignments/ Internals
PO5:	Modern Tool Usage	3	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping (Theory):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	2	3	3	3	2	3	2	2	3	3	3
CO3	3	3	2	3	3	3	3	2	2	3	3	3
CO4	3	3	3	3	3	2	2	3	3	2	2	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3
Avg	3	2.8	2.8	3	3	2.6	2.8	2.6	2.6	2.8	2.8	3

Course Content

UNIT –I

10 Hours

UV Visible spectroscopy

Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations.

Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors- Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode.

Applications - Spectrophotometric titrations, Single component and multi component analysis.

Fluorimetry

Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications.

UNIT –II

10 Hours

IR spectroscopy

Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations.

Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, Pyroelectric detector and applications.

Flame Photometry-Principle, interferences, instrumentation and applications.

Atomic absorption spectroscopy- Principle, interferences, instrumentation and applications.

Nepheloturbidometry- Principle, instrumentation and applications.

UNIT –III

10 Hours

Introduction to chromatography

Adsorption and partition column chromatography-Methodology, advantages, disadvantages and applications.

Thin layer chromatography- Introduction, Principle, Methodology, R_f values, advantages, disadvantages and applications.

Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications

Electrophoresis– Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications.

UNIT –IV

08 Hours

Gas chromatography - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications

High performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

Ion exchange chromatography- Introduction, classification, ion exchange resins, properties, mechanism of ion exchange process, factors affecting ion exchange, methodology and applications

Gel chromatography- Introduction, theory, instrumentation and applications

Affinity chromatography- Introduction, theory, instrumentation and applications

BP705P. INSTRUMENTAL METHODS OF ANALYSIS (Practical)

4 Hours/Week

- 1 Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds.
- 2 Estimation of dextrose by colorimetry.
- 3 Estimation of sulfanilamide by colorimetry.
- 4 Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy.
- 5 Assay of paracetamol by UV- Spectrophotometry.
- 6 Estimation of quinine sulfate by fluorimetry.
- 7 Study of quenching of fluorescence.
- 8 Determination of sodium by flame photometry.
- 9 Determination of potassium by flame photometry.
- 10 Determination of chlorides and sulphates by nephelo turbidometry.
- 11 Separation of amino acids by paper chromatography.
- 12 Separation of sugars by thin layer chromatography.
- 13 Separation of plant pigments by column chromatography.
- 14 Demonstration experiment on HPLC.
- 15 Demonstration experiment on Gas Chromatography.

Recommended Books (Latest Editions)

1. Instrumental Methods of Chemical Analysis by B.K Sharma
2. Organic spectroscopy by Y.R Sharma
3. Text book of Pharmaceutical Analysis by Kenneth A. Connors
4. Vogel's Text book of Quantitative Chemical Analysis by A.I. Vogel
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J.B. Stenlake
6. Organic Chemistry by I. L. Finar
7. Organic spectroscopy by William Kemp
8. Quantitative Analysis of Drugs by D. C. Garrett
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi
10. Spectrophotometric identification of Organic Compounds by Silverstein

BP702T : INDUSTRIAL PHARMACY-II

Credits: T- 4

Sessional Marks: 25 (T)

L:T- 3:1

University Exams: 75 (T)

Course objectives

- This course will enable the student to know the process of pilot plant and scale up of pharmaceutical products.
- Upon completion of the course, the students will also get knowledge with respect to the technology transfer from lab scale to commercial batch.
- This course gives complete package of different laws and acts that regulate the operations in pharmaceutical industries.
- This course also gives an idea to the students about the regulatory requirements for new drug approval process and day-to-day operations in the pharmaceutical industries and provides the confidence to the students to take up jobs in industries.

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	2	2	2	2	2	1	2	1	2	2	1	2
CO4	2	1	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	2	2	2	2
Avg	2	1.4	1.8	1.8	2	1.4	1.8	1.4	2	1.8	1.6	2

BP703T: PHARMACY PRACTICE

Credits: T- 4

Sessional Marks: 25 (T)

L:T- 3:1

University Exams: 75 (T)

Course objectives

- This course deals with the fundamentals of hospital pharmacy, community pharmacy and the role of pharmacist in the hospital
- Upon completion of the course student shall be able to
 - Know various drug distribution methods in a hospital
 - appreciate the pharmacy stores management and inventory control
 - monitor drug therapy of patient through medication chart review and clinical review
 - obtain medication history interview and counsel the patients
 - identify drug related problems
 - detect and assess adverse drug reactions
 - interpret selected laboratory results (as monitoring parameters in therapeutics) of specific disease states
 - know pharmaceutical care services
 - do patient counseling in community pharmacy;
 - appreciate the concept of Rational drug therapy.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Students will demonstrate knowledge of and ability to use principles of therapeutics, quality improvement, communication, economics, health behavior, social and administrative aspects, health policy and legal issues in the practice of pharmacy	L1:Remember L2:Understand L3: Apply
CO2:	Students will use knowledge of drug distribution methods in hospital and apply it in the practice of pharmacy.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Students will effectively apply principles of drug store management and inventory control to medication use.	L3: Apply L4: Analyse L5: Evaluate
CO4:	Students will provide patient-centered care to diverse patients using the best available evidence and monitor drug therapy of patient through medication chart review, obtain medication history interview and counsel the patients, identify drug related problems.	L3: Apply L4: Analyse L5: Evaluate
CO5:	Students will engage in innovative activities by making use of the knowledge of clinical trials	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6:Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	3	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	2	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	1	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	3	Group discussion / Role play
PO7:	Professional Identity	3	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	3	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	3	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	3	2	1	1	2	3	1	2	1
CO2	2	1	3	2	1	1	2	1	3	2	3	2
CO3	1	2	2	1	3	3	3	2	2	2	1	1
CO4	3	1	1	2	2	2	2	1	1	1	2	2
CO5	2	1	2	1	2	2	2	2	2	3	1	3
Avg	1.9	1.8	2.1	1.9	2.1	1.8	2.1	1.7	2.2	1.9	1.9	2.1

Course Content:

Unit I:

10 Hours

a) Hospital and it's organization

Definition, Classification of hospital- Primary, Secondary and Tertiary hospitals, Classification based on clinical and non- clinical basis, Organization Structure of a Hospital, and Medical staffs involved in the hospital and their functions.

b) Hospital pharmacy and its organization

Definition, functions of hospital pharmacy, Organization structure, Location, Layout and staff requirements, and Responsibilities and functions of hospital pharmacists.

c) Adverse drug reaction

Classifications - Excessive pharmacological effects, secondary pharmacological effects, idiosyncrasy, allergic drug reactions, genetically determined toxicity, toxicity following sudden withdrawal of drugs, Drug interaction- beneficial interactions, adverse interactions, and pharmacokinetic drug interactions, Methods for detecting drug interactions, spontaneous case reports and record linkage studies, and Adverse drug reaction reporting and management.

d) Community Pharmacy

Organization and structure of retail and wholesale drug store, types and design, Legal requirements for establishment and maintenance of a drug store, Dispensing of proprietary products, maintenance of records of retail and wholesale drug store.

Unit II:

10 Hours

a) Drug distribution system in a hospital

Dispensing of drugs to inpatients, types of drug distribution systems, charging policy and labelling, Dispensing of drugs to ambulatory patients, and Dispensing of controlled drugs.

b) Hospital formulary

Definition, contents of hospital formulary, Differentiation of hospital formulary and Drug list, preparation and revision, and addition and deletion of drug from hospital formulary.

c) Therapeutic drug monitoring

Need for Therapeutic Drug Monitoring, Factors to be considered during the Therapeutic Drug Monitoring, and Indian scenario for Therapeutic Drug Monitoring.

d) Medication adherence

Causes of medication non-adherence, pharmacist role in the medication adherence, and monitoring of patient medication adherence.

e) Patient medication history interview

Need for the patient medication history interview, medication interview forms.

f) Community pharmacy management

Financial, materials, staff, and infrastructure requirements.

Unit III:

10 Hours

a) Pharmacy and therapeutic committee

Organization, functions, Policies of the pharmacy and therapeutic committee in including drugs into formulary, inpatient and outpatient prescription, automatic stop order, and emergency drug list preparation.

b) Drug information services

Drug and Poison information centre, Sources of drug information, Computerised services, and storage and retrieval of information.

c) Patient counseling

Definition of patient counseling; steps involved in patient counseling, and Special cases that require the pharmacist

d) Education and training program in the hospital

Role of pharmacist in the education and training program, Internal and external training program, Services to the nursing homes/clinics, Code of ethics for community pharmacy, and Role of pharmacist in the interdepartmental communication and community health education.

e) Prescribed medication order and communication skills

Prescribed medication order- interpretation and legal requirements, and Communication skills- communication with prescribers and patients.

Unit IV

8 Hours

a) Budget preparation and implementation

Budget preparation and implementation

b) Clinical Pharmacy

Introduction to Clinical Pharmacy, Concept of clinical pharmacy, functions and responsibilities of clinical pharmacist, Drug therapy monitoring - medication chart review, clinical review, pharmacist intervention, Ward round participation, Medication history and Pharmaceutical care. Dosing pattern and drug therapy based on Pharmacokinetic & disease pattern.

c) Over the counter (OTC) sales

Introduction and sale of over the counter, and Rational use of common over the counter medications.

Unit V

7 Hours

a) Drug store management and inventory control

Organisation of drug store, types of materials stocked and storage conditions, Purchase and inventory control: principles, purchase procedure, purchase order, procurement and stocking, Economic order quantity, Reorder quantity level, and Methods used for the analysis of the drug expenditure

b) Investigational use of drugs

Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

c) Interpretation of Clinical Laboratory Tests

Blood chemistry, hematology, and urinalysis

BP 704T: NOVEL DRUG DELIVERY SYSTEMS

Credits: T- 4, P-2

Sessional Marks: 25 (T), 15(P)

L: T: P- 3:1:4

University Exams: 75 (T), 35(P)

Course objectives

- 1.To understand various approaches for development of novel drug delivery systems.
2. To understand the criteria for selection of drugs and polymers for the development of Novel drug delivery systems, their formulation and evaluation

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates.Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations	L1:Remember L2:Understand L3: Apply
CO2:	Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications	L3: Apply L4: Analyse L5: Evaluate
CO3:	Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches	L3: Apply L4: Analyse L5: Evaluate
CO4:	Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications	L3: Apply L4: Analyse L5: Evaluate
CO5:	Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Program Outcome	Level	Proficiency assessed by
PO1: Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2: Planning Abilities	1	Assignments/ Internals
PO3: Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4: Problem Analysis	2	Assignments/ Internals
PO5: Modern Tool Usage	2	Seminars/academic activities

PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	2	2	2	2	2	2	1	2	1
CO2	2	2	2	2	2	2	1	2	2	2	2	2
CO3	1	2	2	2	2	2	2	2	2	2	2	3
CO4	2	2	2	2	2	2	1	1	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2
Avg	1.8	1.8	1.8	2	2	2	1.6	1.8	2	1.8	2	1.8

BP 704T: NOVEL DRUG DELIVERY SYSTEMS

Course Content:

THEORY 45Hrs

Unit-I 10 Hours

Controlled drug delivery systems: Introduction, terminology/definitions and rationale, advantages, disadvantages, selection of drug candidates. Approaches to design controlled release formulations based on diffusion, dissolution and ion exchange principles. Physicochemical and biological properties of drugs relevant to controlled release formulations

Polymers: Introduction, classification, properties, advantages and application of polymers in formulation of controlled release drug delivery systems.

Unit-II 10 Hours

Microencapsulation: Definition, advantages and disadvantages, microspheres /microcapsules, microparticles, methods of microencapsulation, applications

Mucosal Drug Delivery system: Introduction, Principles of bioadhesion / mucoadhesion, concepts, advantages and disadvantages, transmucosal permeability and formulation considerations of buccal delivery systems

Implantable Drug Delivery Systems: Introduction, advantages and disadvantages, concept of implants and osmotic pump

Unit-III 10 Hours

Transdermal Drug Delivery Systems: Introduction, Permeation through skin, factors affecting permeation, permeation enhancers, basic components of TDDS, formulation approaches

Gastroretentive drug delivery systems: Introduction, advantages, disadvantages, approaches for GRDDS – Floating, high density systems, inflatable and gastroadhesive systems and their applications

Nasopulmonary drug delivery system: Introduction to Nasal and Pulmonary routes of drug delivery, Formulation of Inhalers (dry powder and metered dose), nasal sprays, nebulizers

Unit-IV 08 Hours

Targeted drug Delivery: Concepts and approaches advantages and disadvantages, introduction to liposomes, niosomes, nanoparticles, monoclonal antibodies and their applications

Unit-V 07 Hours

Ocular Drug Delivery Systems: Introduction, intra ocular barriers and methods to overcome –Preliminary study, ocular formulations and ocuserts

Intrauterine Drug Delivery Systems: Introduction, advantages and disadvantages, development of intra uterine devices (IUDs) and applications

Recommended Books: (Latest Editions)

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker, Inc., New York, 1992.
3. Encyclopedia of Controlled Delivery. Edith Mathiowitz, Published by Wiley Interscience Publication, John Wiley and Sons, Inc, New York. Chichester/Weinheim
4. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997 (reprint in 2001).
5. S.P. Vyas and R.K. Khar, Controlled Drug Delivery -concepts and advances, Vallabh Prakashan, New Delhi, First edition 2002.

BP801T. BIostatistics AND RESEARCH METHODOLOGY (Theory)

Credits: T- 4

Sessional Marks: 25 (T)

L:T- 3:1

University Exams: 75 (T)

Course objectives

Scope: To understand the applications of Biostatistics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, Non Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel.

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

- Know the operation of M.S. Excel, SPSS, R and MINITAB ® , DoE (Design of Experiment)
- Know the various statistical techniques to solve statistical problems
- Appreciate statistical techniques in solving the problems.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	The basic principles of Biostatistics and concepts of frequency distribution, measures of central tendency, dispersion and correlation.	L1:Remember L2:Understand L3: Apply
CO2:	Understand and analyze the concepts of Regression, Probability and Parametric tests.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Apply the Concepts of Non parametric tests and understand the fundamentals of Research, Usage of Graphs and Designing the methodology	L2:Understand L3: Apply L4: Analyse L5: Evaluate
CO4:	The concepts of Regression modeling and Practical components of Industrial and clinical trials problems	L3: Apply L4: Analyse L5: Evaluate
CO5:	Understand, design and analyze the concepts of Factorial design and Response surface methodology	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	1	2	2	2	2	1	2	1	2	2	1	2
CO4	1	2	2	2	2	1	2	1	2	2	2	2
CO5	2	2	2	2	2	2	2	2	2	2	2	2
Avg	1.6	2	1.8	2	2	1.4	1.8	1.4	2	1.8	1.6	2

BP802T: SOCIAL AND PREVENTIVE PHARMACY

Credits: T- 4

Sessional Marks: 25 (T)

L:T- 3:1

University Exams: 75 (T)

Course objectives

- This course deals with the importance of various National Health Programmes and role of Pharmacist in these context
- Upon completion of the course student shall be able to
 - Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.
 - Have a critical way of thinking based on current healthcare development.
 - Evaluate alternative ways of solving problems related to health and pharmaceutical issues

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1:	Acquire high consciousness/realization of current issues related to health and pharmaceutical problems within the country and worldwide.	L1:Remember L2:Understand L3: Apply
CO2:	Have a critical way of thinking based on current healthcare development.	L3: Apply L4: Analyse L5: Evaluate
CO3:	Evaluate alternative ways of solving problems related to health and pharmaceutical issues	L3: Apply L4: Analyse L5: Evaluate
CO4:	Design a better health care service system	L3: Apply L4: Analyse L5: Evaluate
CO5:	Students will engage in	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6:Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	3	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	1	Assignments/ Internals
PO5:	Modern Tool Usage	1	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	3	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	3	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	3	2	1	1	2	1	1	2	1
CO2	2	1	2	2	1	1	2	1	2	2	1	2
CO3	1	2	2	1	2	1	3	2	2	2	1	1
CO4	1	1	1	2	2	2	2	1	1	1	2	2
CO5	2	1	2	1	2	2	2	2	2	3	1	2
Avg	1.7	1.7	1.6	1.8	2	1.8	2.1	1.7	2.1	1.9	1.8	2.1

Course Content:

Unit I: **10 Hours**

Concept of health and disease: Definition, concepts and evaluation of public health.

Understanding the concept of prevention and control of disease, social causes of diseases and social problems of the sick.

Social and health education: Food in relation to nutrition and health, Balanced diet, Nutritional deficiencies, Vitamin deficiencies, Malnutrition and its prevention. **Sociology and health:** Socio cultural factors related to health and disease, Impact of urbanization on health and disease, Poverty and health **Hygiene and health:** personal hygiene and health care; avoidable habits

Unit II: **10 Hours**

Preventive medicine: General principles of prevention and control of diseases such as cholera, SARS, Ebola virus, influenza, acute respiratory infections, malaria, chicken guinea, dengue, lymphatic filariasis, pneumonia, hypertension, diabetes mellitus, cancer, drug addiction-drug substance abuse

Unit III: **10 Hours**

National health programs, its objectives, functioning and outcome of the following: HIV AND AIDS control programme, TB, Integrated disease surveillance program (IDSP), National leprosy control programme, National mental health program, National programme for prevention and control of deafness, Universal immunization programme, National programme for control of blindness, Pulse polio programme.

Unit IV: **08 Hours**

National health intervention programme for mother and child, National family welfare programme, National tobacco control programme, National Malaria Prevention Program, National programme for the health care for the elderly, Social health programme; role of WHO in Indian national program

Unit V: **07 Hours**

Community services in rural, urban and school health: Functions of PHC, Improvement in rural sanitation, national urban health mission, Health promotion and education in school

BP803ET-Pharma Marketing Management

Credits: T- 4

Sessional Marks: 25 (T),

L: T: P- 3:1:

University Exams: 75 (T)

Course Objectives

- The pharmaceutical industry not only needs highly qualified researchers, chemists and technical people, but also requires skilled managers who can take the industry forward by managing and taking the complex decisions which are imperative for the growth of the industry.
- The Knowledge and Know-how of marketing management groom the people for taking a challenging role in Sales and Product management.
- The course aims to provide an understanding of marketing concepts and techniques and their applications in the pharmaceutical industry.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to		
CO1:	Describe the concept of pharmaceutical marketing. Enumerate the concept of product management in pharmaceutical industry	L1:Remember L2:Understand L3: Apply
CO2:	Discuss the various components of promotion of pharmaceutical products	L3: Apply L4: Analyse L5: Evaluate
CO3:	Explain the different pharmaceutical marketing channels	L3: Apply L4: Analyse L5: Evaluate
CO4:	Discuss the role and responsibility of professional sales representative and pricing authorities in India	L3: Apply L4: Analyse L5: Evaluate
CO5:	Discuss the emerging concepts of marketing and the role market research	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6:Create

How program outcomes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	2	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	3	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	1	Assignments/ Internals
PO5:	Modern Tool Usage	1	Seminars/academic activities
PO6:	Leadership Skills	2	Group discussion / Role play
PO7:	Professional Identity	3	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	3	Group discussion / Role play
PO11:	Environment And Sustainability	3	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate(Medium), 3- Substantial(High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	1	2	2	2	2	1	2	2	2	2	1	2
CO4	1	2	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	1	2	2	2
Avg	1.4	1.6	1.8	1.8	2	1.4	1.8	1.6	1.8	1.8	1.6	2

BP809ET: Cosmetic Science

Credits: T- 4

Sessional Marks: 25 (T)

L: T- 3:1

University Exams: 75 (T)

Course objectives

- Scope: This course is intended to provide a comprehensive survey of ingredients fundamental to the cosmetic industry. The course will emphasize current trends in the selection of cosmetic ingredients. The chemistry and technology of cosmetic raw materials will be related to their behavioral properties as utilized in the construction of stable functional systems. In this way, it is intended to generate a better understanding of the contributions of ingredients to the performance of finished product formulations.

Course outcomes

S.No	Course Outcomes	Knowledge level (BLOOMS Level)
After successful completion of the course student shall be able to explain		
CO1 :	Classify and define Cosmetics and Cosmeceuticals as per Indian and EU regulations Describe the role of cosmetic excipients and building blocks in the formulation of cosmetics	L1:Remember L2:Understand L3: Apply
CO2 :	Explain the structure and function of the skin, hair, teeth and gums, bleeding gums, mouth odour, teeth discoloration and sensitive teeth.	L3: Apply L4: Analyse L5: Evaluate
CO3 :	Describe the fundamentals of sun protection and the formulation of Sunscreens, antiperspirants and deodorants	L3: Apply L4: Analyse L5: Evaluate
CO4 :	Evaluate cosmetics for various physico-chemical properties.	L3: Apply L4: Analyse L5: Evaluate
CO5 :	Design cosmetics and cosmeceuticals that address the problems of dry skin, acne, dermatitis, prickly heat, wrinkles, blemishes, hair fall, Dandruff, body odour	L3: Apply L4: Analyse L5: Evaluate

BLOOMS Taxonomy- L1: Remember, L2: Understand, L3: Apply, L4: Analyse, L5: Evaluate, L6: Create

How program out comes are assessed:

Program Outcome		Level	Proficiency assessed by
PO1:	Pharmacy Knowledge	2	Assignments/ Internals/Viva
PO2:	Planning Abilities	1	Assignments/ Internals
PO3:	Conduct Investigations of Complex Problems	1	Assignments/ Internals/ Practicals
PO4:	Problem Analysis	2	Assignments/ Internals
PO5:	Modern Tool Usage	2	Seminars/academic activities
PO6:	Leadership Skills	1	Group discussion / Role play
PO7:	Professional Identity	2	Group discussion
PO8:	Pharmaceutical Ethics	2	Personality development seminars
PO9:	Communication	3	Students' seminars/ student-teacher interaction
PO10:	The Pharmacist and Society	2	Group discussion / Role play
PO11:	Environment And Sustainability	2	Students' seminars
PO12:	Life-Long Learning	2	Assignments/ Internals

LEVEL: 1- Slight (Low), 2- Moderate (Medium), 3- Substantial (High)

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	1	2	2	2	2	1	2	1	2	2	1	2
CO4	1	2	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	1	2	2	2
Avg	1.4	1.6	1.8	1.8	2	1.4	1.8	1.4	1.8	1.8	1.6	2

Course Content:

BP809ET - COSMETIC SCIENCE (Theory) 45Hours

UNIT-I

10 Hours

Classification of cosmetic and cosmeceutical products
Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics as quasi and OTC drugs
Cosmetic excipients: Surfactants, rheology modifiers, humectants, emollients, preservatives. Classification and application
Skin: Basic structure and function of skin.
Hair: Basic structure of hair. Hair growth cycle.
Oral Cavity: Common problem associated with teeth and gums.

UNIT II

10 Hours

Principles of formulation and building blocks of skin care products:
Face wash, Moisturizing cream, Cold Cream, Vanishing cream and their advantages and disadvantages. Application of these products in formulation of cosmeceuticals. Antiperspirants & deodorants- Actives & mechanism of action.
Principles of formulation and building blocks of Hair care products:
Conditioning shampoo, Hair conditioner, anti-dandruff shampoo. Hair oils.
Chemistry and formulation of Para-phenylene diamine based hair dye. Principles of formulation and building blocks of oral care products:
Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

UNIT III

10 Hours

Sun protection, Classification of Sunscreens and SPF. Role of herbs in cosmetics:
Skin Care: Aloe and turmeric
Hair care: Henna and amla.
Oral care: Neem and clove
Analytical cosmetics: BIS specification and analytical methods for shampoo, skin- cream and toothpaste.

UNIT IV

08Hours.

Principles of Cosmetic Evaluation: Principles of sebumeter, corneometer. Measurement of TEWL, Skin Color, Hair tensile strength, Hair combing properties
Soaps, and syndet bars. Evolution and skin benefits.

UNIT V

07 Hours

Oily and dry skin, causes leading to dry skin, skin moisturisation. Basic understanding of the terms Comedogenic, dermatitis.
Cosmetic problems associated with Hair and scalp: Dandruff, Hair fall causes
Cosmetic problems associated with skin: blemishes, wrinkles, acne, prickly heat and body odor. Antiperspirants and Deodorants- Actives and mechanism of action

References

- 1) Harry's Cosmeticology, Wilkinson, Moore, Seventh Edition, George Godwin.
- 2) Cosmetics – Formulations, Manufacturing and Quality Control, P.P. Sharma, 4th Edition, Vandana Publications Pvt. Ltd., Delhi.
- 3) Text book of cosmeticology by Sanju Nanda & Roop K. Khar, Tata Publishers

BP805ET-Pharmacovigilance**Credits: T- 4****Sessional Marks: 25 (T),****L: T- 3:1****University Exams: 75 (T)****COURSE OUTCOMES:**

S. No.	Course Outcomes (CO)	Knowledge Level (Blooms Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Students would know why drug safety monitoring is important	L1: Remember L3: Apply
CO2	They would know history and development of pharmacovigilance, know national and international scenario of pharmacovigilance	L2: Understand L3: Apply L4: Analyse
CO3	Students would be able to identify the Dictionaries, coding and terminologies used in pharmacovigilance	L2: Understand L3: Apply L4: Analyse
CO4	Students would be able to perform Detection of new adverse drug reactions and their assessment	L2: Understand L4: Analyse
CO5	Student would have learnt International standards for classification of diseases and drugs	L2: Understand L4: Analyse
CO6	They would have learnt Adverse drug reaction reporting systems and communication in pharmacovigilance	L2: Understand L4: Analyse

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	1	2	2	2	2	1	2	2	2	2	1	2
CO4	1	2	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	1	2	2	2
Avg	1.4	1.6	1.8	1.8	2	1.4	1.8	1.6	1.8	1.8	1.6	2

BP807ET-Computer Aided Drug Design

Credits: T- 4

Sessional Marks: 25 (T)

L: T: - 3:1

University Exams: 75 (T)

Course Objectives

- This subject is designed to provide detailed knowledge of rational drug design process and various techniques used in rational drug design process.
- Upon completion of the course, the student shall be able to understand
 - Design and discovery of lead molecules
 - The role of drug design in drug discovery process
 - The concept of QSAR and docking
 - Various strategies to develop new drug like molecules.
 - The design of new drug molecules using molecular modelling software

Course Objectives

S. No.	Course Outcomes (CO)	Knowledge Level (Blooms Level)
After completing this course, the student must demonstrate the knowledge and ability to:		
CO1	Explain the various stages of drug discovery. Learn the concept of bioisosterism and drug resistance	L1: Remember L3: Apply
CO2	Describe physicochemical Properties and the techniques involved in QSAR. Learn introduction to Bioinformatics and Cheminformatics	L2: Understand L3: Apply L4: Analyse
CO3	Learn methods in molecular and quantum mechanics	L2: Understand L3: Apply L4: Analyse
CO4	Explain various structure based drug design methods (Molecular docking, Denovo drug design)	L2: Understand L4: Analyse
CO5	Learn the concept of pharmacophore and modelling techniques. Explain the various techniques in Virtual Screening	L2: Understand L4: Analyse

Course Outcomes and Program Outcomes (CO-PO) Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	2	2	2	2	2	1	2	2
CO2	2	2	2	2	2	1	1	1	2	2	1	2
CO3	1	2	2	2	2	1	2	2	2	2	1	2
CO4	1	2	2	2	2	1	2	1	2	2	2	2
CO5	2	1	2	2	2	2	2	2	1	2	2	2
Avg	1.4	1.6	1.8	1.8	2	1.4	1.8	1.6	1.8	1.8	1.6	2

