AVANTHI INSTITUTE OF PHARMACEUTICAL SCIENCES (AUTONOMOUS)

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(Approved by P.C.I, New Delhi, Recognized by the Govt. of A.P., Affiliated to JNTU-GV, Vizianagaram)
Cherukupally (Village), Chittivalasa (SO), Bhogapuram (Mandal), Vizianagaram (Dist)-531162
www.avanthipharma.ac.in, principal@avanthipharma.ac.in

DEPARTMENT OF PHARMACY

Course Structure

Program– B. Pharmacy

Regulation-R25

I Year I Semester-Course Structure

S.No	Category	Course Code	Course Title	Hours per Week			
				Lecture	Tutorial	Practical	Credits
1	PC	R25BP101	Human Anatomy and Physiology-I	3	1	0	4
2	PC	R25BP102	Pharmaceutical Inorganic and Analytical Chemistry	4	0	0	4
3	PC	R25BP103	General Dispensing Pharmacy	3	1	0	4
4	SC	R25BP104	Computers and Digital Tools in Pharmacy	3	1	0	4
5	SC	R25BP105	Professional Communication and Presentation Skills	2	0	0	2
6	PC	R25BP106	Human Anatomy and Physiology-I Practical	0	0	4	2
7	PC	R25BP107	Pharmaceutical Inorganic and Analytical Chemistry Practical	0	0	4	2
8	PC	R25BP108	General Dispensing Pharmacy Practical	0	0	4	2
9	SC	R25BP109	Computers and Digital Tools in Pharmacy Practical	0	0	4	2
10	SC	R25BP110	Professional Communication and Presentation Skills Practical	0	0	2	1
11	MC	R25BP111	Health and Wellness, Yoga and Sports	2	0	0	0
Total				17	3	18	27

Category	Courses	Credits
PC-Pharmacy Core Course	6	18
SC-Skill Oriented Course	4	9
MC-Mandatory Course	1	-
Total	**11**	**27**

DEPARTMENT OF PHARMACY

Course Structure

Program– B. Pharmacy

Regulation-R25

I Year II Semester-Course Structure

S No	Category	Course Code	Course Title	Hours per Week			
				Lecture	Tutorial	Practical	Credits
1	PC	R25BP201	Human Anatomy and Physiology II	4	0	0	4
2	PC	R25BP202	Pharmaceutical Organic Chemistry I	3	1	0	4
3	PC	R25BP203	Medicinal Biochemistry	3	1	0	4
4	PC	R25BP204	Pathophysiology	3	1	0	4
5	SC	R25BP205	AI & Python programming for pharmacy – I	3	0	0	3
6	HS	R25BP206	Environmental Sciences	3	0	0	3
7	PC	R25BP207	Human Anatomy and Physiology II Practical	0	0	4	2
8	PC	R25BP208	Pharmaceutical Organic Chemistry I Practical	0	0	4	2
9	PC	R25BP209	Medicinal Biochemistry Practical	0	0	4	2
10	SC	R25BP210	AI & Python programming for pharmacy – I Practical	0	0	2	1
11	MC	R25BP211	Ethics And Universal Human Values	2	0	0	0
			Total	21	3	14	29

Category	Courses	Credits
PC-Pharmacy Core Course	7	22
HS- Humanity Science and Management Course	1	03
SC-Skill Oriented Course	2	04
MC-Mandatory Course	1	0
Total	**11**	**29**

M. pavani

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Avanthi Institute of Pharmaceutical Sciences (A)
Cherukupally (V), Bhogapuram Mandal
Vizianagaram Dt.,- 531162

R25BP101 **HUMAN ANATOMY AND PHYSIOLOGY-I** **3 1 0 4**

Course Objectives:

- To understand the structural and functional organization of human anatomy and physiology at different levels including subcellular, cellular, tissue and organ systems.
- To explain the physiological mechanisms and normal functioning of major body systems and relevant neurological and biochemical control mechanisms.
- To appreciate coordinated working pattern of different organs of each system.
- To familiarise learners with the anatomical and medical terminology and develop analytical skills to understand the disease mechanisms.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs					DOK (Depth of knowledge)
		PO1	PO3	PO9	PO11	PSO1	
R25BP101.1	Recognize the various homeostatic mechanisms, cellular level organization and summarize the characteristics of different types of tissues and their location in various organs.	3	2	1	2	1	L 1, L2
R25BP101.2	Organize the structure and functions of skin, bones and joints of human body.	3	2	2	2	1	L1, L2
R25BP101.3	Analyze the importance of haemopoietic system in human body and Understand the importance of lymphatic system in human body	3	2	2	2	1	L1, L3
R25BP101.4	Analyze the importance of digestive system in human body. Outline the bioenergetics involved in metabolism of food.	3	2	2	2	1	L3, L4
R25BP101.5	Illustrate the anatomy, physiology and coordinated pathway of heart and blood vessels.	3	2	2	2	1	L5, L6

SYLLABUS

Unit I **10 hours**

Introduction to human body: Definition and scope of anatomy and physiology, levels of structural organization and body systems, basic life processes, homeostasis, basic anatomical terminology.

Cellular level of organization: Structure and functions of cell, transport across cell membrane,

cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b)Paracrine c) Synaptic d) Endocrine

Tissue level of organization: Classification of tissues, structure, location and functions of epithelial, muscular and nervous and connective tissues.

CO's-CO1

Self Learning topics: Recent advances in cell signaling and molecular communication.

Unit II **10 hours**

Integumentary system: Structure and functions of skin

Skeletal system: Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system. Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction.

Joints: Structural and functional classification, types of joints movements and its articulation.

CO's-CO2

Self Learning topics:

Axial vs. Appendicular skeleton – A comparative study with examples.

Unit III **10 hours**

Body fluids and blood: Body fluids, composition and functions of blood, hemopoiesis, formation ofhemoglobin, anemia, mechanisms of coagulation, blood grouping, Rh factors, transfusion, its significance and disorders of blood, Reticulo - endothelial system.

Lymphatic system: Lymphatic organs and tissues, lymphatic vessels, lymph circulation and functions of lymphatic system.

CO's-CO3

Self Learning topics: Erythropoiesis and hemoglobin synthesis in health and disease and Role of lymphatic vessels in fluid balance and immunity.

Unit IV **08 hours**

Digestive system: Anatomy of GI Tract with special reference to anatomy and functions of stomach,(Acid production in the stomach, regulation of acid production through parasympathetic nervous system, pepsin role in protein digestion) small intestine and large intestine, anatomy and functions of salivary glands, pancreas and liver, movements of GIT, digestion and absorption of nutrients and disorders of GIT.

Energetics: Formation and role of ATP, Creatinine Phosphate and BMR.

CO's-CO4

Self Learning topics: ATP as an energy currency – Sources and biological significance.

Unit V **07 hours**

Cardiovascular system: Heart – anatomy of heart, blood circulation, blood vessels, structure and functions ofartery, vein and capillaries, elements of conduction system of heart and heart beat, itsregulation by autonomic nervous system, cardiac output, cardiac cycle. Regulation ofblood pressure, pulse, electrocardiogram and disorders of heart.

CO's-CO5

Self Learning Topics: Electrocardiogram (ECG) and Cardiac Conduction System.

Board of Studies: Pharmacy

Approved in BOS No: 01, 22nd October, 2025

Approved in ACM No: 01

Text Books:

1. Ross and Wilson Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York
2. Principles of Anatomy and Physiology by Tortora, Grabowski. Palmetto, GA, U.S.A.
3. Textbook of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
4. Human Physiology (vol 1 and 2) by Dr. C. C. Chatterjee, Academic Publishers Kolkata

Reference Books:

1. Anatomy and Physiology in Health and Illness by Kathleen J.W. Silson
2. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co Riverview, MI, USA.

Web References:

1. www.teachmeanatomy.info
2. www.innerbody.com
3. www.visiblebody.com
4. www.getbodysmart.com

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35%	--
L2	40%	--
L3	25%	25%
L4	--	35%
L5	--	25%
L6		15%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1 – Remembering

1. Define homeostasis.
2. List the types of connective tissues.
3. What are the basic life processes in the human body?
4. Name the layers of the skin.
5. List the divisions of the skeletal system.
6. Define haemopoiesis.
7. What is the function of haemoglobin?

8. Name the chambers of the heart.
9. Define BMR.
10. Name the organs of the digestive system.

L2 – Understanding

1. Explain the process of blood coagulation.
2. Describe the anatomy and functions of the stomach.
3. Explain the role of ATP in cellular metabolism.
4. Differentiate between axial and appendicular skeleton.
5. Describe the function of the lymphatic system.
6. Explain the classification of joints.
7. Compare arteries and veins based on structure and function.
8. Explain how the autonomic nervous system regulates heart rate.
9. Describe intracellular signaling through synaptic and endocrine pathways.
10. Describe the physiology of neuromuscular junction.

L3 – Applying

1. Illustrate and label the structure of a human cell.
2. Compare compact and spongy bone with examples.
3. Classify joints and provide suitable examples.
4. Illustrate the cardiac cycle with a labelled diagram.
5. Analyze the impact of anemia on oxygen transport.
6. Compare the structure and function of small and large intestines.
7. Illustrate the pathway of digestion from mouth to small intestine.
8. Apply the concept of homeostasis to explain temperature regulation.
9. Compare parasympathetic and sympathetic control of heart function.

L4 -Analyze

1. Compare and contrast intrinsic and extrinsic pathways of coagulation.
2. Analyze the relationship between hemoglobin synthesis and oxygen transport.
3. Break down the sequence of events in protein digestion from ingestion to absorption.
4. Analyze how parasympathetic nervous system regulates acid production in the stomach.

L5 -Evaluate

1. Evaluate the clinical significance of ATP as an energy currency in muscle fatigue.
2. Judge the effectiveness of pancreatic enzymes compared to gastric enzymes in digestion.
3. Evaluate the role of autonomic nervous system in regulating heart rate during exercise vs rest.
4. Critically assess the clinical utility of electrocardiogram in diagnosing heart disorders.

L6 - Create

1. Design a simulation model to demonstrate blood flow through the heart and circulation.
2. Create a diagnostic decision tree to identify common heart disorders based on ECG patterns.

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R25BP102 PHARMACEUTICAL INORGANIC AND ANALYTICAL CHEMISTRY 4 0 0 4

Course Objectives:

- To understand the pharmaceutical importance of inorganic compounds.
- To comprehend the principles of volumetric analysis.
- To develop practical skills in performing and interpreting limit tests and analytical tests.
- To emphasize the importance of radiopharmaceuticals in Pharmacy.
- To analyze inorganic compounds products by different volumetric methods.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs							DOK
		PO1	PO3	PO4	PO6	PO9	PO11	PSO1	
R25CO102.1	Identify sources and types of errors in pharmaceutical analysis, and impurities products	2	2	-	2	1	-	-	L 1, L2
R25CO102.2	Describe and differentiate various analytical techniques used in pharmaceutical analysis, including titrimetric methods, and their specific applications in quality assessment.	2	2	-	1	-	2	-	L2, L3
R25CO102.3	Apply concepts of acid-base chemistry, buffer systems with importance of electrolytes	2	2	3	1	-	2	-	L3, L4
R25CO102.4	Analyze the properties, mechanisms, and therapeutic uses of gastrointestinal agents, Radio pharmaceuticals, expectorants, antidotes, and other pharmaceutical compounds, illustrating their roles in therapy and safety considerations.	2	2	3	1	-	2	-	L1, L5
R25CO102.5	Describe the drugs used in expectorants, emetics, haematinics, poison and antidote and astringents.	2	3	3	1	-	2	-	L2, L6

SYLLABUS

For compounds marked with an asterisk (*), study the general methods of preparation, Properties, assay procedures, and medicinal uses. For compounds without an asterisk, study their formula and medicinal uses.

UNIT I: **08 Hours**

Introduction to pharmaceutical analysis: Different techniques of analysis, Methods of expressing strength of solutions, Primary and secondary standards with examples.

Errors: Sources of errors, types of errors, methods of minimizing errors, accuracy, precision and significant figures.

Impurities: Definition, types, contents and regulatory importance. Sources and types of impurities in Pharmaceuticals, limit tests for chloride, sulphate, iron, arsenic, lead, heavy metals, and modified limit test for chloride and sulphate. **CO's–CO1**

Self Learning Topics: ICH Guidelines for Impurity Limits, Modern Techniques for Heavy Metal Detection and Toxicological Effects of Pharmaceutical Impurities.

UNIT II: **07 Hours**

Acid-Base Chemistry and Buffer Systems in Pharmacy: Definition of acids, bases, buffers, pH Scale and its significance, Buffer equation, calculation of pH for Buffer solution. Isotonicity and its application in IV Fluids and Ophthalmic Solutions.

Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium chloride and Oral Rehydration Salt (ORS), Physiological acid base balance. **`CO's–CO2**

Self Learning Topics: Pharmaceutical Applications of Buffers and Isotonic Solutions, Role of Electrolytes in Acid-Base Balance and Fluid Replacement Therapy

UNIT III: **14 Hours**

Principles and applications of the following titrimetric methods of analysis:

Acid base titrations: Theories of acid base indicators, classification of acid base titrations. Preparation and standardization of titrants viz. hydrochloric acid and sodium hydroxide. Theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curves.

Non-aqueous titrations: Types of solvents used, acidimetric and alkalimetric titration using non-aqueous solvents. Preparation and standardization of acidic and basic titrants. Estimation of weakly acidic and basic substances using non- aqueous titrants.

Precipitation titrations and gravimetry: Mohr's method, Volhard's, Modified Volhard's, Fajans method. Estimation of barium sulphate by gravimetry.

Complexometric titrations: Classification, metal ion indicators, masking and demasking reagents, preparation and standardization of disodium EDTA. Estimation of Magnesium sulphate and Calcium gluconate*.

Redox titrations: Concepts of oxidation and reduction, Types of redox titrations viz. Permanganometry, Cerimetry, Iodimetry, Iodometry and titrations with potassium iodate.

CO's–CO3

Self Learning Topics: Applications of various titrations in assay of official compounds.

UNIT IV: **10 Hours**

Gastro intestinal agents

a. Acidifiers: Sodium acid phosphate and Dilute Hydrochloric acid

b. Antacids: Ideal properties of antacids, combinations of antacids, Sodium bicarbonate*, Aluminium hydroxide gel*

c. Agents promote bowl movements: Magnesium hydroxide, Sodium orthophosphate, Sodium Potassium tartrate

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

Radiopharmaceuticals: Basics of radioactivity, applications of radioisotopes of Sodium Iodide I-131, Technetium-99m, Cobalt-60, Phosphorus-32 including safe handling, storage, and disposal of radiopharmaceuticals, adhering to regulatory guidelines for safety. **CO's–CO4**

Self Learning Topics: Mechanism and Therapeutic Uses of Inorganic acidifiers, antacids, cathartics and anti microbial agents. Radiation Safety and Handling of Radiopharmaceuticals

UNIT V: **06 Hours**

Miscellaneous Compounds

Expectorants: Potassium iodide, Ammonium chloride*.

Emetics: Copper sulphate*, Sodium potassium tartrate

Haematinics: Ferrous sulphate*, Ferrous gluconate

Poison and Antidote: Definition, classification of antidotes, Sodium thiosulphate, activated charcoal, Sodium nitrite

Astringents: Zinc Sulphate, Aluminium sulphate **CO's–CO5**

Self Learning Topics: Mechanism and Therapeutic Uses of Inorganic compounds.

Board of Studies: Pharmacy

Approved in BOS No: 01, 22nd October, 2025

Approved in ACM No: 01

Text Books:

1. Vogel's Text Book of Quantitative Chemical Analysis. Pearson Education Limited, Essex, England
2. Block JH. Inorganic, Medicinal and Pharmaceutical Chemistry. Philadelphia: Lea & Febige.
3. Beckett AH, Stenlake JB. Practical Pharmaceutical Chemistry. Part I & II London: Stahlone Press, University of London.
4. Indian Pharmacopoeia. Indian Pharmacopoeia Commission, Ghaziabad.
5. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II,Stahlone Press of University of London, 4th edition.
6. A.I. Vogel, Text Book of Quantitative Inorganic analysis
7. M.L Schroff, Inorganic Pharmaceutical Chemistry

Reference Books:

1. Indian Pharmacopoeia
2. United State Pharmacopoeia
3. Bentley and Driver's Textbook of Pharmaceutical Chemistry
4. Anand & Chatwal, Inorganic Pharmaceutical Chemistry

Web References:

1. https://www.pharmacytimes.com/
2. https://nptel.ac.in/
3. https://ipc.gov.in/
4. https://www.pharmacopoeia.com/

5. https://www.usp.org/
6. https://www.sciencedirect.com/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	20%	20%
L2	25%	25%
L3	20%	20%
L4	15%	15%
L5	10%	10%
L6	10%	10%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1. Remember

1. Define primary standard and secondary standard with examples.
2. List the different sources of errors in pharmaceutical analysis.
3. State any two types of impurities found in pharmaceuticals.
4. State the Henderson–Hasselbalch equation.
5. List major intracellular and extracellular electrolytes.
6. Define isotonicity.
7. State the principle of Mohr's method.
8. List different types of acid–base indicators.
9. Name two examples of non-aqueous solvents used in titrations.
10. Name two examples of systemic antacids.
11. List commonly used radiopharmaceutical isotopes.
12. State the ideal properties of an antacid.
13. Define antidote with examples.
14. List two haematinics used in iron-deficiency anaemia.
15. Name two astringents used in pharmacy.

L2. Understand

1. Explain the significance of significant figures in pharmaceutical analysis.
2. Differentiate between systematic errors and random errors with examples.
3. Describe the regulatory importance of testing impurities in pharmaceuticals.
4. Explain the importance of isotonicity in ophthalmic solutions.
5. Describe the role of sodium and potassium ions in maintaining physiological balance.
6. Explain the concept of physiological acid–base balance.
7. Explain why non-aqueous solvents are required in some titrations.
8. Discuss the role of masking and demasking agents in complexometric titrations.
9. Describe the difference between acid–base, redox, and precipitation titrations.
10. Explain the mechanism of action of hydrogen peroxide as an antimicrobial.

11. Describe the safe handling procedures for radiopharmaceuticals.
12. Explain the difference between systemic and non-systemic antacids.
13. Explain the mechanism of action of activated charcoal as an antidote.
14. Describe the difference between expectorants and emetics.
15. Explain why ferrous salts are preferred as haematinics.

L3. Apply

1. Calculate the molarity of a solution containing 9.8 g of H_2SO_4 in 1 L of solution.
2. Apply the concept of limit test to determine chloride impurity in a pharmaceutical sample.
3. Use the concept of significant figures to round off the value 0.004578 to three significant figures.
4. Calculate the pH of a buffer prepared from 0.1 M acetic acid and 0.1 M sodium acetate.
5. Apply the knowledge of electrolytes to suggest a therapy for dehydration using ORS.
6. Prepare an isotonic solution of sodium chloride suitable for intravenous use.
7. Standardize 0.1 N NaOH using oxalic acid as a primary standard.
8. Estimate the amount of magnesium sulphate in a sample using EDTA titration.
9. Apply redox titration principles to determine the concentration of ferrous sulphate using $KMnO_4$.
10. Suggest a suitable combination of antacids for a patient suffering from hyperacidity.
11. Apply isotonicity principles to design an ophthalmic preparation.
12. Recommend a radiopharmaceutical isotope for the diagnosis of thyroid disorders.
13. Recommend a haematinic preparation for a patient with iron-deficiency anaemia.
14. Apply the concept of antidote therapy in treating cyanide poisoning.
15. Prescribe an expectorant for a patient with productive cough.

L4. Analyze

1. Compare accuracy and precision using given analytical data.
2. Analyze the differences between primary and secondary standards with examples.
3. Examine the types of impurities in pharmaceuticals and classify them based on their sources.
4. Differentiate between acidic and basic buffer systems with examples.
5. Analyze the consequences of sodium–potassium imbalance in the human body.
6. Break down the role of electrolytes in maintaining osmotic pressure.
7. Compare the neutralization curves of strong acid vs weak acid titrations.
8. Analyze the difference between Mohr's method and Volhard's method in precipitation titrations.
9. Distinguish between permanganometry and iodometry in redox titrations.
10. Compare the properties of sodium bicarbonate and aluminium hydroxide as antacids.
11. Analyze the advantages and limitations of using I-131 in thyroid disorder treatment.
12. Examine the different classes of antimicrobials used in pharmacy and their mechanisms.
13. Differentiate between systemic and local astringents with examples.
14. Analyze the therapeutic role of emetics in accidental poisoning.
15. Compare the mechanisms of action of sodium nitrite and activated charcoal as antidotes.

L5. Evaluate

1. Justify the need for modified limit tests in chloride and sulphate determination.
2. Evaluate the reliability of a method that shows consistent but inaccurate results.
3. Critically assess the importance of error minimization techniques in analytical chemistry.
4. Critically evaluate the use of ORS in treating electrolyte imbalance.
5. Assess the importance of buffer capacity in pharmaceutical formulations.

6. Judge the clinical significance of maintaining acid–base balance in the body.
7. Justify the choice of EDTA as a versatile titrant in complexometric titrations.
8. Evaluate the accuracy and sensitivity of gravimetric analysis compared to titrimetric methods.
9. Appraise the importance of selecting appropriate indicators in acid–base titrations.
10. Assess the safety concerns of long-term use of magnesium hydroxide as a laxative.
11. Evaluate the regulatory importance of radioactive waste disposal in hospitals.
12. Judge the effectiveness of different antimicrobial agents in controlling microbial growth.
13. Evaluate the effectiveness of sodium thiosulphate as an antidote in arsenic poisoning.
14. Critically appraise the use of copper sulphate as an emetic in modern clinical practice.
15. Assess the therapeutic value of ferrous salts in the treatment of anaemia

L6. Create

1. Design a simple experimental procedure to minimize random errors in volumetric analysis.
2. Propose a flow chart for classifying impurities in pharmaceutical substances.
3. Develop a checklist for ensuring accuracy and precision in pharmaceutical analysis.
4. Formulate an isotonic ophthalmic solution using sodium chloride.
5. Design a buffer system to maintain the pH of a drug solution at 7.4.
6. Propose a composition for an IV fluid that restores electrolyte balance during dehydration.
7. Design a stepwise protocol for iodometric estimation of copper sulphate.
8. Propose a modified titration method for a weakly acidic drug insoluble in water.
9. Develop a decision tree to select the appropriate titration method for different classes of drugs.
10. Design an educational chart highlighting the classification of gastrointestinal agents with examples.
11. Propose a safe disposal protocol for radioactive waste in hospitals.
12. Create a comparative table showing the mechanism, advantages, and limitations of different antacids.
13. Design a patient information leaflet on the use of ORS and haematinics.
14. Propose a decision tree for the classification and therapeutic use of antidotes.
15. Develop a treatment chart summarizing expectorants, emetics, haematinics, antidotes, and astringents.

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R25BP103 **GENERAL DISPENSING PHARMACY** **3 1 0 4**

Course Objectives:

- To know about the evolution and development of Pharmacy profession in India and the growth of the Pharmaceutical Industries over the years.
- To understand the role of Pharmacopoeias and other official books in maintaining the standards of medicines. Responsibilities of Pharmacist in various domains of pharmacy
- To exercise the pharmaceutical calculations used in dispensing and compounding.
- To understand the role of active pharmaceutical ingredients and pharmaceutical excipients in drug formulations
- To gain knowledge about formulation and preparation of various solid, liquid and semisolid dosage forms.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs							DOK
		PO1	PO3	PO4	PO6	PO7	PO9	PSO1	
R25CO103.1	Know the history of profession of pharmacy. Understand the basics of different dosage forms and importance of prescription.	2	2	-	2	3	1	3	L1, L2
R25CO103.2	Solve the pharmaceutical calculations and summarize the importance of posology. Know the classification of dosage forms.	3	3	3	1	-	-	3	L1, L3
R25CO103.3	Summarize the basics of compounding and dispensing of solid dosage forms such as powders, tablets and capsules liquid dosage forms.	3	3	3	1	-	3	3	L2, L4
R25CO103.4	Understand the preparation of various Compounding of monophasic and biphasic liquid dosage forms.	3	3	3	1	-	3	3	L1, L5
R25CO103.5	Know the preparation of semisolid dosage forms and suppositories Understand Various pharmaceutical incompatibilities	3	2	3	1	-	3	1	L2, L6

SYLLABUS

UNIT I

09 Hours

Historical background and development of profession of pharmacy: History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Evolution, Development and Milestones.

Scope of Pharmacy Profession: Role and Responsibilities of Pharmacist in –Retail/ Community Pharmacy, Hospital and Clinical Pharmacy, and Industrial Pharmacy including research and development

Pharmacopoeias: Introduction to IP, BP, USP, BPC, INF and Extra Pharmacopoeia. Structure and Content of IP, Study of one model IP monograph

Dosage forms: Introduction to dosage forms, classification and definitions

Prescription: Definition, Parts of prescription, handling of Prescription, Errors in prescription and Modern prescription, Latin Terminology related to prescription.

CO's–CO1

Self- Learning Topics : Pharmacy organizations in India, Role of pharmacopoeias, digital prescribing.

UNIT II:

09 Hours

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

Posology: Definition, Factors affecting posology. Pediatric dose calculations based on age, body weight and body surface area.

Introduction to Dosage Forms: Introduction to Routes of administration, Classification of Dosage Forms. Introduction to Active Pharmaceutical Ingredient and Excipients: Definition, Ideal Characteristics and Importance.

CO's–CO2

Self- Learning Topics: Complex calculation methods for formulation design, Practice problems: Dilution of stock solutions to desired strength.

UNIT III

09 Hours

Solid dosage forms

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

Tablets: Definition, Types of Tablets including moulded Tablets and pills with Examples, Advantages and Disadvantages. Brief introduction to methods of preparation.

Capsules: Definition, Types of Capsules, Advantages and Disadvantages, Capsule sizes. Brief introduction to methods of preparation.

CO's–CO3

Self- Learning Topics: Overcoming stability issues, Comparison of natural vs synthetic excipients, Practical examples from marketed products.

UNIT IV

09 Hours

Liquid dosage forms: Advantages and disadvantages of liquid dosage forms. Excipients used in formulation of liquid dosage forms. Solubility enhancement techniques.

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

Biphasic liquids:

Suspensions: Definition, advantages and disadvantages, classifications, Preparation of suspensions; Flocculated and Deflocculated suspension.

Emulsions: Definition, classification, emulsifying agent, test for the identification of type of Emulsion, Methods of preparation.

CO's–CO4

Self- Learning Topics: Overcoming stability issues, Comparison of natural vs synthetic excipients, Practical examples from marketed products.

UNIT V **09 Hours**

Semisolid dosage forms: Definitions, Classification, Advantages & disadvantages, Ointment Bases and other excipients used in Semi-Solid Dosage Forms, General Methods of Preparation of Ointments, Pastes, Creams, and Gels.

Suppositories: Definition, Types of Suppositories, Advantages and Disadvantages, Formulation Excipients used in Suppositories, Properties of Ideal Suppository Bases, Types of Suppository Bases, Displacement value, General Method of Preparation.

Pharmaceutical incompatibilities: Definition, classification, physical, chemical and therapeutic incompatibilities with examples.

CO's–CO5

Self- Learning Topics: Role of enhancers, Oleaginous bases, step-by-step calculation practice for displacement value. Real-world implications for patient safety, Use of solvents, adjustment of pH, altering order of mixing.

Board of Studies: Pharmacy

Approved in BOS No: 01, 22nd October, 2025

Approved in ACM No: 01

Text Books:

1. Mehta, R. M. (2024). Pharmaceutics-I (6th ed.; rpt. 2024). Vallabh Prakashan.
2. Cooper, J. W, & Gunn, C. (1972). Cooper & Gunn's Tutorial Pharmacy (6th ed.). Pitman Medical.
3. Dispensing of Pharmaceutical students - Cooper & Gunn's.

Reference Books:

1. M.E. Aulton, Pharmaceutics, The Science& Dosage Form Design, Churchill Livingstone, Edinburgh.
2. Indian pharmacopoeia
3. British pharmacopoeia.
4. Lachmann. Theory and Practice of Industrial Pharmacy, Lea & Febiger Publisher, The University of Michigan.

Web References:

1. https://ipc.gov.in

2. https://www.pharmacopoeia.com
3. https://www.ipec.org
4. https://www.pharmpress.com/product/9780857113757/handbook-of-pharmaceutical-excipients
5. https://www.pharmacy180.com/menu/pharmacy/?utm_source=chatgpt.com

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	20%	20%
L2	25%	25%
L3	20%	20%
L4	15%	15%
L5	10%	10%
L6	10%	10%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Define pharmacopoeia.
2. Mention any two factors affecting posology.
3. Name the first edition of Indian Pharmacopoeia and its year of publication.
4. List the main parts of a prescription.
5. Write two career opportunities available in the pharmacy profession.
6. Define alligation in pharmaceutical calculations.
7. Write any two advantages of powders as a dosage form.
8. What is meant by proof spirit?
9. Define eutectic mixture with one example.
10. What is geometric dilution?
11. Define semisolid dosage forms with two examples.
12. Write any two factors influencing dermal penetration of drugs.
13. Define tablets and capsule with examples.
14. List the types of suppository bases.
15. State two advantages of suppositories as a dosage form.

L2: Understand

1. Explain the importance of pharmacopoeias in maintaining drug quality.
2. Discuss the development of pharmacy education in India after independence.
3. Differentiate between solid and liquid dosage forms with examples.
4. Explain the significance of avoiding errors in prescriptions.
5. Describe how age influences drug dosing in pediatrics.
6. Explain the advantages and disadvantages of liquid dosage forms.
7. Describe the role of excipients in liquid dosage form formulation with examples.
8. Explain any two solubility enhancement techniques used in pharmacy.
9. Differentiate between flocculated and deflocculated suspensions.
10. Explain the significance of emulsifying agents in emulsions.
11. Explain the term pharmaceutical incompatibility with an example.
12. Differentiate between physical and chemical incompatibilities.
13. Describe therapeutic incompatibility with a suitable example.
14. Why is it important for a pharmacist to understand classification of incompatibilities?
15. Explain how solubility issues can lead to physical incompatibility in prescriptions.
16. Explain methods of preparation of tablets.
17. Explain methods of preparation of Capsules.

L3: Apply

1. Calculate the grams of NaCl required to prepare 250 mL of 0.9% w/v solution.
2. Using alligation method, find the volumes of 95% alcohol and water required to prepare 300 mL of 70% alcohol.
3. A prescription requires compound powder of aspirin and caffeine in a 4:1 ratio. Calculate the quantities of each ingredient for 10 g of powder.
4. Prepare effervescent powder containing 2 g citric acid. Calculate the amount of sodium bicarbonate required (molar ratio 1:3).
5. A physician prescribes compound powder of 150 mg aspirin and 50 mg caffeine per dose. Calculate the quantities required for 20 doses.
6. Apply solubility enhancement techniques to improve drug dissolution.
7. Calculate displacement value for suppository formulation.
8. Prepare an ointment base formulation for topical application.
9. Identify and resolve physical incompatibility in a parenteral mixture.
10. Modify a prescription to avoid therapeutic incompatibility.

L4: Analyze

1. Compare suspensions and emulsions in terms of definition, formulation, and stability.

2. Analyze the stability problems in suspensions and suggest methods to overcome them.
3. Evaluate the tests used to identify the type of emulsion and justify their importance.
4. Compare the therapeutic applications of monophasic liquids such as syrups, elixirs, and gargles.
5. Examine the reasons why flocculated suspensions are considered more stable than deflocculated suspensions in practice.

L5: Evaluate

1. Critically evaluate the suitability of ointments vs creams for dermatological conditions.
2. Judge the clinical importance of calculating displacement value in suppository formulation.
3. Evaluate the role of excipients in semisolid dosage forms in relation to patient compliance.
4. Compare and justify the use of rectal suppositories vs oral dosage forms in pediatric patients.
5. Assess the effectiveness of evaluation parameters (like consistency, spreadability, melting point) in ensuring quality of semisolids and suppositories.

L6: Create

1. Design a protocol for minimizing prescription errors due to incompatibilities in a community pharmacy.
2. Propose a decision-making flowchart to identify and resolve incompatibilities in extemporaneous compounding.
3. Create a case scenario involving a chemical incompatibility and suggest a practical solution.
4. Suggest innovative formulation strategies to prevent therapeutic incompatibilities in polypharmacy.
5. Develop a guideline for pharmacists to counsel physicians and patients about avoiding incompatibilities.

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R25BP104 COMPUTERS AND DIGITAL TOOLS IN PHARMACY 3 1 0 4

Course Objectives:

1. To know the various types of application of computers in pharmacy
2. To describe use of web technologies such as HTML, XML, CSS, Programming languages, Web servers and pharmacy drug database.
3. To discuss about different types of databases, applications of computers and databases in pharmacy.
4. To explain about bioinformatics and its impact in vaccine discovery and database.
5. Analyses computers as data analysis in preclinical development.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs							DOK
		PO1	PO3	PO4	PO6	PO9	PO11	PSO1	
R25CO104.1	Illustrate the concept of number system in computers.	2	2	-	2	1	-	-	L 1, L2
R25CO104.2	Describe use of web technologies such as HTML, XML, CSS, Programming languages, Web servers and pharmacy drug database.	2	2	-	1	-	2	-	L1, L3
R25CO104.3	Discuss about different types of databases, applications of computers and databases in pharmacy. Appraise the applications of computers in pharmacy such as drug information services, pharmacokinetics, mathematical model in drug design, hospital and clinical pharmacy etc.,	2	2	3	1	-	2	1	L2, L3
R25CO104.4	Illustrate bioinformatics and its impact in vaccine discovery and database. Cheminformatics and Pharmacogenomics	2	2	3	1	-	2	-	L3, L5
R25CO104.5	Analyze computers as data analysis in preclinical development.	2	3	3	1	-	2	-	L4, L6

SYLLABUS

UNIT I: **09 Hours**

Number system: Binary number system, Decimal number system, Octal number system, Hexadecimal number systems, conversion decimal to binary, binary to decimal, octal to binary etc, binary addition, binary subtraction – One's complement, Two's complement method, binary multiplication, binary division.

Concept of Information Systems and Software: Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project.

CO's–CO1

Self learning topics: Binary Coded Decimal (BCD), ASCII and Unicode.

UNIT II: **09 Hours**

Web technologies: Introduction to HTML, XML,CSS and Programming languages, introduction to web servers and Server Products Introduction to databases, MYSQL, MS ACCESS, Pharmacy Drug database. Drug information databases (Micromedex, Lexicomp, PubMed, Medscape), Online bibliographic databases (Scopus, Web of Science, PubMed Central).

CO's–CO2

Self learning topics: CSS (Cascading Style Sheets), JavaScript (JS) – Client-side Programming.

UNIT III: **09 Hours**

Application of computers in Pharmacy: Drug information storage and retrieval, Pharmacokinetics, Mathematical model in Drug design, Hospital and Clinical Pharmacy, Electronic Health Records (EHRs), e-Prescriptions and Computerized Physician Order Entry (CPOE), barcode medicine identification and automated dispensing of drugs, mobile technology and adherence monitoring. Diagnostic System, Lab-diagnostic System, Patient Monitoring System, Pharma Information System.

Telepharmacy & Health: Telemedicine & telepharmacy concepts, Mobile apps for drug adherence and patient counseling, Wearable devices and digital therapeutics, Case studies on digital health applications.

CO's–CO3

Self learning topics: SQL, Excel, Microsoft Access, Healthcare IT standards.

UNIT IV: **09 Hours**

Bioinformatics: Introduction, Objective of Bioinformatics, Bioinformatics Databases, Concept of Bioinformatics in drug discovery, Impact of Bioinformatics in Vaccine Discovery, Cheminformatics and Pharmacogenomics.

CO's–CO4

Self learning topics: DNA/Protein sequence analysis, Gene-drug interaction studies.

UNIT V: **09 Hours**

Computers as data analysis in Preclinical development: Chromatographic dada analysis (CDS), Laboratory Information management System (LIMS) and Text Information Management System (TIMS).

Cybersecurity and Legal Aspects: Data protection, patient confidentiality (HIPAA, GDPR, IT Act), Cybersecurity issues in pharmacy practice, Ethical considerations in digital pharmacy.

CO's–CO5

Self learning topics: Software to assist in therapeutic decisions, Drug-allergy and drug-drug interaction checks

Board of Studies: Pharmacy
Approved in BOS No: 01,
22nd October, 2025 Approved in ACM No: 01

Text Books:

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA.

Reference Books:

1. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi-CBS Publishers and Distributors.
2. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague – Wiley Dreamtech India (P) Ltd.

Web References

1. https://www.capterra.com/pharmacy-software/?
2. https://www.pbahealth.com/elements/pharmacy-software
3. https://www.qualio.com/blog/pharmaceutical-software?utm_sourc

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35%	--
L2	40%	--
L3	25%	25%
L4	--	35%
L5	--	25%
L6	--	15%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1- Remember

1. What do you understand by the term requirement analysis and feasibility analysis?
2. Write a short note on planning the project.
3. How will you convert Binary System into decimal number system and vice versa? Give examples.
4. What do you understand by electronic description? What are its benefits?
5. Write a short note on drug information storage and Retrieval.
6. Write a short note on medication monitoring.
7. Write a short note on lab Diagnostic systems.

L2- Understand

1. Describe a data flow diagram in your own words.
2. What is CCS and what are its advantages?
3. What is the advantages and disadvantages of using high level languages?
4. Define MS Access list its uses and limitations.
5. What is the purpose of pharmacy drug database?
6. Give few examples of Pharmacy drug database.
7. Differentiate between HTML and XML.
8. Describe briefly various types of programming languages and their advantages and disadvantages.

L3- Apply

1. Briefly describe Hospital and clinical pharmacy. Also discuss you just in hospital and clinical pharmacy.
2. What do you understand by the term "Bioinformatics"
3. Name of few bioinformatic databases along with their usage.
4. Briefly explain the impact of bioinformatics in discovery of vaccines
5. Discuss classification of biological data bases in detail
6. Discuss laboratory information management system in detail
7. Describe chromatography data analysis and its importance
8. Explain concept of bioinformatics databases to illustrate how genomic data can be used in vaccine discovery.
9. How cheminformatics tools can be used to identify potential lead compounds in drug discovery?
10. Pharmacogenomics principles to explain how genetic variations influence drug response in different populations.
11. Explain the process of integrating bioinformatics and cheminformatics data for designing personalized vaccines.

L4- Analyze

1. Differentiate between the roles of CDS, LIMS, and TIMS in managing preclinical data.
2. Analyze how the integration of CDS and LIMS improves data accuracy and regulatory compliance.
3. Identify the potential risks of non-compliance in electronic submissions and analyze their impact on drug approval timelines.

L5- Evaluate

1. Evaluate the effectiveness of bioinformatics in accelerating vaccine discovery compared to traditional laboratory methods.
2. Assess the role of pharmacogenomics in reducing adverse drug reactions and improving patient safety.
3. Critique the limitations of current bioinformatics databases in providing reliable information for vaccine development.
4. Recommend strategies for integrating cheminformatics and bioinformatics to improve drug design and vaccine discovery.
5. Prioritize the advantages of pharmacogenomics over conventional pharmacology in developing precision medicine.

L6- Create

1. Design a data workflow that integrates CDS, LIMS, and TIMS to streamline preclinical data analysis.
2. Formulate a strategy to ensure seamless transfer of experimental data from CDS/LIMS to regulatory submission tools.
3. Develop a model for error detection in automated compliance checking of preclinical datasets.

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R25BP105 PROFESSIONAL COMMUNICATION AND PRESENTATION SKILLS

2 0 0 2

Course Objectives:

- To understand the principles, barriers, and processes of communication within professional and cross-cultural contexts.
- To demonstrate competence in listening, written, and oral communication skills tailored for pharmacy practice and healthcare settings.
- To apply effective interpersonal and group communication strategies including interview, presentation, and group discussion techniques.
- To analyse the factors influencing communication perceptions and style for better professional rapport.
- To evaluate communication situations for clarity, purpose, audience, and effectiveness using technological tools where required.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs							DOK
		PO2	PO3	PO8	PO9	PO11	PSO1	PSO2	
R25C0105.1	Explain the purpose and importance of communication and identify various communication barriers.	-	-	3	1	2	-	2	L 1, L2
R25C0105.2	Differentiate communication styles and explain their relevance in professional and intercultural contexts.	1	1	3	-	2	-	2	L2, L3
R25C0105.3	Demonstrate active and empathetic listening in healthcare communication scenarios.	-	-	3	-	2	-	2	L 3, L4
R25C0105.4	Analyse written communication methods, structure, and techniques for pharmacy contexts.	-	-	3	-	2	1	2	L3, L4
R25C0105.5	Apply strategies in interviews, presentations, and group discussions using appropriate technology and style	-	-	3	1	2	-	2	L5, L6

SYLLABUS

UNIT I **07 Hours**

Communication Foundations & Barriers: Definition, importance in pharmacy, Communication process and barriers, Physiological, psychological, interpersonal, cultural aspects, Visual perception, language, past experiences.

CO's- CO1

Self-Learning Topics: How Cultural and Psychological Barriers Affect Patient Counseling in Pharmacy Practice

UNIT II **07 Hours**

Elements & Styles of Communication: Tone, body language, verbal/non-verbal cues Communication styles matrix, Cross-cultural communication.

CO's- CO2

Self-Learning Topics: Active Listening Strategies in Managing Difficult Patient Interactions

UNIT III **07 Hours**

Listening Skills: Active listening, Empathetic listening in healthcare, Handling difficult listening.situations.

Written Communication: When to use written communication Clarity, message structure, audience awareness, Use of visual aids.

CO's- CO3

Self-Learning Topics: Designing Effective Pharmacy Presentations and Participating in Health-Based Group Discussions

UNIT IV **05 Hours**

Interview & Presentation Skills: Purpose and technique of interviews, Structuring presentations, Use of technology, delivery methods.

CO's-CO4

Self-Learning Topics: Common Interview Mistakes and How to Avoid Them in Healthcare Settings.

UNIT V **04 Hours**

Group Discussion Skills: GD protocols and purpose, Do's and Don'ts, Evaluation techniques.

CO's- CO5

Self-Learning Topics: Common GD Evaluation Criteria and How to Perform Well in Campus Placements.

Board of Studies: Pharmacy

Approved in BOS No: 01, 22nd October, 2025

Approved in ACM No: 01

Text Books

1. Meenakshi Raman and Sangeeta Sharma – Technical Communication: Principles and Practice, Oxford University Press.

2. Leena Sen – Communication Skills, Prentice-Hall of India.

Reference Books

1. Raymond Murphy – English Grammar in Use, Cambridge University Press.

2. Barun K. Mitra – Personality Development and Soft Skills, Oxford University Press.

3. Dr. Shalini Verma – Body Language: Your Success Mantra, S. Chand Publishing .

4. Dr. K. Alex – Soft Skills: Know Yourself and Know the World, S. Chand Publishing.

Web References:

1. https://www.skillsyouneed.com/ips/communication-skills.html
2. https://www.indeed.com/career-advice/career-development/types-of-communication
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5665170/
4. https://www.mbauniverse.com/group-discussion

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35%	--
L2	40%	--
L3	25%	25%
L4	--	35%
L5	--	25%
L6		15%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1 – Remember

1. Define communication and list its elements.
2. What are emotional barriers to effective communication?
3. List and explain any two functions of communication.

L2 – Understand

1. Describe a case of poor intercultural communication in a pharmacy setting.
2. Compare direct and considerate communication styles.
3. Relate active listening with a healthcare example.

L3 – Apply

1. Illustrate a visual layout for a pharmacy-related presentation.
2. Correlate the use of non-verbal cues in group discussions.
3. Explain a communication checklist for interviewing a patient.
4. Examine how delivery methods (verbal, non-verbal, digital) affect audience engagement in healthcare presentations.
5. Compare the strengths and weaknesses of using slides vs. handouts during pharmacy presentations.
6. Analyze common interview mistakes and their potential impact on a candidate's performance.

L4 – Analyze

1. Analyze the differences in approach between academic presentations and professional healthcare interviews.
2. Break down the components of a well-structured healthcare presentation and explain how each contributes to clarity.
3. Examine how delivery methods (verbal, non-verbal, digital) affect audience engagement in healthcare presentations.
4. Compare the strengths and weaknesses of using slides vs. handouts during pharmacy presentations.
5. Analyze common interview mistakes and their potential impact on a candidate's performance.

L5 – Evaluate

1. Critically evaluate the effectiveness of a group discussion in selecting candidates for healthcare-related jobs.
2. Assess the importance of following GD protocols in ensuring fair and productive discussions.
3. Judge the impact of common "Do's and Don'ts" on the outcome of a pharmacy-related group discussion.
4. Evaluate different evaluation techniques used in GDs and suggest which is most suitable for healthcare settings.
5. Critically appraise the role of communication skills versus subject knowledge in determining GD performance.

L6 – Create

1. Design a new GD protocol tailored for evaluating pharmacy students' communication and decision-making skills.

2. Develop a set of innovative evaluation criteria that can measure empathy and teamwork in healthcare GDs.
3. Create a mock GD scenario on the topic "Over-the-counter drug misuse in India" including roles and expected outcomes.
4. Formulate an alternative strategy for conducting GDs online in virtual healthcare education platforms.
5. Construct a comprehensive guideline booklet on GD "Do's and Don'ts" for pharmacy students.

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R25BP106 **Human Anatomy and Physiology-I Practical** **0 0 4 2**

Course Objectives:

1. To understand and describe the principles and applications of microscopy techniques.
2. To explain the gross morphology, structures and functions of various organs and organ systems of the human body.
3. To estimate various haematological parameters and to describe the various homeostatic mechanisms and their imbalances.
4. To understand coordinated working patterns of different organs of each system.

Course outcomes:

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs					DOK
		PO1	PO3	PO9	PO11	PSO1	
R25BP106.1	Recall handling of compound microscope and to outline the microscopic characteristics of various tissues.	3	2	1	2	1	L1, L2
R25BP106.2	Summarize the characteristics of different bones (skeletal system) & types of joints. Estimate ESR, and their own blood group.	3	2	2	2	1	L2, L3
R25BP106.3	Determine various physical parameters such as heart rate, ECG, BP.	3	2	2	2	1	L 3, L4
R25BP106.4	Estimate the various haematological parameters such as WBC, RBC count, bleeding, clotting time Hb.	3	2	2	2	1	L5, L6

Board of Studies: Pharmacy

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COURSE CONTENT

Practical HAP allows the verification of physiological processes discussed in theory classes through experiments on living tissues, simulated animal models, charts, and models.

S. No	Name of the Experiment	CO's
01	Principle and applications of compound microscope	CO1
02	Microscopic study of epithelial, connective tissues.	CO1
03	Microscopic study of muscular tissues	CO1
04	Microscopic study of nervous tissues	CO1
05	Determination of blood groups	CO2
06	Estimation of haemoglobin content	CO2
07	Determination of erythrocyte sedimentation rate (ESR)	CO2
08	Identification of axial bones and appendicular bones	CO3
09	Learning through charts and models – Digestive system	CO3
10	Learning through charts and models – Heart and blood vessels	CO3
11	Determination of heart rate, pulse rate	CO3
12	Recording blood pressure and studying the components of ECG	CO3
13	Determination of bleeding time and clotting time	CO4
14	Demonstration of complete blood count by cell analyzer	CO4
15	Introduction to hematocytometer	CO4
16	Estimation of white blood cell (WBC) count	CO4
17	Estimation of red blood corpuscles (RBC) count	CO4

Textbooks

1. Laboratory Manual and Journal of Physiology. Dr. V. G. Ranade, Pune Vidhyarthee Prakashan.
2. Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma, Jaypee Brother's medical publishers, New Delhi.

Reference Books (Latest Editions)

1. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg, OH, U.S.A.
2. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterrje, Academic Publishers Kolkata.

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R25BP107 Pharmaceutical Inorganic and Analytical Chemistry Practical 0 0 4 2

Course Objectives:

- To gain practical knowledge on various volumetric titrations techniques.
- To learn the principles of volumetric analysis.
- To study the preparation and assessment of inorganic compounds.
- To determine the assay of various inorganic compounds in pharmaceutical use.
- To develop analytical skill for the qualitative and quantitative analysis of various inorganic compounds.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping wit Pos and PSOs							DO K
		PO1	PO3	PO4	PO6	PO9	PO11	PSO1	
R25CO107.1	Perform limit tests to detect and identify impurities in pharmaceutical substances.	2	2	-	2	1	-	-	L1,L 2
R25CO107.2	Prepare various pharmaceutical inorganic compounds following standard procedures.	2	3	-	1	-	1	-	L2,L 3
R25CO107.3	Analyze the significance of quality control in pharmaceutical products and raw materials.	2	2	3	1	-	1	1	L1,L 2
R25CO107.4	Demonstrate proficiency in titrimetric analysis using different volumetric techniques.	2	2	3	1	-	1	-	L2,L 3

Board of Studies: Pharmacy

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COURSE CONTENT

Experiment No	Name of the Experiment	Course Outcome
Limit Tests (Any 4 Experiments)		
1)	Limit test and modified limit test for Chloride as per Indian Pharmacopoeia	CO1

2)	Limit test and modified limit test for sulphate as per Indian Pharmacopoeia	CO1
3)	Limit test for Iron	CO1
4)	Limit test for Lead	CO1
5)	Demonstration of Limit test for arsenic	CO1
Preparation of inorganic pharmaceuticals (Any 3 Experiments)		
6)	Preparation of Aluminium hydroxide	CO2
7)	Preparation of potash alum	CO2
8)	Preparation of ferrous sulphate	CO2
9)	Preparation of Magnesium sulphate from magnesium hydroxide or magnesium carbonate	CO2
Test for Purity (Any 2 Experiments)		
11)	Assessment of swelling power of bentonite as per Indian Pharmacopoeia	CO3
12)	Evaluation of acid neutralizing capacity of aluminium hydroxide gel	CO3
13)	Determination of potassium iodate and iodine in potassium Iodide	CO3
Assay of the following inorganic compounds including standardization of titrant (Any 5 Experiments)		
14)	Assay of ammonium chloride by acid base titration	CO4
15)	b. Assay of Ferrous sulphate by Cerimetry	CO4
16)	c. Assay of Copper sulphate by Iodometry	CO4
17)	d. Assay of Calcium gluconate by Complexometry	CO4
18)	e. Assay of Hydrogen peroxide by Permanganometry	CO4
19)	f. Assay of Sodium benzoate by non-aqueous titration	CO4
20)	g. Assay of Sodium Chloride by precipitation titration (Modified Volhard's method)	CO4

Textbooks:

1. Bentley and Driver's Textbook of Pharmaceutical Chemistry. Oxford University Press, Oxford, UK.
2. Vogel's Text Book of Quantitative Chemical Analysis. Pearson Education Limited, Essex, England.
3. Block JH. Inorganic, Medicinal and Pharmaceutical Chemistry. Philadelphia: Lea & Febige.

4. Beckett AH, Stenlake JB. Practical Pharmaceutical Chemistry. Part I & II London: Stahlone Press, University of London.
5. Kennedy JH. Analytical Chemistry: Principles. Saunders College Publishing. NewYork.
6. Schroff ML. Inorganic Pharmaceutical Chemistry: Oxford Book Company. Delhi.
7. Indian Pharmacopoeia. Indian Pharmacopoeia Commission, Ghaziabad.
8. Anand & Chatwal, Inorganic Pharmaceutical Chemistry.

Reference Books:

1. Indian Pharmacopoeia
2. United States Pharmacopoeia

M. pavani

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R25BP108 **General Dispensing Pharmacy Practical** **0 0 4 2**

Course Objectives:

- To understand the principles, composition, and preparation techniques of various oral liquid dosage forms (syrups, elixirs, and solutions) with reference to official standards (IP, BPC, WHO).
- To develop the ability to formulate, compound, and evaluate suspensions and linctuses.
- To gain knowledge of powder and granule formulations including their types, methods of preparation, and applications in pharmacy practice.
- To acquire skills to prepare and evaluate topical and mucosal preparations such as gargles, mouthwashes, suppositories, ointments, and gels, ensuring patient compliance and therapeutic efficacy.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with Pos and PSOs						DOK
		PO1	PO3	PO4	PO9	PO11	PSO1	
R25CO108.1	Able to formulate skills of preparing syrups, elixirs and solutions.	2	3	2	3	2	1	L1, L2
R25CO108.2	Gain knowledge on preparation of biphasic liquid dosage forms.	2	3	2	3	2	1	L2, L3
R25CO108.3	Able to prepare various solid dosage using different techniques and equipment's.	2	3	2	3	2	1	L3, L4
R25CO108.4	Understand the preparation of Semisolid dosage forms and Incompatibilities	2	3	2	3	2	1	L5, L6

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COURSE CONTENT

Experiment No	Name of the Experiment	Course Outcome
	Syrups	
1)	Preparation of Syrup IP'66	CO1
2)	Preparation of Compound syrup of Ferrous Phosphate BPC'68	CO1
	Solutions	
3)	Preparation of Strong solution of ammonium acetate	CO1
4)	Preparation of Cresol with soap solution	CO1
5)	Preparation of Lugol's solution	CO1
	Elixirs &Linctus	
6)	Piperazine citrate elixir	CO1
7)	Paracetamol pediatric elixir	CO1
8)	Iodine Throat Paint (Mandles Paint)	CO1
9)	Terpin Hydrate Linctus IP'66	CO1
	Suspensions	
10)	Preparation of Calamine lotion	CO2
11)	Preparation of Magnesium Hydroxide mixture	CO2
12)	Preparation of Aluminimum Hydroxide gel	CO2
	Emulsions	
13)	Preparation of Turpentine Liniment	CO2
14)	Preparation of Liquid paraffin emulsion	CO2
	Powders &Granules	
15)	Preparation of ORS powder (WHO)	CO3
16)	Preparation of Dusting powder	CO3
17)	Preparation of Divided powders	CO3
18)	Preparation of Effervescent granules	CO3
	Gargles and Mouthwashes	
19)	Preparation of Iodine gargle	CO3
20)	Preparation of Chlorhexidine mouthwash	CO3
	Suppositories	
21)	Preparation of Glycerogelatin suppository	CO4

22)	Preparation of Coca butter suppository	CO4
23)	Preparation of Zinc Oxide suppository	CO4
Semisolids		
24)	Preparation of Sulphur ointment	CO4
25)	Preparation of non-staining-iodine ointment with methyl salicylate	CO4
26)	Preparation of Carbopol gel	CO4
Incompatibilities		
27)	Physical Incompatibilities	CO4
28)	Chemical Incompatibilities	CO4

Textbooks:

1. Das N. Practical Manual of Dispensing Pharmacy. 1st ed. Agartala, Tripura: Medtech Publications; 2017.Lab manuals (DS)
2. Chatterjee Ganguly S. Lab Manual of Pharmaceutics I. Kolkata: Brainware University/Local publisher; ca. 2024.
3. Varma AK, Saxena J, Bairagee D. Practical Manual of Pharmaceutics – I. 1st ed. Delhi: R. Narain Publishers & Distributors; 2022.

Reference Books:

1. Mohanta GP, Manna PK. Pharmaceutics: A Practical Manual. Revised ed. Delhi: PharmaMed Press/BSP Publications; 2019. 120 p.
2. Ramu B, Kranthi Kumar K. Lab Manual of Physical Pharmaceutics-I. 1st ed.: PV Books.
3. Sharma S. Pharmaceutics Laboratory Manual. 1st ed. [City]: AkiNik Publications; 2025.

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R25BP109 COMPUTERS AND DIGITAL TOOLS IN PHARMACY PRACTICAL 0 0 4 2

Course Objectives:

- To know the various types of application of computers in pharmacy.
- To know the various types of databases.
- To know the various applications of databases in pharmacy.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs							DOK
		PO1	PO3	PO4	PO6	PO9	PO11	PSO1	
R25CO109.1	Design a questionnaire using a word processing package to gather information about a particular disease. Create a HTML web page to show personal information	2	2	-	2	1	-	-	L1, L2
R25CO109.2	Retrieve the information of a drug and its adverse effects using online tools. Creating mailing labels Using Label Wizard , generating label in MS WORD	2	3	-	1	-	1	-	L2, L3
R25CO109.3	Create a database, Design a form, Generating report and printing the report in MS Access	2	2	3	1	-	1	1	L1, L5
R25CO109.4	Exporting Tables, Queries, Forms and Reports to web pages. Exporting Tables, Queries, Forms and Reports to XML pages	2	2	3	1	-	1	-	L2, L3

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COURSE CONTENT

Experiment No	Experiment	CO
1.	Design a questionnaire using a word processing package to gather information about a particular disease.	CO1
2.	Create a database in MS Access to store the patient information with the required fields Using access	CO1
3.	Creating mailing labels Using Label Wizard , generating	CO1

	label in MS WORD	
4.	Create a HTML web page to show personal information.	CO2
5.	Retrieve the information of a drug and its adverse effects using online tools	CO2
6.	Design a form in MS Access to view, add, delete and modify the patient record in the database	CO2
7.	Generating report and printing the report from patient database	CO3
8.	Exporting Tables, Queries, Forms and Reports to web pages	CO3
9.	Drug information storage and retrieval using MS Access	CO3
10.	Creating and working with queries in MS Access	CO4
11.	Exporting Tables, Queries, Forms and Reports to XML p	CO4
12.	Creating invoice table using – MS Access.	CO4

Text books

1. Computer Application in Pharmacy – William E.Fassett –Lea and Febiger, 600 South Washington Square, USA, (215) 922-1330.
2. Computer Application in Pharmaceutical Research and Development –Sean Ekins – Wiley-Interscience, A John Willey and Sons, INC., Publication, USA.

Reference books

1. Bioinformatics (Concept, Skills and Applications) – S.C.Rastogi.
2. Microsoft office Access - 2003, Application Development Using VBA, SQL Server, DAP and Infopath – Cary N.Prague.

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R25BP110 Professional Communication and Presentation Skills Practical 0 0 2 1

Course Objectives:

- To improve students' verbal and non-verbal communication.
- To develop presentation, group discussion, and interview skills.
- To enhance confidence in speaking fluently and accurately in English.
- To promote effective listening, note-taking, and summarizing abilities.
- To facilitate interpersonal communication and public speaking proficiency.

Course Outcomes:

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs							DOK
		PO2	PO3	PO8	PO9	PO11	PSO1	PSO2	
R25CO110.1	Demonstrate effective verbal and non-verbal communication in professional settings	-	-	3	1	2	1	2	L1, L2
R25CO110.2	Exhibit confidence in delivering structured oral presentations and public speaking.	1	1	3	-	2	1	2	L2, L4
R25CO110.3	Participate actively in group discussions and interviews using appropriate language.	-	-	3	-	2	1	2	L2, L3
R25CO110.4	Apply active listening, summarizing, and note-taking skills in academic contexts	-	-	3	-	2	1	2	L2, L6

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COURSE CONTENT

S.No	Name of the Experiment	CO's
01	Introduction to Communication – Types, Process, Barriers, and Importance of Feedback	CO1
02	Speaking Skills – Self-introduction, JAM sessions	CO1
03	Non-verbal Communication – Gestures, Posture, Eye contact, and Body language	CO1
04	Reading Aloud and Pronunciation Practice – Phonetics Lab sessions	CO2

05	Oral Presentations – Preparation and Delivery	CO2
06	Public Speaking – Speech preparation and delivery	CO2
07	Email, Letter, and Report Writing Exercises	CO3
08	Extempore and Debate Practice	CO3
09	Interview Skills – Mock interviews and role-plays	CO3
10	Group Discussions – Practice and Evaluation	CO3
11	Note-taking from lectures and videos	CO4
12	Listening Skills – Audio-based practice and listening to TED talks	CO4

Reference Books

1. Technical Communication by Meenakshi Raman and Sangeeta Sharma (Oxford University Press).

2. English for Technical Communication by K. R. Lakshminarayan.

3. Soft Skills by Dr. K. Alex (S. Chand Publishers).

4. Developing Communication Skills by Krishna Mohan and Meera Banerjee.

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R25BP111 **Health and Wellness, Yoga and Sports** **2 0 0 0**

Course Objectives:

1. To maintain the students mental and physical wellness by balancing emotions in their life.
2. To enhance the essential traits required for the development of the personality.
3. To discover the sense of oneness with ourselves, world and nature.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	CO-PO Mapping		
		PO3	PO10	PO11
R25CO111.1	Understand the importance of yoga and sports for Physical fitness and sound health.	2	2	1
R25CO111.2	Demonstrate an understanding of health-related fitness components.	1	1	1
R25CO111.3	Compare and contrast various activities that help enhance their health	2	2	1
R25CO111.4	Assess current personal fitness levels.	1	1	1
R25CO111.5	Develop Positive Personality	1	1	1

SYLLABUS

UNIT I: **3 Hours**

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

1. Organizing health awareness programmes in community.
2. Preparation of health profile.
3. Preparation of chart for balance diet for all age groups

CO's–CO1

UNIT II: **3 Hours**

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities: Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar.

CO's–CO2

UNIT III: **3 Hours**

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

1. Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
2. Practicing general and specific warm up, aerobics.
3. Practicing cardio respiratory fitness, treadmill, run test, 9 min walk, skipping and running.

CO's–CO3

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Text Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022.
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice.
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993.
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014.
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Assessment Pattern:

1. Evaluated for a total of 100 marks.
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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R25BP201 HUMAN ANATOMY AND PHYSIOLOGY-II 4 0 0 4

Course Objectives:

- To impart fundamental knowledge on the structure and functions of the various organ systems of the human body
- To understand both homeostatic mechanisms.
- To appreciate coordinated working pattern of different organs of each system.
- To appreciate the interlinked mechanisms in the maintenance of normal functioning (homeostasis) of human body.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs					DOK
		PO1	PO3	PO9	PO11	PSO1	
R25BP201.1	Relate the physiology of sympathetic, parasympathetic, spinal/cranial nerves	3	2	1	2	1	L 1, L2
R25BP201.2	Relate the physiology of Central nervous system with the functioning of neuronsand organization of special senses	3	2	2	2	1	L1, L2,
R25BP201.3	Outline the importance of Respiratory system in human body and Understand the importance of Urinary system in human body.	3	2	2	2	1	L 2, L3
R25BP201.4	Analyze the importance of endocrine system in body. Illustrate the anatomy, physiology and coordinated pathway of Reproductive system.	3	2	2	2	1	L3, L4
R25BP201.5	Understand basic concepts of genetics.	3	2	2	2	1	L5,L6

SYLLABUS

Unit I **08 hours**

Nervous system: Organization of nervous system, neuron, neuroglia, classification andproperties of nerve fibre, electrophysiology, action potential, nerve impulse, receptors, synapse, neurotransmitters.

Peripheral nervous system: Classification of peripheral nervous system: Structure and functions ofsympathetic and parasympathetic nervous system.

Origin and functions of spinal and cranial nerves.

CO's-CO1

Self-Learning Topics: Differences between sympathetic and parasympathetic nervous systems with examples.

Unit II **10 hours**

Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brainstem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity)

Special senses: Structure and functions of eye, ear, nose and tongue and their disorders.

CO's-CO2

Self-Learning Topics: Common disorders of the special senses: cataract, deafness, anosmia, ageusia.

Unit III **10 hours**

Respiratory system: Anatomy of respiratory system with special reference to anatomy of lungs, mechanism of respiration, regulation of respirationLung Volumes and capacities transport of respiratory gases, artificial respiration, and resuscitation methods.

Urinary system: Anatomy of urinary tract with special reference to anatomy of kidney andnephrons, functions of kidney and urinary tract, physiology of urine formation, micturition reflex and role of kidneys in acid base balance, role of RAS in kidneyand disorders of kidney.

CO's-CO3

Self-Learning Topics: Lung function tests and their interpretation.

Unit IV **08 hours**

Endocrine system: Classification of hormones, mechanism of hormone action, structureand functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders.

Reproductive system: Anatomy of male and female reproductive system, Functions of male and female reproductive system, sex hormones, physiology of menstruation, fertilization, spermatogenesis, oogenesis, pregnancy and parturition.

CO's-CO4

Self-Learning Topics: Role of the pineal gland in circadian rhythm

Unit V **09 hours**

Introduction to genetics: Chromosomes, genes and DNA.

Genome Structure and Central Dogma: Organization of the mammalian genome. DNA replication, Transcription, and Translation.

Genetic Code and Regulation of Protein Synthesis: Properties of the genetic code: Inhibitors of transcription and translation (antibiotics, toxins).

DNA Repair and Related Disorders: DNA damage types, Repair mechanisms. Clinical disorders associated with faulty DNA repair.

CO's-CO5

Self-Learning Topics: Basics of genetic counseling and gene therapy.

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Text Books:

1. Essentials of Medical Physiology by K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi.
2. Anatomy and Physiology in Health and Illness by Kathleen J.W. Wilson, Churchill Livingstone, New York.
3. Principles of Anatomy and Physiology by Tortora Grabowski. Palmetto, GA, U.S.A.

Reference Books:

1. Physiological basis of Medical Practice-Best and Tailor. Williams & Wilkins Co,Riverview.
2. Text book of Medical Physiology- Arthur C, Guyton and John. E. Hall. Miamisburg.
3. Human Physiology (vol 1 and 2) by Dr. C.C. Chatterjie ,Academic Publishers Kolkata.

Web References:

1. TeachMePhysiology -https://teachmephysiology.com
2. Khan Academy – Human Anatomy & Physiology, https://www.khanacademy.org/science/health- and-medicine/human-anatomy-and-physiology
3. Visible Body – Learn Anatomy https://www.visiblebody.com/learn
4. InnerBody – Anatomy Explorer https://www.innerbody.com
5. MedlinePlus – Medical Encyclopedia (by NIH) https://medlineplus.gov/encyclopedia.html

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35%	--
L2	40%	--
L3	25%	25%
L4	--	35%
L5	--	25%
L6		15%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1 – Remember

1. Define neuron and neuroglia.
2. List the types of nerve fibers.
3. Name the divisions of the peripheral nervous system.

4. Define synapse.
5. What are neurotransmitters?
6. List the meninges covering the brain.
7. Name the ventricles of the brain.
8. State any two disorders of special senses.
9. Define lung volumes and capacities.
10. List the parts of the nephron.

L2 – Understand

1. Explain the classification of the peripheral nervous system.
2. Describe the mechanism of nerve impulse conduction.
3. Explain the functions of cerebrum and cerebellum.
4. Describe the structure of the spinal cord.
5. Describe the mechanism of respiration.
6. Explain the physiology of urine formation.
7. Describe the mechanism of hormone action.
8. Explain the functions of the adrenal gland.
9. Explain the physiology of menstruation.
10. Describe the process of fertilization

L3 – Apply

1. Differentiate between sympathetic and parasympathetic nervous systems with examples.
2. Classify the reflex arcs and illustrate with an example.
3. Relate the structure of the eye to its function.
4. Discuss the role of RAS in kidney function.
5. Interpret a sample lung function test result.
6. Compare the symptoms of hypothyroidism and hyperthyroidism.
7. Correlate hormone imbalance with endocrine disorders.
8. Illustrate the stages of pregnancy and parturition.
9. Discuss the genetic pattern of inheritance using an example

L4 - Analyze

1. Analyze how negative feedback regulates thyroid hormone secretion.
2. Compare the hormonal roles of adrenal cortex and adrenal medulla in stress response.
3. Differentiate between endocrine and exocrine functions of the pancreas.
4. Analyze how parathyroid hormone and calcitonin work together to regulate calcium levels.
5. Compare the mechanism of action of peptide hormones (like insulin) vs steroid hormones (like cortisol).

L5 - Evaluate

1. Evaluate the role of progesterone in maintaining pregnancy and predict what would happen if its levels drop prematurely.
2. Critically assess the medical and ethical issues of assisted reproductive technologies (IVF, surrogacy).
3. Evaluate the clinical importance of understanding genetic inheritance patterns in preventing hereditary disorders.
4. Judge the effectiveness of contraceptive methods (hormonal vs barrier methods) in terms of mechanism and reliability.

L6 - Create

1. Design a flowchart showing the sequence of events from ovulation to implantation.
2. Propose a gene therapy strategy for treating a single-gene disorder (e.g., sickle cell anemia).
3. Develop a case study to explain the hormonal changes during different trimesters of pregnancy.

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R25BP202 **Pharmaceutical Organic Chemistry- I** **3 1 0 4**

Course Objectives:

- To enable students to demonstrate a clear understanding of foundational organic chemistry concepts.
- To equip students with the skills to systematically name organic compounds following IUPAC nomenclature.
- To help students accurately classify various types of organic compounds based on structural features and functional groups.
- To develop students' abilities in synthesizing simple organic compounds using established laboratory methods.
- To provide a solid understanding of organic reaction mechanisms, enhancing analytical and problem-solving skills in chemical transformations.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs					DOK
		PO1	PO3	PO4	PO11	PSO1	
R25CO202.1	Capable to give nomenclature and Identify isomerism of organic compounds.	2	2	2	1	2	L1, L2
R25CO202.2	Remember the preparation methods and properties of alkanes, alkenes and conjugated dienes	2	2	2	1	2	L1, L2
R25CO202.3	Remember the preparation methods and properties of alkyl halides and alcohols.	2	2	2	1	2	L2, L3
R25CO202.4	Remember the preparation methods And properties of Carbonyl compounds.	2	2	2	1	2	L4,L5
R25CO202.5	Remember thepreparation methods and properties of Carboxylic acids.	2	2	2	1	2	L1,L6

SYLLABUS

UNIT-I **10 Hours**

Classification, nomenclature and isomerism: Classification of Organic Compounds, Common and IUPAC systems of nomenclature of organic compounds (up to 10 Carbons open chain and carbocyclic compounds).

Structural isomerisms in organic compounds: Types of structural isomerism.

CO's–CO1

Self- Learning Topics: Practice Naming Organic Compounds, Identifying Functional Groups, Drawing Isomers, Understanding isomerism.

UNIT-II **10 Hours**

Alkanes, Alkenes, Alkynes and Conjugated dienes: SP^3 hybridization in alkanes, Halogenation of alkanes, uses of paraffins. Stabilities of alkenes, SP^2 hybridization in alkenes.

E1 and E2 reactions: kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences. E1 verses E2 reactions, Factors affecting E1 and E2 reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, Anti Markownikoff's orientation.

Cycloalkanes: Study of Baeyer's strain theory and its limitations, Coulson-Moffitt's modification and Sachse - Mohr's theory.

Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement.

CO's–CO2

Self- Learning Topics: Reaction Mechanisms, Comparison of Reactions.

UNIT-III **8 Hours**

Alkyl halides: SN1 and SN2 reactions- kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.

SN1versus SN2 reactions: Factors affecting SN1 and SN2 reactions.

Structure and uses of ethylchloride, Chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

Alcohols: Qualitative tests, Structure and uses of Ethyl alcohol, Methyl alcohol, chlorobutanol, Cetosteryl alcohol, Benzyl alcohol, Glycerol, Propylene glycol.

CO's–CO3

Self- Learning Topics: Reaction Mechanisms, Comparison of Reactions, Structure-Activity Relationship.

UNIT-IV **10 Hours**

Carbonyl compounds (Aldehydes and ketones): Nucleophilic addition, Electromeric effect, aldol condensation, Crossed Aldol condensation, Cannizzaro reaction, Crossed Cannizzaro reaction, Benzoin condensation, Perkin condensation, qualitative tests,

Structure and uses of Formaldehyde, Paraldehyde, Acetone, Chloral hydrate, Hexamine, Benzaldehyde, Vanilin, Cinnamaldehyde.

CO's–CO4

Self- Learning Topics: Nucleophilic Addition Reactions, Qualitative Tests.

UNIT-V **07 Hours**

Carboxylic acids: Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amides and esters.

Structure and Uses of Acetic acid, Lactic acid, Tartaric acid, Citric acid, Succinic acid. Oxalic acid, Salicylic acid, Benzoic acid, Benzyl benzoate, Dimethyl phthalate, Methyl salicylate and Acetyl salicylic acid

Aliphatic amines: Basicity, effect of substituent on Basicity. Qualitative test, Structure and uses of Ethanolamine, Ethylenediamine, Amphetamine.

CO's–CO5

Self- Learning Topics: Understanding Acidity, Effect of Substituents.

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Text Books :

1. Organic Chemistryby Morrison and Boyd
2. Organic Chemistryby I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistryby P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

Reference Books:

1. Organic Chemistry, by Robert Thornton Morrison, Robert Neilson Boyd and Saibal Kanti Bhattacharjee, Pearson Education India, 7 th edition, 2010 (ISBN 9788131704813).
2. Organic Chemistry, Vol. 1, by IL FINAR, Pearson Books, 6th Edition, 2002, (ISBN-13. 978- 8177585421).
3. Principles of Pharmaceutical Organic Chemisty, by Rama Rao Nadendla, PharmMed Press, 2 nd edition, 2018, (ISBN 978-93-5230-197-3).

Web References:

1. https://www.organic-chemistry.org
2. https://chem.libretexts.org
3. http://www.masterorganicchemistry.com
4. https://common organicchemistry.com

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	55%	25%
L2	30%	25%
L3	15%	--
L4	--	35%
L5	--	5%
L6	--	10%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Define IUPAC rules for naming alkanes, alkenes, and alkynes.
2. List the different types of structural isomerism in organic compounds.
3. Recall the structure and uses of important alkyl halides.
4. Recall the structure and uses of important carbonyl compounds.
5. Recall the structure and uses of important carboxylic acids.

L2: Understand

1. Explain the stability of alkenes and the factors affecting it.
2. Describe the mechanism of E1 and E2 reactions, including kinetics and stereochemistry.
3. Explain the nucleophilic addition reactions of aldehydes and ketones.
4. Describe the acidity of carboxylic acids and the effect of substituents on acidity.
5. Explain the basicity of aliphatic amines and the effect of substituents on basicity.

L3: Apply

1. Apply IUPAC rules to name simple organic compounds (up to 10 carbons).
2. Predict the products of electrophilic addition reactions of alkenes.
3. Determine the products of SN1 and SN2 reactions.
4. Apply the aldol condensation reaction to synthesize complex molecules.
5. Use qualitative tests to identify alcohols, aldehydes, and ketones.

L4: Analyze

1. Predict the product of the reaction between propene and HCl.
2. Determine the structure of an unknown compound based on its IR spectrum.
3. Design a synthesis route for a given compound using alkenes and alkynes.
4. Calculate the number of possible isomers for a given molecular formula.
5. Identify the functional group present in a given compound.

L5: Evaluate

1. Design a synthesis route for a given compound using various organic reactions.
2. Propose a mechanism for a given reaction.
3. Predict the products of a reaction and explain the stereochemistry.
4. Develop a qualitative test for a given functional group.
5. Design a molecule with specific properties based on the principles of organic chemistry.

L6: Create

1. Evaluate the effectiveness of different methods for synthesizing a given compound.
2. Compare the advantages and disadvantages of different qualitative tests for a given functional group.
3. Discuss the importance of understanding reaction mechanisms in organic chemistry.
4. Evaluate the impact of substituents on the reactivity of a molecule.
5. Justify the choice of a particular reaction pathway for a given synthesis.

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Vizianagaram Dt.,- 531162

R25BP203 **MEDICINAL BIOCHEMISTRY** **3 1 0 4**

Course Objectives:

- To learn about the metabolism of carbohydrates, lipids, and proteins, and how hormones control metabolism.
- To understand genetic errors can cause diseases, and how these errors are inherited.
- To learn about the organization of DNA in a genome, how it is replicated and repaired, and how genetic information is expressed as proteins.
- To gain knowledge about enzymes, enzyme kinetics and biological functions of coenzymes.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with Pos and PSOs							DOK
		PO1	PO3	PO4	PO6	PO7	PO9	PSO1	
R25CO203.1	Recall the classification, biological role, properties and significance of carbohydrates, lipids, nucleic acids, amino acids and proteins. Outline the concepts of bioenergetics	2	2	-	2	3	1	2	L1,L2
R25CO203.2	Understand the metabolism of carbohydrates, its metabolic disorders and outline the concepts of Biological oxidation	3	3	-	1	-	-	2	L2, L3
R25CO203.3	Understand the metabolism of nutrient molecules Lipids and proteins in physiological conditions and its metabolic disorders	3	3	3	1	-	3	2	L4, L6
R25CO203.4	Understand the metabolism of Nucleic Acids and the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins.	3	3	3	1	-	3	2	L3, L5
R25CO203.5	Understand the catalytic role of enzymes, importance of enzyme inhibitors therapeutic and diagnostic applications of enzymes.	3	2	3	1	-	3	2	L3, L5, L6

SYLLABUS

UNIT I **08 Hours**

Biomolecules: Introduction, classification, chemical nature and biological role of carbohydrate, lipids, nucleic acids, amino acids and proteins.

Bioenergetics: Concept of free energy, endergonic and exergonic reaction, Relationship between free energy, enthalpy and entropy; redox potential.

Energy rich compounds: Classification, biological significances of ATP and cyclic AMP

CO's-CO1

Self-Learning Topics: Structure and Functions of Biomolecules, Carbohydrates, Proteins, Lipids, and Nucleic Acids, Types, functions, and biological significance.

UNIT II **10 Hours**

Carbohydrate metabolism: Glycolysis – Pathway, energetic and significance, Citric acid cycle – Pathway, energetic and significance, HMP shunt and its significance; Glucose-6-Phosphate dehydrogenase (G6PD) deficiency, Glycogen metabolism Pathways and glycogen storage diseases (GSD), Gluconeogenesis – Pathway and its significance, Hormonal regulation of blood glucose level and Diabetes mellitus.

Biological Oxidation: Electron transport chain (ETC) and its mechanism, Oxidative phosphorylation & its mechanism and substrate level phosphorylation, Inhibitors ETC and oxidative phosphorylation/Uncouplers.

CO's-CO2

Self learning Topics: Glycolysis, Gluconeogenesis, Citric Acid Cycle (TCA), Glycogen metabolism.

UNIT III **10 Hours**

Lipid metabolism: β-Oxidation of saturated fatty acid (Palmitic acid), Formation and utilization of ketone bodies; ketoacidosis, De novo synthesis of fatty acids (Palmitic acid), Biosynthesis and Biological significance of cholesterol and conversion of cholesterol into bile acids, steroid hormone and vitamin D.

Disorders of lipid metabolism: Hypercholesterolemia, atherosclerosis, fatty liver and obesity.

Amino acid metabolism: General reactions of amino acid metabolism: Transamination, deamination and decarboxylation, urea cycle and its disorders, Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenyketonuria, Albinism, alkeptonuria, tyrosinemia).

Synthesis and Significance of biological substances: 5-HT, melatonin, dopamine, noradrenaline, adrenaline.

Catabolism of heme; hyperbilirubinemia and jaundice.

CO's-CO3

Self learning Topics: β-oxidation, Fatty acid synthesis, Ketone body formation.

UNIT IV **10 Hours**

Nucleic acid metabolism and genetic information transfer: Biosynthesis of purine and pyrimidine nucleotides, Catabolism of purine nucleotides and Hyperuricemia and Gout disease, Organization of mammalian genome (replication, transcription, and translation), Structure of DNA and RNA and their functions, DNA replication (semi conservative model), Transcription or RNA synthesis, Genetic code and inhibitors of protein synthesis.

CO's-CO4

Self learning Topics: Levels of protein structure, Denaturation and protein folding, Transcription and translation (basic concepts).

UNIT V **07 Hours**

Enzymes: Introduction, properties, nomenclature and IUB classification of enzymes, Enzyme kinetics (Michaelis plot, Line Weaver Burke plot), Enzyme inhibitors with examples, Regulation of enzymes: enzyme induction and repression, allosteric enzymes regulation, Therapeutic and diagnostic application of enzymes and isoenzymes, Structure and Biochemical functions of coenzymes.

pH and Buffer Systems: Concept of pH, Physiological buffer systems: Role in acid-base homeostasis.

Clinical Chemistry: Liver function tests (routinely performed tests based on liver function). Renal

function tests (routinely performed tests based on kidney function, ELISA test)

CO's-CO5

Self learning Topics: Classification, mechanism of action, Factors affecting enzyme activity, Enzyme inhibition.

Board of Studies: Pharmacy

Approved in BOS No: 01, 22nd October, 2025

Approved in ACM No: 01

Text Books

1. Lehninger principles of Biochemistry by David Nelson, Michael Cox, and Aaron Hoskins. Macmillan Publishing Company. Eight edition.
2. Harper's Illustrated Biochemistry, by Kennelly PJ, Botham KM, Victor W. Rodwell, P. Anthony Weil. Mc Graw Hill Education .Thirty-Second Edition, 2023.
3. Biochemistry by U. Satyanarayana, U. Chakrapani, Elsevier Health Sciences, 5th edition, 2020. ISBN: 9788131262535.

Reference Books

1. A Textbook of Biochemistry, A. V. S. S. Rama Rao.
2. Fundamentals of Biochemistry by Deb, A. C.
3. Biochemistry by Berg, Jeremy M. Tymoczko, John L., Gatto.
4. Outlines of Biochemistry by Erice Conn.

Web References:

1. https://www.ncbi.nlm.nih.gov/books/
2. https://www.khanacademy.org/science/biology/biochemistry
3. https://bio.libretexts.org/Bookshelves/Biochemistry
4. https://www.biochemistryquestions.com/
5. https://www.lecturio.com/medical-courses/biochemistry.course

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35%	--
L2	40%	--
L3	25%	25%
L4	--	35%
L5	--	25%
L6		15%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

Level 1 – Remember

1. Define biomolecules and classify carbohydrates with examples.
2. Write the structure and functions of ATP.
3. List different types of lipids and their biological significance.

4. Define gluconeogenesis and mention its significance.
5. Write the steps of glycolysis.
6. Mention glycogen storage diseases.
7. Define oxidative phosphorylation.
8. List the reactions of β-oxidation of palmitic acid.
9. Define enzyme and coenzyme.
10. List types of enzyme inhibitors with examples.

Level 2 – Understand

1. Explain the significance of glycolysis in energy production.
2. Describe the structure and biological functions of proteins.
3. Explain HMP shunt and its importance.
4. Describe the hormonal regulation of blood glucose levels.
5. Explain the mechanism of oxidative phosphorylation.
6. Describe ketone body formation and its clinical relevance.
7. Explain the role of cholesterol in bile acid and steroid hormone synthesis.
8. Describe the urea cycle and its disorders.
9. Explain transcription in prokaryotes.
10. Describe therapeutic and diagnostic importance of enzymes.

Level 3 – Apply

1. Calculate the net ATP yield from complete oxidation of one glucose molecule.
2. Apply Henderson–Hasselbalch equation to explain buffer action of amino acids.
3. Solve a problem: predict ATP yield from β-oxidation of palmitic acid.
4. Demonstrate the role of enzymes as diagnostic markers in myocardial infarction.
5. Apply knowledge of glycogen metabolism to explain fasting hypoglycemia.
6. Solve: determine Km and Vmax using Lineweaver–Burk plot data.
7. Apply redox concepts to explain inhibition of ETC by cyanide.
8. Predict biochemical changes in G6PD deficiency.
9. Demonstrate how enzyme induction regulates drug metabolism.

Level 4 – Analyze

1. Compare glycolysis and gluconeogenesis.
2. Differentiate between oxidative phosphorylation and substrate-level phosphorylation.
3. Analyze the role of insulin and glucagon in glucose metabolism.
4. Compare β-oxidation and fatty acid synthesis.
5. Analyze metabolic defects in phenylketonuria, albinism, and alkaptonuria.
6. Examine the biochemical basis of jaundice.
7. Distinguish between purine and pyrimidine catabolism.
8. Compare competitive and noncompetitive enzyme inhibition.
9. Analyze the clinical significance of isoenzymes (LDH, CK-MB).
10. Compare DNA replication in prokaryotes and eukaryotes.

Level 5 – Evaluate

1. Evaluate the importance of ATP as an energy currency.
2. Assess the role of HMP shunt in maintaining cellular redox balance.
3. Justify the importance of cholesterol metabolism in health and disease.
4. Evaluate the therapeutic use of enzyme inhibitors as drugs.
5. Judge the role of oxidative phosphorylation uncouplers in metabolic regulation.
6. Critically assess the role of ketone bodies in starvation.
7. Evaluate the diagnostic value of liver enzymes in hepatitis.
8. Appraise the role of uric acid metabolism in gout.
9. Judge the importance of coenzymes in enzyme catalysis.
10. Critically assess the relationship between free energy, enthalpy, and entropy in biological reactions.

Level 6 – Create

1. Design a metabolic map showing carbohydrate, lipid, and protein interrelationship.
2. Propose an experimental method to study enzyme inhibition in vitro.
3. Formulate a flowchart of glycolysis with ATP yield.
4. Develop a therapeutic strategy for management of hypercholesterolemia.
5. Create a model to explain regulation of blood glucose in diabetes mellitus.
6. Formulate a flowchart showing amino acid catabolism leading to neurotransmitter synthesis.
7. Design a schematic representation of transcription and translation.

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R25BP204 **PATHOPHYSIOLOGY** **3 1 0 4**

COURSE OBJECTIVES:

- To understand how cells get injured, adapt, and repair, including necrosis, apoptosis, and autophagy.
- To explain inflammation, wound healing, and atherosclerosis with focus on mediators, cytokines, and immune roles.
- To analyze the cause of major disorders (cardiac, respiratory, renal, endocrine, GI, neurological, psychiatric) and apply knowledge to clinical conditions like hypertension, diabetes, COPD, renal failure, anemia, psychiatric illnesses, and cancer.
- To evaluate diseases of bone, joints, liver, and GI; understand cancer mechanisms, genetic changes, and new therapies (immunotherapy, targeted therapy).
- To Examine infectious and sexually transmitted diseases, including new infections (COVID-19, fungal, HPV), and relate mechanisms to diagnosis and treatment.

Course Outcomes

At the end of the course, students will be able to:

Course Cod	Course Outcomes (COs)	Mapping with POs and PSO					DOK
		PO1	PO3	PO9	PO1	PSO1	
R25BP204.1	Understanding the mechanisms o cell injury, repair, inflammation, an their clinical significance.	3	2	1	2	1	L 1, L2
R25BP204.2	Analysing the cardiovascular respiratory, and rena pathophysiology with emphasis o mechanisms, complications, an modern insights.	3	2	2	2	1	L1, L2,
R25BP204.3	Remembering the haematological endocrine, nervous system, and G disorders,relating pathophysiology t clinical outcomes.	3	2	2	2	1	L 2, L3
R25BP204.4	Summarizing the hepatic, bone/join diseases, and cancer Pathophysiology integrating molecular basis wit clinical relevance.	3	2	2	2	1	L3, L4
R25BP204.5	Assessing the pathogenesis an complications of infectious an sexually transmitted diseases including emerging infections.	3	2	2	2	1	L5,L6

SYLLABUS

Unit I **10 Hours**

Cellular Pathophysiology

Cell injury: Causes (physical, chemical, infectious, immunological, genetic, nutritional).

Mechanisms: Oxidative stress, mitochondrial dysfunction, DNA damage, ER stress.

Morphology of injury: Atrophy, Hypertrophy, Hyperplasia, Metaplasia, Dysplasia.

Reversible vs irreversible cell injury: necrosis, apoptosis, necroptosis, autophagy.

Cellular adaptation and repair: Intracellular accumulations, calcification, enzyme leakage.

Acid–base disorders: Acidosis, alkalosis; Electrolyte imbalance: Na^+, K^+, Ca^{2+}, Mg^{2+}.

Inflammation and Tissue Repair: Clinical signs and systemic effects of inflammation.

Mechanisms: Vascular changes, WBC migration, role of adhesion molecules.

Mediators: Cytokines, chemokines, prostaglandins, leukotrienes, complement system. Acute vs chronic inflammation, granulomatous inflammation.

Wound healing: Healing by primary and secondary intention, scar formation, fibrosis.

Role of inflammation in metabolic disorders (obesity, diabetes).

CO'S-CO1

Self-learning topics: Case study on necrosis vs apoptosis in myocardial infarction.Short note on oxidative stress and antioxidants in cell injury. Autophagy in neurodegenerative diseases. Clinical correlation: Electrolyte imbalance in dehydration and kidney disease. Role of cytokines in COVID-19 cytokine storm.

Unit II **10 Hours**

Cardiovascular System Disorders: Hypertension – essential, secondary; end-organ damage. Heart failure – systolic vs diastolic dysfunction.

Ischemic heart disease: Angina, MI – role of platelets, coagulation, and reperfusion injury.

Emerging concepts: Endothelial dysfunction, inflammation in cardiovascular disease, metabolic syndrome.

Respiratory System Disorders: Asthma: immunological & genetic factors.

COPD: chronic bronchitis, emphysema, lung remodelling.

Recent addition: Pulmonary fibrosis and obstructive sleep apnoea.

Renal System Disorders: Acute kidney injury, chronic kidney disease, Diabetic nephropathy and polycystic kidney disease (PKD).

CO'S-CO2

Self-learning topics: Cardiovascular, Respiratory & Renal Disorders, Hypertensive crisis and organ damage.Role of endothelial dysfunction in atherosclerosis, Asthma vs COPD – similarities and differences, Pulmonary fibrosis and sleep apnoea as emerging health issues, Diabetic nephropathy – clinical progression and biomarkers, Polycystic kidney disease (PKD): genetics and pathogenesis.

Unit III **10 Hours**

Haematological Disorders: Iron deficiency anaemia, Megaloblastic anaemia.

Haemolytic disorders: Sickle cell anaemia, Thalassemia, Haemophilia& coagulation defects.

Introduction to haematological malignancies (Leukaemia, Lymphoma – overview).

Endocrine Disorders: Diabetes mellitus – type 1, type 2, complications.

Thyroid disorders: Hypo/hyperthyroidism, Hashimoto's thyroiditis, Graves' disease.

Metabolic & hormonal disorders: Obesity, Polycystic ovarian syndrome (PCOS).

Nervous System Disorders: Epilepsy, Parkinson's disease, Stroke.

Psychiatric disorders: Depression, Schizophrenia.

Neurodegeneration: Alzheimer's disease, Multiple sclerosis, Huntington's disease.

Gastrointestinal Disorders: Peptic ulcer – H. pylori and stress, Non-alcoholic fatty liver disease (NAFLD), Irritable Bowel Syndrome (IBS).

CO'S-CO3

Self-learning topics: Anaemia classification flowchart, Role of erythropoietin in anaemia management, Parkinson's disease – role of dopamine and basal ganglia dysfunction, Alzheimer's disease – amyloid plaques vs tau pathology.

Unit IV **08 Hours**

Hepatic and Gastrointestinal Disorders: Inflammatory bowel disease (Ulcerative colitis, Crohn's), Jaundice – haemolytic, hepatocellular, obstructive, Viral hepatitis (A–E), Alcoholic & non-alcoholic steatohepatitis.

Bone and Joint Disorders: Rheumatoid arthritis, Osteoarthritis, Osteoporosis, Gout. Autoimmune aspects of joint diseases.

Cancer: Classification, etiology, carcinogenesis, Oncogenes, tumour suppressor genes, DNA repair defects, Hallmarks of cancer, tumour microenvironment, angiogenesis.

Modern insights: Immunopathology of cancer, targeted therapy (brief).

CO'S-CO4

Self-learning topics:

Viral hepatitis types (A–E): comparative chart, Alcoholic vs Non-alcoholic steatohepatitis , Gout and uric acid metabolism, Hallmarks of cancer – summarizing with recent examples.Tumour suppressor genes (p53, Rb) and their clinical significance. Modern therapies: Immunotherapy vs Targeted therapy.

Unit V **07 Hours**

Infectious Diseases: Meningitis, Typhoid, Leprosy, Tuberculosis, Urinary tract infections.

Emerging infections: COVID-19, Fungal infections (Mucormycosis, Candidiasis).

Sexually Transmitted Infections (STIs)

AIDS: HIV virology, pathogenesis, complications, Syphilis, Gonorrhoea, Human Papillomavirus (HPV) and cervical cancer.

CO'S-CO5

Self-learning topics: Case discussion: Meningitis in children vs adults.Tuberculosis: drug resistance mechanisms (MDR-TB, XDR-TB).COVID-19 complications, Opportunistic infections in HIV/AIDS patients. Gonorrhoea and syphilis – pathophysiology and complications.

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TEXTBOOKS:

1. Essentials of Pathophysiology – Carol Mattson Porth (Lippincott Williams & Wilkins)
2. Textbook of Pathophysiology – Harsh Mohan (Jaypee Brothers)
3. Robbins Basic Pathology – Kumar, Abbas, Aster (Elsevier)
4. Essentials of Medical Pharmacology (for integration with drug effects) – K.D. Tripathi (Jaypee)
5. Clinical Pharmacy and Therapeutics – Roger Walker & Cate Whittlesea (Churchill Livingstone)

REFERENCE BOOKS:

1. Pathophysiology of Disease: An Introduction to Clinical Medicine – Gary D.Hammer & Stephen J. McPhee (Lange / McGraw-Hill).
2. Textbook of Pathophysiology – Jacqueline L. Banasik (Elsevier).
3. Davidson's Principles and Practice of Medicine – Brian Walker, Nicki College et al. (Churchill Livingstone).
4. Goodman & Gilman's The Pharmacological Basis of Therapeutics (McGraw-Hill).
5. Harrison's Principles of Internal Medicine (McGraw-Hill).

WEB REFERENCES:

1. MedlinePlus (NIH) – https://medlineplus.gov
2. Pathology Outlines – https://www.pathologyoutlines.com
3. American Heart Association (AHA) – https://www.heart.org
4. National Heart, Lung, and Blood Institute (NHLBI) – https://www.nhlbi.nih.gov
5. National Kidney Foundation – https://www.kidney.org
6. American Society of Hematology (ASH) – https://www.hematology.org

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35%	--
L2	40%	--
L3	25%	25%
L4	--	35%
L5	--	25%
L6		15%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1-REMEMBER

1. Define cell injury. Explain causes and mechanisms of cell injury.
2. Describe adaptive changes of cells (atrophy, hypertrophy, hyperplasia, metaplasia, dysplasia) with examples.
3. Discuss the pathophysiology of necrosis and apoptosis.
4. Explain the clinical features and mechanisms of acute and chronic inflammation.
5. Write the pathophysiology of hypertension.
6. Describe the pathogenesis of myocardial infarction.
7. Explain the mechanism of asthma and COPD.
8. Describe the pathophysiology of acute kidney injury and chronic kidney disease.
9. Write the types, causes, and complications of diabetes mellitus.
10. Explain the pathophysiology of hypothyroidism and hyperthyroidism.

L2- UNDERSTAND

1. Describe the pathogenesis of sickle cell anaemia and thalassemia.
2. Explain the clinical features and pathogenesis of Parkinson's disease.
3. Discuss the pathophysiology of Alzheimer's disease.
4. Describe the causes and pathogenesis of peptic ulcer disease.
5. Explain the types and pathogenesis of jaundice.
6. Write notes on rheumatoid arthritis, osteoporosis, and gout.
7. Describe the classification, etiology, and pathogenesis of cancer.
8. Discuss the pathophysiology of tuberculosis.
9. Explain the virology, pathogenesis, and complications of HIV/AIDS.
10. Write the pathogenesis of meningitis.

L3-APPLY

1. Differentiate between necrosis and apoptosis with examples.
2. Compare acute vs chronic inflammation with suitable case examples.
3. Discuss the process of wound healing and factors affecting it.

L4-ANALYZE

1. Analyse the role of endothelial dysfunction in atherosclerosis.
2. Compare the pathophysiology of asthma and COPD.
3. Discuss the mechanisms of pulmonary fibrosis and obstructive sleep apnoea.
4. Analyse the complications of diabetic nephropathy.
5. Compare and contrast iron deficiency anaemia and megaloblastic anaemia.
6. Discuss the role of insulin resistance in metabolic syndrome and PCOS.
7. Compare peptic ulcer and non-alcoholic fatty liver disease (NAFLD).
8. Differentiate between alcoholic liver disease and non-alcoholic steatohepatitis (NASH).
9. Analyse the autoimmune mechanisms involved in rheumatoid arthritis.
10. Discuss the hallmarks of cancer with examples.
11. Compare bacterial infections (typhoid, leprosy) with viral infections (COVID-19, hepatitis).
12. Explain the mechanisms of drug resistance in tuberculosis.

L5- EVALUATE

1. Evaluate the role of oxidative stress and mitochondrial dysfunction in disease progression.
2. Assess the role of cytokines in COVID-19–related inflammation ("cytokine storm").
3. Critically evaluate the role of inflammation in cardiovascular disease and metabolic syndrome.
4. Suggest preventive strategies for diabetic nephropathy based on pathophysiological mechanisms.

5. Evaluate the role of amyloid plaques and tau proteins in Alzheimer's disease.
6. Propose a model explaining the gut–brain axis in irritable bowel syndrome (IBS).
7. Evaluate the role of tumour suppressor genes (p53, Rb) in cancer pathogenesis.

L6 - CREATE

1. Design a flowchart showing molecular basis of cancer and therapeutic targets (immunotherapy, targeted therapy).
2. Critically analyse the complications of opportunistic infections in AIDS.
3. Propose preventive and control strategies for emerging infectious diseases (COVID-19, fungal infections, HPV) based on their pathophysiology.

M. pavani

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R25BP205 AI & PYTHON PROGRAMMING FOR PHARMACY – I 3 0 0 3

Course Objectives:

- To introduce foundational concepts of Artificial Intelligence and Machine Learning so students grasp the historical context, core approaches, and common problem-solving paradigms.
- To explain key learning paradigms (supervised, unsupervised, reinforcement) and representative algorithms-Naive Bayes, KNN, regression models, clustering techniques, and basic neural networks-to build analytical intuition.
- To demonstrate real-world applications of AI/ML across the pharmaceutical value chain, highlighting contemporary research avenues in drug discovery, formulation, quality assurance, and personalized medicine.
- To develop practical Python programming skills-from installation and scripting fundamentals to control structures, data types, collections, functions, and basic file/exception handlingenabling students to implement AI/ML workflows.
- To cultivate problem-solving and critical-thinking abilities by integrating AI/ML algorithms with Python to tackle pharmacy-relevant case studies, fostering readiness for advanced study or industry projects.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs							DOK
		PO1	PO3	PO4	PO6	PO9	PO11	PSO1	
R25CO205.1	Describe the evolution, key approaches, and knowledge-representation methods of AI.	2	2	-	2	1	-	-	L 1, L2
R25CO205.2	Differentiate and choose appropriate ML paradigms (supervised, unsupervised, reinforcement) and implement basic algorithms.	2	2	-	1	-	2	-	L1, L3
R25CO205.3	Analyze pharmaceutical case studies and justify AI/ML techniques that improve efficiency in drug development, manufacturing, or pharmacovigilance.	2	2	3	1	-	2	1	L2, L3
R25CO205.4	Write well-structured Python programs employing variables, control flow, collections, functions, and file/exception handling to solve defined tasks.	2	2	3	1	-	2	-	L3, L5
R25CO205.5	Integrate AI/ML algorithms with Python to design and execute a mini-project addressing a real pharmacy challenge, and interpret the results critically.	2	3	3	1	-	2	-	L4, L6

SYLLABUS

UNIT I: **08 Hours**

Foundations of Artificial Intelligence: History of AI, Major approaches to AI (symbolic, statistical, connectionist, evolutionary, hybrid, etc., AI problem-solving paradigms, Knowledge representation techniques, Reasoning under uncertainty, Decision-making strategies.

CO's–CO1

Self learning topics: Timeline of AI milestones (from Dartmouth Conference to Deep Learning), Expert systems in healthcare and pharmacy, Hybrid AI and Neuro-symbolic systems, Real-world examples of reasoning under uncertainty (e.g., medical diagnosis), **AI ethics:** transparency, bias, accountability in decision-making.

UNIT II: **08 Hours**

Machine-Learning Essentials:

Learning paradigms: Supervised learning, Unsupervised learning, Reinforcement.

learning.Core algorithms and where they fit: Naïve Bayes, k-Nearest Neighbours (KNN), Linear & logistic regression, Clustering algorithms (e.g., k-means, hierarchical), Neural networks (basic feed-forward concepts).

CO's–CO2

Self learning topics: Overfitting vs. underfitting in ML models, Feature engineering and importance in ML, Evaluation metrics (accuracy, precision, recall, F1-score), Comparison of supervised vs. unsupervised learning with pharmacy examples, Case studies of reinforcement learning in drug design.

UNIT III: **08 Hours**

AI/ML in Pharmaceutical Sciences:

Industrial applications of AI/ML in the pharmaceutical sector (formulation, process optimisation, quality control, supply-chain analytics, pharmacovigilance, etc.)

Research avenues of AI/ML in pharmacy (drug discovery, QSAR/QSPR, clinical trial design, personalised medicine, regulatory science, real-world evidence, etc.)

CO's–CO3

Self learning topics: AI-driven formulation optimization case studies, Machine learning in pharmacovigilance (adverse drug reaction detection), Role of AI in digital pathology and biomarker discovery, Regulatory aspects of AI/ML in pharmaceuticals (FDA, EMA perspectives), AI in personalized/precision medicine.

UNIT IV: **08 Hours**

Python Setup and Language Basics: Why Python for AI/ML and scientific computing, Installing Python and choosing an IDE (IDLE, VS Code, PyCharm, Jupyter, etc.), Writing and running your first Python script, Core syntax rules: indentation, comments, Declaring and using variables, Built-in data types (int, float, str, bool), Type casting and the type () function.

CO's–CO4

Self learning topics: Exploring Google Colab vs. Jupyter Notebook, Python packages for AI/ML: NumPy, Pandas, Scikit-learn, TensorFlow, PyTorch, Role of virtual environments in Python project management, Python for pharmaceutical data analysis (datasets from PubChem, ChEMBL).

UNIT V: **08 Hours**

Python Programming Constructs & Data Handling:

Operators and expressions: Arithmetic and assignment operators, Comparison and logical operators

Conditional statements: if, elif, else, Nested conditions and typical use cases.

Looping constructs: for loops with range(), while loops.

Loop controls: break, continue, pass, Iterating through strings and lists.

Core collections: Creating, accessing, and modifying lists, List methods and slicing, Tuples and immutability, Iterating over collections.

Functions: defining, calling, returning values.

File handling basics (open, read, write, close)

Exception handling (try–except–finally)

CO's–CO5

Self learning topics: Error handling in prescription parsing using exception handling, Data handling from CSV/Excel using Python, Using Python collections for managing drug databases.

Board of Studies: Pharmacy

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Approved in ACM No: 01

Text Books:

- For depth on core concepts, start with Artificial Intelligence: A Modern Approach by Russell & Norvig (4th ed., 2021).
- Ethem Alpaydin's Introduction to Machine Learning (4th ed., 2020) adds a concise, mathematically grounded view of supervised, unsupervised, and reinforcement methods.
- To get hands-on, Aurélien Géron's Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow (3rd ed., 2022) walks you through coding every major algorithm in Python.
- Pair that with Eric Matthes' Python Crash Course (3rd ed., 2023) for a brisk but thorough introduction to the language itself.
- Finally, Nathan Brown's Artificial Intelligence in Drug Discovery (2020) shows how AI/ML directly accelerates target identification, lead optimization, and formulation within the pharmaceutical arena.

Reference Books:

- Nils J. Nilsson – Principles of Artificial Intelligence, Morgan Kaufmann, 2014.
- Wolfgang Ertel – Introduction to Artificial Intelligence, Springer, 2nd Edition, 2017.
- Bharat Kwatra – Artificial Intelligence in Healthcare and Pharmacy, Bentham Books, 2021.
- Parashar Shah – Python and R for the Modern Data Scientist, Packt, 2021.
- Edited by Andreas Holzinger – Machine Learning for Health Informatics, Springer, 2016.

Web References

1. https://www.cet.edu.in/noticefiles/271_AI%20Lect%20Notes.pdf?
2. https://www.nrigroupindia.com/e-book/Introduction%20to%20Machine%20Learning%20with%20Python%20%28%20PDFDrive.com%20%29-min.pdf?
3. https://www.ijper.org/sites/default/files/IndJPhaEdRes-55-2-304.pdf?
4. https://library.fiveable.me/introduction-cognitive-science/unit-8/foundations-artificial-intelligence/study-guide/QQSG6D6E5cHe6v3u?

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	35%	--
L2	40%	--
L3	25%	25%
L4	--	35%
L5	--	25%
L6	--	15%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1- Remember

1. Define Artificial Intelligence.
2. List the major approaches to AI.
3. What is knowledge representation?

L2- Understand

1. Explain symbolic vs. connectionist approaches to AI.
2. Summarize the history of AI with milestones.
3. Describe reasoning under uncertainty with one healthcare example.
4. Explain how AI supports clinical trial design.
5. Describe AI in formulation and process optimization.
6. Explain why Python is suitable for AI/ML applications.
7. Describe built-in data types in Python.

L3- Apply

1. Apply AI problem-solving paradigms to a pharmacy-based case study (e.g., drug interaction prediction).
2. Demonstrate decision-making strategies with an example of medical diagnosis.
3. Write a Python script to display patient details (name, age, prescription).
4. Demonstrate type casting using drug dosage values.

L4- Analyze

1. Compare symbolic, statistical, and hybrid AI approaches.
2. Analyze the advantages and limitations of different knowledge representation techniques.
3. Distinguish between supervised and unsupervised learning in terms of pharmacy applications.
4. Compare KNN, regression, and Naïve Bayes models.
5. Apply ML algorithms to predict drug toxicity from datasets.
6. Use AI to optimize pharmaceutical supply chain data.
7. Compare Python with R/MATLAB for AI applications.
8. Analyze the role of Python packages (NumPy, Pandas) in data analysis.

L5- Evaluate

1. Critically evaluate the role of reasoning under uncertainty in drug discovery.
2. Assess the impact of decision-making strategies in real-world healthcare AI.
3. Assess the effectiveness of reinforcement learning in drug design.
4. Evaluate the suitability of clustering algorithms in pharmaceutical quality control.
5. Design a simple neural network model to predict drug activity.
6. Develop an ML workflow for personalized medicine recommendations.
7. Assess the benefits of using Jupyter Notebook for scientific computing.
8. Evaluate Python's dominance in AI compared to other languages.
9. Evaluate the role of functions in modular programming with pharmacy use cases.
10. Assess exception handling as a tool for data integrity in pharmacy informatics.

L6- Create

1. Design a simple framework for AI-based clinical decision support system.
2. Create a Python function to simulate drug release data.
3. Design a complete program for pharmacokinetic parameter calculation (Cmax, Tmax, AUC).

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R25BP206 **ENVIRONMENTAL SCIENCES** **3 0 0 3**

COURSE OBJECTIVES:

1. To impart fundamental knowledge of environmental science.
2. To create awareness about the importance and conservation of natural resources.
3. To educate students about various types of environmental pollution.
4. To sensitize students to pressing environmental and social issues.
5. To study the interrelationship between human population, health, and environment.

COURSE OUTCOMES:

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs							DOK
		PO1	PO3	PO4	PO6	PO7	PO9	PSO1	
R25CO206.1	Understand the structure, components and functioning of various types of ecosystems.	2	2	-	2	3	1	3	L1, L2
R25CO206.2	Classifying the types of natural resources and explain the importance of natural resources.	3	3	3	1	-	-	3	L1, L3
R25CO206.3	Identifying the major types, sources and causes of environmental pollution and use of technologies for pollution prevention and environmental protection.	3	3	3	1	-	3	3	L2, L4
R25CO206.4	Identifying the environmental and occupational health hazards and the collective efforts in achieving environmental balance.	3	3	3	1	-	3	3	L1, L5
R25CO206.5	Understand the principles of disaster management and evaluate the role of NGOs, Government bodies and public in environmental issues and promoting awareness.	3	2	3	1	-	3	1	L2, L6

SYLLABUS

UNIT I **10 Hours**

Introduction to Environment and Ecosystems: Definition, scope, and importance of environmental studies. Components of the environment: atmosphere, hydrosphere, lithosphere,

biosphere.Structure and function of ecosystems. Types of ecosystems: forest, grassland, desert, aquatic (pond, lake, river, ocean). Energy flow in the ecosystem, food chains, food webs, ecological pyramids. Ecological succession and biodiversity (definition, levels, and importance).

CO'S - CO1

Self Learning Topics: Study of endangered species and their habitats in India. National Parks and Biosphere Reserves of India. Impact of invasive species on ecosystems.

UNIT II **10 Hours**

Natural Resources: Types: Renewable and Non-renewable. Forest resources: use, overexploitation, deforestation, afforestation. Water resources: use, scarcity, conflicts, water conservation. Mineral resources: extraction and impact on environment. Food resources: world food problems, effects of modern agriculture. Energy resources: growing energy needs, renewable vs. non-renewable energy sources. Land resources: land degradation, soil erosion, desertification.Sustainable management and conservation strategies.

CO'S – CO2

Self Learning Topics: Rainwater harvesting systems: models and success stories. Sustainable farming practices (e.g., organic farming, permaculture). Impact of e-waste on natural resources

UNIT III **10 Hours**

Environmental Pollution: Definition, types, causes, effects, and control measures. Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal and radioactive pollution, Solid waste management: causes, effects, methods of disposal. Role of individuals in pollution prevention, Environmental ethics and public awareness.

CO'S – CO3

Self Learning Topics: Effects of microplastics and marine pollution, Bioremediation and phytoremediation technologies, Analysis of local solid waste management practices.

UNIT IV **10 Hours**

Social Issues and Environment: Urban and rural environmental issues, Climate change, global warming, acid rain, ozone layer depletion, Disaster management: floods, earthquakes, cyclones, landslides, Environmental laws and acts:Environment Protection Act, Air (Prevention and Control of Pollution) Act.Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act. Role of NGOs and local bodies in environmental protection.

CO'S – CO4

Self Learning Topics: Community-based disaster preparedness models, Review of environmental court cases in India (e.g., Vellore Leather Industry). Green building concepts and certifications (LEED, GRIHA).

UNIT V **10 Hours**

Human Population and the Environment: Population growth and its impact on environment. Human health and environment (sanitation, communicable diseases, lifestyle diseases). Environmental and occupational hazards. Environment and human rights. Value education and environmental stewardship. Sustainable development goals (SDGs) and green practices.Role of youth and community in environmental conservation.

CO'S – CO5

Self Learning Topics: Effects of urbanization on environmental health. Study of public health programs related to sanitation (e.g., Swachh Bharat Mission). Environmental impact of Consumerism. Eco-friendly lifestyle and zero-waste living. Role of students in campus sustainability (e.g., waste audits, plantation drives).

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Text Books:

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers,
2. Bangalore.
3. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
4. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd.,
5. Ahmedabad – 380 013, India.
6. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
7. Clark R.S., Marine Pollution, Clanderson Press Oxford.

Reference Books

1. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001,Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
2. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
3. Down of Earth, Centre for Science and Environment.
4. Perspectives in Environmental Studies by Anubha Kaushik & C.P. Kaushik.
5. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha.

WEB REFERENCES:

1. https://retailmaharaj.com/products/textbook-of-environmental-studies-3rd-edition
2. https://retailmaharaj.com/products/a-textbook-of-environmental-studies-and-sustainability

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	20%	20%
L2	25%	25%
L3	20%	20%
L4	15%	15%
L5	10%	10%
L6	10%	10%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels
L1: Remember

1. Define environmental studies and state its scope.
2. List the four major components of the environment.Name any three types of ecosystems with examples.
3. What is meant by an ecological pyramid?
4. Define biodiversity and mention its three levels.
5. Define renewable and non-renewable resources.
6. List four examples of renewable resources.
7. Give two examples of non-renewable energy sources.
8. What is meant by afforestation?
9. Name any two causes of land degradation.
10. Mention two methods of water conservation.
11. State any two effects of modern agriculture on the environment.
12. What is desertification.
13. List any three types of energy resources
14. Define environmental pollutioList any four types of pollution..
15. What is meant by solid waste management?
16. List any two methods of solid waste disposal.
17. Mention two individual actions to prevent pollution.

L2: Understand

1. Explain the importance of environmental studies in modern society.
2. Differentiate between food chain and food web with examples.
3. Describe the structure and function of an aquatic ecosystem.
4. Summarize the significance of biodiversity in ecosystem stability.
5. Illustrate energy flow through an ecosystem using a diagram.
6. Explain the difference between renewable and non-renewable resources with examples.
7. Describe the impact of deforestation on the environment.
8. Discuss the reasons for water scarcity in India.
9. Explain how conflicts arise over water resources.
10. Summarize the effects of mineral extraction on the environment.
11. Differentiate between renewable and non-renewable energy sources.
12. Interpret the relationship between soil erosion and land degradation.
13. Explain why sustainable management of resources is important.
14. Describe the major problems caused by overexploitation of forest resources.
15. Discuss the consequences of world food problems.

L3: Apply

1. Apply the concept of disaster management to prepare a safety plan for earthquake-prone areas.
2. Illustrate how acid rain affects agricultural land and suggest preventive measures.
3. Demonstrate how urbanization contributes to air pollution using real-life examples.
4. Use the provisions of the Water (Prevention and Control of Pollution) Act to address water pollution in a river.
5. Apply the concept of environmental ethics to reduce plastic pollution in urban areas.
6. Show how NGOs can implement community programs to mitigate climate change effects.
7. Prepare a simple flowchart showing the effects of global warming on weather patterns.
8. Use the Environment Protection Act to propose actions against an industry violating emission norms.

9. Apply the Forest Conservation Act to design a plan for reducing deforestation in rural areas.
10. Illustrate a disaster response plan for cyclone-affected coastal regions.

L4: Analyze

1. Compare the causes and effects of air pollution and water pollution.
2. Analyze the role of human activities in increasing noise and soil pollution.
3. Differentiate between thermal and radioactive pollution with respect to sources and impact.
4. Examine how improper solid waste management affects soil and water quality.
5. Analyze the relationship between industrialization and different types of environmental pollution.
6. Compare the effectiveness of traditional vs. modern methods of solid waste disposal.
7. Analyze how public awareness can reduce the impact of environmental pollution.
8. Examine the ethical issues involved in environmental pollution and their societal implications.
9. Differentiate the health impacts of air pollution and noise pollution.
10. Analyze the interconnection between water pollution and biodiversity loss.
11. Analyze the effectiveness of disaster management strategies during floods versus earthquakes.
12. Compare the roles of NGOs and local bodies in enforcing environmental protection laws.
13. Analyze how global warming contributes to the frequency of natural disasters.
14. Examine the significance of environmental laws in controlling industrial pollution.
15. Compare the impact of deforestation and urbanization on rural environmental issues.
16. Analyze how local governance can mitigate climate change at the community level.

L5:Evaluate

1. Assess the impact of rapid population growth on sustainable development goals.
2. Judge the effectiveness of government policies in controlling communicable diseases linked to poor sanitation.
3. Critically evaluate the role of youth in environmental conservation in urban areas.
4. Justify the need for integrating value education in environmental protection programs.
5. Evaluate the success of green practices in reducing occupational hazards in industries.
6. Analyze the ethical implications of human rights violations caused by environmental degradation.
7. Determine whether population control is the most effective strategy for reducing environmental pollution.
8. Critique the implementation of environmental stewardship programs in educational institutions.
9. Assess the importance of sanitation programs in reducing lifestyle and communicable diseases.
10. Appraise the effectiveness of global initiatives towards achieving the SDGs related to the environment.

L6: Create

1. Design a community-based program to promote environmental stewardship among youth.
2. Develop a sustainable urban model that reduces population pressure on natural resources.
3. Formulate a plan to minimize environmental and occupational hazards in industrial zones.

4. Create an awareness campaign linking human rights with environmental protection.
5. Construct a roadmap for achieving SDG targets related to clean water and sanitation in rural areas.
6. Propose a green practice model for schools to enhance student participation in sustainability.
7. Design a disaster preparedness strategy that considers human health and population density.
8. Develop an innovative app concept to track and reduce lifestyle diseases caused by environmental factors.
9. Formulate guidelines for integrating value education into corporate environmental responsibility programs.
10. Create a youth-driven initiative to reduce plastic waste and promote recycling in local communities.

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R25BP207 HUMAN ANATOMY AND PHYSIOLOGY -II PRACTICAL 0 0 4 2

Course Objectives:

- To allow the verification of physiological processes discussed in theory classes through experiments on living tissue, intact animals.
- To Apply knowledge of various organs, and feedback systems to analyze physiological functions using models, simulations, and practical measurements.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs					DOK
		PO1	PO3	PO9	PO11	PSO1	
R25CO207.1	Recall and explain the anatomy and physiology of the central and peripheral nervous systems, specialsenses, and integumentary system with the help of models, charts, and specimens.	3	2	1	2	1	L 1, L2
R25CO207.2	Demonstrate and interpret various sensory and motor functions, including reflex activity, visual and olfactory functions, and taste sensation, using charts, models, and clinical demonstration	3	2	2	2	1	L2, L3
R25CO207.3	Apply knowledge of endocrine, respiratory, and feedback systems to analyze physiological functions using models, simulations, and practical measurements	3	2	2	2	1	L3, L5
R25CO207.4	Evaluate body functions such as body temperature, BMI, and reproductive health through observation of diagnostic tools, organ tissues, and family planning devices.	3	2	2	2	1	L4, L6

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COURSE CONTENT

Practical HAP allows the verification of physiological processes discussed in theory classes through experiments on living tissues, simulated animal models, charts, and models.

S.No	Name of the Experiment	CO's
01	Study of brain and spinal cord using models/specimens	CO1
02	Study of cranial and spinal nerves using models/charts	CO1
03	Study the integumentary and special senses using specimen, models	CO1
04	Demonstration of neurological examination (reflexes, tone, motor)	CO1
05	Demonstration of reflex activity (e.g., knee jerk)	CO2
06	Demonstration of visual acuity using Snellen's chart	CO2
07	Demonstration of olfactory nerve function	CO2
08	Taste sensation testing (sweet, salty, sour, bitter)	CO2
09	Study of endocrine glands using models (pituitary, thyroid, etc.)	CO3
10	Demonstration of feedback mechanisms using charts/simulations	CO3
11	Study of respiratory system using models/specimens	CO3
12	Determination of tidal volume and vital capacity	CO3
13	Study of urinary and reproductive systems using models	CO4
14	Demonstration of pregnancy detection kits and family planning devices	CO4
15	Recording of body temperature and BMI	CO4
16	Observation of permanent slides of vital organs (kidney, liver, gonads)	CO4

Textbooks:

1. Textbook of Practical Physiology by C.L. Ghai, Jaypee brothers medical publishers, New Delhi.

2.Practical workbook of Human Physiology by K. Srinageswari and Rajeev Sharma,Jaypee brother's medical publishers, New Delhi.

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R25BP208 PHARMACEUTICAL ORGANIC CHEMISTRY- I PRACTICAL 0 0 4 2

Course Objectives:

- To understand Laboratory Techniques, use of various equipment and safety measures in a pharmaceutical chemistry laboratory, including calibration of thermometers and simple laboratory techniques.
- To analyze organic compounds qualitatively and synthesize derivatives.
- To synthesize of suitable solid derivatives of organic compounds and identify unknown organic compounds.
- To gain practical knowledge from laboratory synthesis of medicinal organic molecules and qualitative organic analysis to interpret and arrive at valid conclusions.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs					DOK
		PO1	PO3	PO4	PO11	PSO1	
R25CO208.1	Analyze unknown pharmaceutical organic compounds by determining their melting point/boiling point.	2	2	2	1	2	L1, L2
R25CO208.2	Prepare and characterize the derivatives of organic compounds.	2	2	2	1	2	L1, L2
R25CO208.3	Perform qualitative analysis of pharmaceutical organic compounds and identify the extra elements present in the pharmaceutical organic compounds and find the presence of several functional groups in Pharmaceutical compounds.	2	2	2	1	2	L2, L3
R25CO208.4	Able to construct molecular models.	2	2	2	1	2	L4,L5

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COURSE CONTENT

S.NO	NAME OF THE EXPERIMENT	CO's
Systematic qualitative analysis of unknown organic compounds		CO1
1	Systematic qualitative analysis of unknown organic compounds Sample - 1	
2	Systematic qualitative analysis of unknown organic compounds sample- 2	
3	Systematic qualitative analysis of unknown organic compounds sample-3	
4	Systematic qualitative analysis of unknown organic compounds sample-4	
Identification of the unknown compound from the literature using melting point/ boiling point/ solubility.		CO2
5	To determine and Report the Melting point of given Sample	
6	To determine and Report the Boiling point of given Sample	
7	To determine and Report the Solubility of given Sample	
Preparation of suitable solid derivatives from organic compounds.		CO3
8	Preparation of picric acid	
9	Preparation of acetyl salicylic acid	
10	Preparation of acetanilide from aniline	
11	Preparation of phenyl benzoate from phenol	
12	Synthesis of m- dinitro benzene from nitro benzene	
13	Synthesis of 2,4,6 – tri bromo aniline from aniline	CO4
14	Synthesis of benzanilide from aniline	
15	Synthesis of Benzil from benzoin	
16	**Construction of molecular models**	

Text Books:

1. 1.Organic Chemistryby Morrison and Boyd
2. Organic Chemistryby I.L. Finar , Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic ChemistrybyP.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.

9. Reaction and reaction mechanism by Ahluwaliah/Chatwal.

Reference Books: -

1. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry: A classic textbook that covers the fundamental principles of chemistry, biochemistry, and biology underlying medicinal chemistry.
2. Advanced Practical Organic Chemistry: A detailed guide for navigating organic chemistry complexities, bridging theoretical knowledge and practical application.
3. Organic Chemistry by Dr. K. S. Jain and Dr. P. B. Miniyar: A book that simplifies pharmaceutical organic chemistry concepts.

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R25BP209 MEDICINAL BIOCHEMISTRY PRACTICAL 0 0 4 2

Course Objectives:

- To carry out the qualitative analysis of different nutrients such as carbohydrates, protein and lipids.
- To learn about safety and precautionary measures, how to handle glassware and minor equipment, and how to prepare laboratory reagents and standard chemical solutions.
- To analyze carbohydrates, proteins, lipids, urine, blood creatinine, blood sugar, and serum total cholesterol.
- To learn about enzymatic hydrolysis of starch, effect of temperature and effect of substrate concentrate on amylase activity.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs				DOK
		PO1	PO3	PO4	PSO2	
R25C0209.1	To recall the qualitative analysis of carbohydrates and proteins and Lipids.	3	1	2	2	L1, L6
R25C0209.2	To discuss the amount of proteins, creatinine and cholesterol in blood and study their clinical significance To explain the principle involved in estimation of blood glucose and its clinical significance.	3	1	2	2	L2, L3
R25C0209.3	To experiment with determination of reducing sugars by DNSA method To test for normal and abnormal constituents present in urine and study their clinical significance	3	1	2	2	L2, L5
R25C0209.4	To understand and analyze the enzymatic activity of salivary amylase through experiments	3	1	2	2	L3, L4

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COURSE CONTENT

EXPERIMENT NO.	EXPERIMENT NAME	CO'S
1	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Sucrose and starch	CO1
2	Identification tests for Lipids	CO1
3	Identification tests for Proteins (Albumin and Casein	CO1
4	Determination of blood creartinine	CO2
5	Determination of blood sugar	CO2
6	Determination of serum total cholesterol	CO2
7	Quantitative analysis of reducing sugars (DNSA method) and Protein (Biuret method)	CO3
8	Qualitative analysis of urine for abnormal constituents	CO3
9	Study of enzymatic hydrolysis of starch	CO4
10	Determination of Salivary amylase activity	CO4
11	Study the effect of Temperature on Salivary amylase activity	CO4
12	Study the effect of substrate concentration on salivary amylase activity	CO4

Text books

1. Principles of Biochemistry by Lehninger.
2. Harper's Biochemistry by Robert K. Murry, Daryl K. Granner and Victor W. Rodwell.
3. Biochemistry by D. Satyanarayan and U.Chakrapani.

Reference books

1. Textbook of Biochemistry by Rama Rao.
2. Textbook of Biochemistry by Deb.
3. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
4. ntroduction of Practical Biochemistry by David T. Plummer.
5. Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.

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R25BP210 AI & PYTHON PROGRAMMING FOR PHARMACY – I PRACTICAL 0 0 2 1

Course Objectives:

- To introduce students to Python programming for scientific computing and pharmacy applications
- To train students in importing, cleaning, preprocessing, and managing pharmaceutical and clinical datasets using Python libraries like NumPy and Pandas.
- To develop competency in integrating computational tools with practical pharmacy applications.
- To provide foundational knowledge of Artificial Intelligence, Machine Learning, and Deep Learning in the context of healthcare and pharmacy.

Course Outcomes:

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs							DOK
		PO1	PO3	PO4	PO6	PO9	PO11	PSO1	
R25CO210.1	Demonstrate basic Python programming skills, including syntax, variables, data types, operators, control structures (conditional statements and loops). Develop simple Python functions and modules for pharmacy-related calculations (e.g., BMI, drug dosage).	2	2	-	2	1	-	-	L1, L2
R25CO210.2	Apply statistical analysis methods (mean, median, mode, standard deviation, correlation) on clinical and drug-related data.	2	2	-	1	-	2	-	L2, L4
R25CO210.3	Understand basic concepts of Artificial Intelligence, Machine Learning, and Deep Learning in healthcare and pharmacy. Implement simple Python-based AI applications for drug discovery, formulation, or pharmacy practice.	2	2	3	1	-	2	1	L2, L3
R25CO210.4	Develop Python-based solutions for real-world pharmacy problems, such as medicine reminders or patient risk prediction.	2	2	3	1	-	2	-	L2, L6

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COURSE CONTENT

S.No	Name of the Experiment	CO's
01	Write a Python program to demonstrate variables, data types, and operators.	CO1
02	Write a program to use conditional statements and loops (e.g., check if a given drug is in a formulary list).	CO1
03	Develop Python functions and modules for simple pharmaceutical calculations (e.g., BMI, dosage calculation).	CO1
04	Import, clean, and manipulate drug-related datasets using Pandas.	CO2
05	Perform basic statistical analysis (mean, median, SD, correlation) on clinical trial data.	CO2
06	Visualize drug release profile data using Matplotlib/Seaborn (line plot, bar graph, histogram, scatter plot).	CO2
07	Build a simple drug classification model (e.g., antibiotic vs. analgesic) using logistic regression/decision tree.	CO3
08	Apply text mining to extract keywords (like drug names, diseases) from abstracts of pharmaceutical research papers.	CO3
09	Develop a predictive model to estimate drug solubility or drug-likeness from molecular property datasets.	CO3
10	Create a simple medicine reminder chatbot using Python basics.	CO3
11	AI-based prediction of patient risk (e.g., diabetes dataset).	CO4
12	Python-based prescription analysis system.	CO4

Reference Books

- Allen B. Downey – Think Python: How to Think Like a Computer Scientist, O'Reilly, 2nd Edition, 2016.
- Stuart Russell & Peter Norvig – Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2021.
- Ethem Alpaydin – Introduction to Machine Learning, MIT Press, 4th Edition, 2020.

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R25BP211 ETHICS AND UNIVERSAL HUMAN VALUES 2 0 0 0

Course Objectives:

- To create an awareness on Pharmacy Ethics and Human Values.
- To understand social responsibility as Pharmacist.
- To appreciate ethical dilemma while discharging duties in professional life.

Course Outcomes

At the end of the course, students will be able to:

Course Code	Course Outcomes (COs)	Mapping with POs and PSOs					DOK
		PO2	PO5	PO7	PO11	PSO1	
R25CO211.1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	2	2	3	1	1	L1, L2
R25CO211.2	Distinguish between values and skills,happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	2	2	3	1	1	L1, L4
R25CO211.3	Understand the role of a human being in ensuring harmony in self, family, society & nature and apply in professional life.	2	2	3	1	1	L5, 6

SYLLABUS

UNIT-I **10 Hours**

Introduction to Value Education : Value Education, Definition, Concept and Need for Value Education, The Content and Process of Value Education, Apply Different values in the regular life, Self-exploration-Attitude, confidence as a means of Value Education, Right understanding about Happiness and Prosperity.

CO's–CO1

Self- Learning Topics: SWOT analysis for Attitude & Confidence, Distinguish between sensory pleasure and sustained happiness, Difference between moral education, ethics, and value education.

UNIT-II **10 Hours**

Harmony in the Human Being: Human Being is more than just the Body, Harmony of the Self ('I') with the Body, Understanding Myself as Co-existence of the Self and the Body, Understanding Needs of the Self and the needs of the Body, Understanding the activities in the Self and the activities in the Body.

CO's–CO2

Self- Learning Topics: Distinction between "being alive" and "living with purpose", Balance between inner satisfaction and physical well-being, Right evaluation of needs for a holistic lifestyle.

UNIT-III **8 Hours**

Harmony in the Family and Society and Harmony in the Nature: Family as a basic unit of Human Interaction and Values in Relationships, Basics for Respect and today's Crisis: Affection, kindness, Guidance, Reverence, Glory, Gratitude and Love, Comprehensive Human Goal: The Five Dimensions of Human Endeavour, Harmony in Nature: The Four Orders in Nature, The Holistic Perception of Harmony in Existence.

CO's–CO3

Self- Learning Topics: Difference between biological connection vs. value-based connection, Misuse of nature vs. sustainable living, Contrast between fragmented view vs. holistic view of life, Practices for living in harmony (sustainability, cooperation, ethical living).

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Text Books :

1. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019.

Reference Books:

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Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)
L1	55%	25%
L2	30%	25%
L3	15%	--
L4	--	35%

L5	--	5%
L6	--	10%
Total (%)	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. What is the definition of value education?
2. List the objectives of value education.
3. What are the two major components of a human being?
4. Define respect in relationships.
5. State the five dimensions of comprehensive human goal.

L2: Understand

1. Explain why value education is necessary in today's society.
2. Differentiate between value education and information-based education.
3. Explain why the Self and the Body must be seen in harmony.
4. Describe the qualitative needs of the Self vs. quantitative needs of the Body.
5. Explain how family is the foundation of human interaction.
6. Illustrate with examples how gratitude strengthens relationships.

L3: Apply

1. Apply the value of honesty in a classroom or workplace situation.
2. How can self-exploration help in building confidence?
3. Show how right understanding in the Self can guide healthy use of the Body.
4. Apply the distinction between Self and Body in handling stress.
5. Apply kindness and guidance in resolving conflicts among peers.
6. Show how affection and reverence are practiced in your family.

L4: Analyze

1. Analyze the difference between temporary happiness and sustainable happiness.
2. Compare prosperity based on material possessions vs. prosperity with right understanding.
3. Analyze the impact of misunderstanding body needs as self-needs.
4. Compare the consequences of living with harmony vs. disharmony between Self and Body.
5. Analyze the causes of crisis in family relationships today.
6. Distinguish between respect based on social status vs. respect based on values.

L5: Evaluate

1. Judge whether modern education sufficiently addresses human values. Give reasons.
2. Evaluate the role of self-exploration in decision-making.
3. Critically assess how modern lifestyles ignore the needs of the Self.
4. Evaluate whether technology supports or disturbs Self–Body harmony.
5. Evaluate whether material success ensures harmony in family and society.
6. Judge the importance of trust in sustaining love in relationships.

L6: Create

1. Design a daily routine that integrates values like respect, responsibility, and cooperation.
2. Propose an activity to promote value education in schools/colleges.
3. Create a self-care plan that balances needs of Self and Body.
4. Propose strategies for cultivating harmony between Self and Body in students.
5. Design a family charter with values and practices for harmony.
6. Propose a community activity that promotes respect and gratitude.

M. pavani

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Board of Studies

Chairperson
Board of Studies (AIPS)
Avanthi Institute of Pharmaceutical Sciences (
Cherukupally (V), Bhogapuram Mand
Vizianagaram Dt.,- 531162