AVANTHI INSTITUTE OF PHARMACEUTICAL SCIENCES (AUTONOMOUS)

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Cherukupally (Village), Chittivalasa (SO), Bhogapuram (Mandal),Vizianagaram (Dist)-531162
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DEPARTMENT OF PHARMACY

Course Structure

Program– Pharm D

Regulation-R25

I Year -Course Structure

S.No	Category	Course Code	Course Title	Hours per Week			
				Lecture	Tutorial	Practical	Credits
1	PC	R25PP101	Human Anatomy and Physiology	3	1	0	4
2	PC	R25PP102	General Dispensing Pharmacy	3	1	0	4
3	PC	R25PP103	Medicinal Biochemistry	3	1	0	4
4	PC	R25PP104	Pharmaceutical Organic Chemistry	3	1	0	4
5	PC	R25PP105	Pharmaceutical Inorganic Chemistry	3	1	0	4
6	SC	R25PP106	Computational tools in pharmacy practice	3	1	0	4
7	PC	R25PP107	Human Anatomy and Physiology Practical	0	0	4	2
8	PC	R25PP108	General Dispensing Practical	0	0	4	2
9	PC	R25PP109	Medicinal Biochemistry Practical	0	0	4	2
10	PC	R25PP110	Pharmaceutical Organic Chemistry Practical	0	0	4	2
11	PC	R25PP111	Pharmaceutical Inorganic Chemistry Practical	0	0	4	2
12	SC	R25PP112	Computational tools in pharmacy practice Practical	0	0	4	2
13	MC	R25PP113	Effective Communication Skills Practical	0	0	2	0
Total				18	6	26	36

Category	Courses	Credits
PC-Pharmacy Core Course	10	30
SC-Skill Oriented courses	2	6
MC-Mandatory Course	1	-
Total	**13**	**36**

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R25PP101 **Human Anatomy & Physiology** **3 1 0 4**

Course Objectives:

- To impart a fundamental knowledge on the structure and functions of the human body.
- To understand both homeostasis mechanisms and homeostatic imbalances of various body systems.
- To correct the deviations in human body,since a medicament, which is produced by pharmacist.
- To understand how the drugs act on the various body systems in correcting the disease state of the organs.

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	Describe the various homeostatic mechanisms and their imbalances of various systems.	3	2	2	2	1	L1, L2
R25BP101.3	Perform the hematological tests and Relate the physiology of sympathetic, parasympathetic, spinal/cranial nerves.	3	2	2	2	1	L1, L3
R25BP101.4	Outline the importance of Reproductive system in human body and Understand the importance of Urinary system in human body.	3	2	2	2	1	L3, L4
R25BP101.5	Understand the organization of special senses and effect of physiology of sports in humans.	3	2	2	2	1	L5, L6

SYLLABUS

UNIT I: **15 Hours**

Scope of anatomy and physiology: Basic terminologies used in this subject (Description of the body as such planes and terminologies).

Structure of cell : Cell Components and their functions.

Elementary tissues of the human body: Epithelial, Connective, Muscular and nervous tissues-their sub-types and characteristics

Osseous system: Structure, composition and functions of the Skeleton,Classification of joints, Types of movements of joints and disorders of joints (Definitions only)

CO's–CO1

Self Learning topics: Recent advances in cell signaling and molecular communication, Axial vs. Appendicular skeleton – A comparative study with examples.

Unit II: **10 Hours**

Haemopoetic System : Composition and functions of blood,Haemopoesis and disorders of blood components (definition of disorder), Blood groups, Clotting factors and mechanism, Platelets and disorders of coagulation

Lymphatic System: Lymph and lymphatic system,composition,formation and circulation,Spleen structure and functions,Disorders of lymphatic system (definition only)

Cardiovascular system : Anatomy and functions of heart,Blood vessels and circulation (Pulmonary, coronary and systemic circulation),Electrocardiogram (ECG),Cardiac cycle and heart sounds,Blood pressure, its maintenance and regulation,Definition of the following disorders Hypertension, Hypotension, Arteriosclerosis, Atherosclerosis, Angina, Myocardial infarction, Congestive heart failure, Cardiac arrhythmias

CO's–CO2

Self Learning topics: Erythropoiesis and hemoglobin synthesis in health and disease and Role of lymphatic vessels in fluid balance and immunity, Electrocardiogram (ECG) and Cardiac Conduction System.

Unit III: **12 Hours**

Respiratory system: Anatomy of respiratory organs and functions,Mechanism,physiology of respiration and regulation of respiration,Transport of respiratory gases,Respiratory volumes and capacities and Definition of Hypoxia, Asphyxia, Dybarism, Oxygen therapy and resuscitation.

Digestive system: Anatomy and physiology of GIT, Anatomy and functions of accessory glands of GIT,Digestion and absorption,Disorders of GIT (definitions only).

Nervous system: Definition and classification of nervous system,Anatomy,physiology and functional areas of cerebrum,Anatomy and physiology of cerebellum,Anatomy and physiology of mid brain,Thalamus, hypothalamus and Basal Ganglia,Spinal card; Structure & reflexes,mono poly planter, Cranial nerves names and functions, Autonomos Nervous system Anatomy & functions of sympathetic & parasympathetic Nervous Sysytem.

CO's–CO3

Self-Learning Topics: Differences between sympathetic and parasympathetic nervous systems with examples, Common disorders of the digestive and nervous systems.

Unit IV: **8 Hours**

Urinary system: Anatomy and physiology of urinary system,Formation of urine,Renin Angiotensin system,Juxtaglomerular apparatus,Acid base Balance,Clearance tests and micturition.

Endocrine system: Pituitary gland,Adrenal gland,Thyroid and Parathyroid glands,Pancreas and gonads.

Reproductive system: Male and female reproductive system,Their hormones,Physiology of menstruation;Spermatogenesis,Oogenesis,Sex determination (genetic basis), Pregnancy and maintenance and parturition,Contraceptive devices.

CO's–CO4

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

Unit V: **10 Hours**

Sense organs: Eye,Ear,Skin,Tongue,Nose.
Skeletal muscles: Histology,Physiology of Muscle contraction,Physiological properties of skeletal muscle and their disorders (Definitions).
Sports physiology: Muscles in exercise, Effect of athletic training on muscles and muscle performance, Respiration in exercise, CVS in exercise, Body heat in exercise, Body fluids and salts in exercise, Drugs and athletics.

CO's–CO5

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

Board of Studies: Pharmacy

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

Approved in ACM No: 01

Text Books:

1. Tortora Gerard J. and Nicholas, P. Principles of anatomy and physiology Publisher Harpercollins college New York.
2. Wilson, K.J.W. Ross and Wilson's foundations of anatomy and physiology. Publisher: Churchill Livingstone, Edinburg.

Reference Books:

1. Guyton arthur, C. *Physiology of human body*. Publisher: Holtsaunders.
2. Chatterjee,C.C. *Human physiology*. Volume 1&11. Publisher: medical allied agency, Calcutta.
3. Peter L. Williams, Roger Warwick, Mary Dyson and Lawrence, H. *Gray's anatomy*. Publisher:Churchill Livingstone, London.

Web References:

1. https://pharmdguru.com/category/anatomy-and-physiology/
2. https://pharmacyinfoline.com/human-anatomy-physiology-pharm-d/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)	Internal Assessment #3(%)
L1	30%	-	-
L2	20%	-	-
L3	25%	30%	30%
L4	25%	20%	20%
L5	-	25%	25%
L6	-	25%	25%
Total (%)	100%		100%

Sample Short and Long Answers questions of Various Cognitive Levels

Level 1: 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 – Understanding

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 – Applying

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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R25PP102 **GENERAL DISPENSING PHARMACY** **3 1 0 4**

Course Objectives:

- To understand the volution 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.
- To understand the responsibilities of Pharmacist in various domains of pharmacy and role of hospital pharmacist in communicating with healthcare professionals and patients effectively.
- To understand the role of active pharmaceutical ingredients and pharmaceutical excipients in drug formulations.
- To gain basic knowledge about formulation and preparation of various solid, liquid and semisolid dosage forms.
- To understand the incompatibilities during design and usage of dosage form.

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	PO2	PO3	PO4	PO5	PO11	PSO1	PSO2	
R25PP102.1	Outline the classification of dosage forms, handling of prescription and summarize the importance of posology.	3	2	-	1	2	2	3	-	L 1, L2
R25PP102.2	Solve the pharmaceutical calculations involved in design of dosage form and understand the formulation of powders, granules.	3	3	3	1	2	2	3	1	L1, L4
R25PP102.3	Gain knowledge on formulation of monophasic liquid dosage forms, biphasic dosage forms.	3	2	2	1	3	2	3	1	L 2, L3
R25PP102.4	Acquire knowledge on formulation of Semisolids, Suppositories & Galenical's.	3	2	2	2	3	2	3	-	L3, L5
R25PP102.5	Identify the types incompatibilities in dosage forms & avoid the incompatibilities during dispensing.	3	3	2	3	3	2	3	-	L4, L6

SYLLABUS

UNIT I: **18 Hours**

Historical back ground and development of profession of pharmacy and pharmaceutical industry in brief.

Development of Indian Pharmacopoeia and introduction to other Pharmacopoeias such as BP, USP, European Pharmacopoeia, Extra pharmacopoeia and Indian national formulary.
Introduction to dosage forms: Classification and definitions.
Prescription: Definition, parts and handling, Modern prescription.
Posology: Definition, Factors affecting dose selection. Calculation of children and infant doses.

CO's–CO1

Self-Learning Topics: Common Abbreviations and Latin terms used in Prescriptions, Types of Prescriptions, Electronic Prescriptions, Interpretation of Prescription Orders, Dose Adjustment in special Populations.

Unit II: **18 Hours**

Weights and measures and Pharmaceutical calculations : Calculations involving percentage solutions, allegation, proof spirit, isotonic solutions etc.
Powders and Granules: Classification advantages and disadvantages, Preparation of simple, compound powders, Insufflations, Dusting powders, Eutectic and Explosive powders, Tooth powder and effervescent powders and granules.

CO's–CO2

Self-Learning Topics: Practice unit conversions, granulometric Analysis and Importance of Particle Size of powers, Pharmaceutical calculations, Granulation Techniques, Evaluation of granules.

Unit III: **18 Hours**

Monophasic Dosage forms: Theoretical aspects of formulation including adjuvant like stabilizers, colorants, flavours with examples. Study of Monophasic liquids like gargles, mouth washes, Throat paint, Ear drops, Nasal drops, Liniments and lotions, Enemas and collodions.
Biphasic dosage forms: Suspensions and emulsions, Definition, advantages and disadvantages, classification, test for the type of emulsion, formulation, stability and evaluation.

CO's–CO3

Self-Learning Topics: Challenges encountered in formulation of monophasic and biphasic liquid systems, Review case studies involving formulation failure.

Unit IV: **18 Hours**

Semisolid dosage forms: Definition, advantages and disadvantages, types of bases, method of preparation and evaluation of ointments, creams, pastes and gels.
Suppositories and pessaries: Definition, advantages and disadvantages, types of base, method of preparation, Displacement value and evaluation.
Galenicals: Definition, equipment for different extraction processes like infusion, Decoction, Maceration and Percolation, methods of preparation of spirits, tinctures and extracts.

CO's–CO4

Self-Learning Topics: Applications of semisolids in dermatology and rectal/vaginal drug delivery, Role of galenicals in modern herbal and ayurvedic formulations.

Unit V: **18 Hours**

Incompatibilities: Introduction, classification and methods to overcome the incompatibilities.
Surgical aids: Surgical dressings, absorbable gelatin sponge, sutures, ligatures and medicated bandages.

CO's–CO5

Self-Learning Topics: Analyze sample prescriptions and identify, rectify incompatibilities. Selection and dispensing of appropriate surgical aids.

Board of Studies: Pharmacy

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

Approved in ACM No: 01

Text Books:

1. Mehta R.M, Pharmaceutics – I – 6th edition.
2. Cooper and Gunns Dispensing for pharmacy students.
3. A text book Professional Pharmacy by N.K.Jain and S.N.Sharma.

Reference Books:

1. Introduction to Pharmaceutical dosage forms by Howard C. Ansel.
2. Remington's Pharmaceutical Sciences.
3. Lachmann. Theory and practice of industrial practice , Lea and febiger publisher, University of Michigan.
4. Register of General Pharmacy by Cooper and Gunn.
5. General Pharmacy by M.L.Schroff.
6. Indian Pharmacoepia
7. British Pharmacoepia
8. United states Pharmacoepia

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(%)	Internal Assessment #3 (%)
L1	35%	25%	-
L2	40%	20%	-
L3	-	35%	25%
L4	25%	15%	35%
L5	-	5%	25%
L6	-	-	15%
Total (%)	100%	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Write a note on history of pharmacy.
2. Write a note on Indian Pharmacopoeia.
3. Define dosage form. Give a detailed classification of dosage forms.
4. Define and classify powders. Add a note on bulk and divided powders. .
5. Define and classify emulsions. What are the advantages and disadvantages of emulsions?
6. Write a note on powders for internal usage.
7. Write a note on vehicles for liquid dosage forms.
8. Explain different methods of extraction.

L2: Understand

1. What is the need to develop dosage form? Classify dosage form with suitable e.g.
2. Explain in detail handling of prescription.
3. Write a note on errors in prescription.
4. Define posology. Explain any 4 factors affecting the dose of the drug (posology).
5. Describe therapeutic incompatibility with an example.
6. Differentiate between prescription and medication order.
7. Explain the role of a pharmacist in patient counseling.
8. Describe the significance of Latin terms in prescription writing.

L3: Apply

1. Interpret a prescription and calculate the correct dosage for a child using Young's Rule.
2. Prepare a mixture prescription using appropriate ingredients and techniques.
3. Apply knowledge of incompatibility types to suggest an alternative formulation.
4. Demonstrate the process of dispensing a powder or lotion.
5. Use a case to identify and resolve a dispensing error.
6. Calculate the grams of NaCl required to prepare 250 mL of 0.9% w/v solution.
7. Using alligation method, find the volumes of 95% alcohol and water required to prepare 300 mL of 70% alcohol.
8. 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.
9. Apply solubility enhancement techniques to improve drug dissolution.
10. Calculate displacement value for suppository formulation.
11. Prepare an ointment base formulation for topical application.
12. Identify and resolve physical incompatibility in a parenteral mixture.
13. 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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R25PP103 **MEDICINAL BIOCHEMISTRY** **3 1 0 4**

Course Objectives:

- To understand the catalytic activity of enzymes and importance of isoenzymes in diagnosis of diseases;
- To know the metabolic process of biomolecules in health and illness (metabolic disorders);
- To understand the genetic organization of mammalian genome; protein synthesis; replication; mutation and repair mechanism
- To know the biochemical principles of organ function tests of kidney, liver and endocrine gland; and
- To do the qualitative analysis and determination of biomolecules in the body fluids.

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	PO2	PO3	PO4	PO5	PO11	PSO1	PSO2	
R25PPC03.1	Remember the Cell and its biochemical organization, and malfunction transport process, Energy rich compounds, and classification of enzymes and know the importance of Isoenzymes and Coenzymes their therapeutic and diagnostic applications.	3	2	-	1	2	2	3	-	L 1, L2
R25PPC03.2	Know the metabolism of carbohydrates. Metabolic disorders of carbohydrate metabolism Galactose tolerance test and their significance; hormonal regulation of carbohydrate metabolism. Understand the process of metabolism of lipids and Defective metabolism of lipids.	3	3	3	1	2	2	3	1	L1, L2, L3
R25PPC03.3	Acquire knowledge on Protein and amino acid metabolism,and Nucleic acid metabolism & disorders associated with it.	3	2	2	1	3	2	3	1	L 2, L3
R25PPC03.4	Understand the Role of the clinical chemistry in laboratory and aquire knowledge on kidney function tests and Liver function tests.	3	2	2	2	3	2	3	-	L2, L3
R25PPC03.5	Understand of Lipid profile tests: Lipoproteins, composition, functions. Elaborate knowledge on immunochemical techniques.	3	3	2	3	3	2	3	-	L1, L2,L3

SYLLABUS

UNIT I: **18 Hours**

Introduction to biochemistry: Cell and its biochemical organization, malfunction, transport process across the cell membranes. Energy rich compounds; ATP, Cyclic AMP and their biological significance.

Enzymes: Definition; Nomenclature; IUB classification; Factor affecting enzyme activity; Enzyme action; enzyme inhibition. Isoenzymes and their therapeutic and diagnostic applications; Coenzymes and their biochemical role and deficiency diseases.

Biological oxidation: Coenzyme system involved in Biological oxidation. Electron transport chain (its mechanism in energy capture; regulation and inhibition); Uncouplers of ETC; Oxidative phosphorylation;

CO's–CO1

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

Unit II: **18 Hours**

Carbohydrate metabolism: Glycolysis, Citric acid cycle (TCA cycle), HMP shunt, Glycogenolysis, gluconeogenesis, glycogenesis. Metabolic disorders of carbohydrate metabolism (diabetes mellitus and glycogen storage diseases); Glucose, Galactose tolerance test and their significance; hormonal regulation of carbohydrate metabolism.

Lipid metabolism: Oxidation of saturated (b-oxidation); Ketogenesis and ketolysis; biosynthesis of fatty acids, lipids; metabolism of cholesterol; Hormonal regulation of lipid metabolism. Defective metabolism of lipids (Atheroslerosis, fatty liver, hypercholesterolmiea).

CO's–CO2

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

Unit III: **18 Hours**

Protein and amino acid metabolism: protein turn over; nitrogen balance; Catabolism of Amino acids (Transamination, deamination & decarboxylation). Urea cycle and its metabolic disorders; production of bile pigments; hyperbilirubinemia, porphoria, jaundice. Metabolic disorder of Amino acids.

Nucleic acid metabolism: Metabolism of purine and pyrimidine nucleotides; Protein synthesis; Genetic code; inhibition of protein synthesis; mutation and repair mechanism; DNA replication (semiconservative /onion peel models) and DNA repair mechanism

CO's–CO3

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

Unit IV:

Role of the clinical chemistry laboratory. **18 Hours**

The kidney function tests: Role of kidney; Laboratory tests for normal function includesa) Urine analysis (macroscopic and physical examination, quantitative and semiquantitative tests.) Test for NPN constituents. (Creatinine /urea clearance, determination of blood and urine creatinine, urea and uric acid) , Urine concentration test ,Urinary tract calculi. (stones)

Liver function tests: Physiological role of liver, metabolic, storage, excretory, protective, circulatory functions and function in blood coagulation. Test for hepatic dysfunction-Bile pigments metabolism. Test for hepatic function test- Serum bilirubin, urine bilirubin, and urine urobilinogen. Dye tests of excretory function. Tests based upon abnormalities of serum proteins. Selected enzyme tests.

CO's–CO4

Self learning Topics: Significance and diagnosis of kidney and liver function tests.

Unit V: **18 Hours**

Lipid profile tests: Lipoproteins, composition, functions. Determination of serum lipids, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.

Immunochemical techniques: for determination of hormone levels and protein levels in serum for endocrine diseases and infectious diseases: Radio immuno assay (RIA) and Enzyme Linked Immuno Sorbent Assay (ELISA).

Electrolytes: Body water, compartments, water balance, and electrolyte distrubution. Determination of sodium, calcium potassium, chlorides, bicarbonates in the body fluids.

CO's–CO5

Self learning Topics: Significance and diagnosis of Lipid profile tests.

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

Text Books:

a. Harpers review of biochemistry - Martin
b. Text book of biochemistry – D.Satyanarayana
c. Text book of clinical chemistry- Alex kaplan &Laverve L.Szabo

Reference Books:

a. Principles of biochemistry – Lehninge
b. Text book of biochemistry -- Ramarao
c. Practical Biochemistry-David T.Plummer.
d. Practical Biochemistry-Pattabhiraman.

Web References:

1. http://www.Pharmadost.in/
2. https://pharmdguru.com/category/medicinal-biochemistry/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)	Internal Assessment #3(%)
L1	25%	-	-
L2	30%	-	-
L3	25%	25%	-
L4	20%	40%	25%
L5	-	35%	40%
L6	-	-	35%
Total (%)	100%	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Write a note on cell composition and malfunction .
2. Explain energy rich compounds and their signifcance.
3. Write a note on electron transport chain .
4. Write a note on uncopulers of ETC.
5. Define enzyme. Give a detailed classification of enzymes.
6. Explain factors effecting enzyme activity.
7. Explain Metabolic disorders of carbohydrate metabolism.
8. Explain Glucose, Galactose tolerance test and their significance.

L2: Understand

1. Explain biosynthesis of fatty acids.
2. Explain in detail Hormonal regulation of lipid metabolism.
3. Write a note on Ketogenesis and ketolysis.
4. Write a note on protein turn over & nitrogen balance.
5. Write a note on Catabolism of Amino acids.
6. Write a note on Urea cycle and its metabolic disorders.
7. Write a note on porphoria,& jaundice.
8. Write a note on Metabolism of purine and pyrimidine nucleotides.
9. Write a note on Genetic code.
10. Write a note on inhibition of protein synthesis. .
11. Write a note on mutation and repair mechanism.
12. Write a note on DNA replication.
13. Explain in detail about physical examination, quantitative and semiquantitative tests in Urine analysis.
14. Write in detail about determination of blood and urine creatinine.

L3: Apply

1. Write a note on Physiological role, metabolic, storage of liver.
2. Write a note on stability of suspensions.
3. Write a note on Bile pigments metabolism.
4. Write a note on hepatic function tests- Serum bilirubin, urine bilirubin, and urine urobilinogen.
5. Write a note on Dye tests of excretory function.
6. Explain Tests based upon abnormalities of serum proteins
7. Explain Selected enzyme tests.
8. Explain Lipoproteins composition and functions.
9. Explain principle and procedure and applications of Radio immuno assay (RIA)
10. Explain principle and procedure and applications of of Enzyme Linked Immuno Sorbent Assay (ELISA)

L4: Analysing

1. Explain Determination of total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides.
2. Explain Determination of sodium, calcium potassium, in the body fluids
3. Explain Determination chlorides, bicarbonates in the body fluids.

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R25PP104 PHARMACEUTICAL ORGANIC CHEMISTRY 3 1 0 4

Course Objectives:

1. To learn and apply the rules of IUPAC and common systems of nomenclature for simple organic compounds belonging to different classes.
2. To explain the important physical properties of organic compounds and relate them to structure and bonding.
3. To Understand and interpret various types of organic reactions including substitution, addition, elimination, oxidation, and reduction. To illustrate reaction mechanisms, orientation, reactivity order, and stability of intermediates and compounds.
4. To describe important named organic reactions with detailed mechanisms and their synthetic applications.
5. To learn methods of preparation, tests for purity, assay principles, and medicinal uses of selected important organic compounds.
6. To apply theoretical knowledge to solve problems in organic synthesis, drug design, and analysis of organic compounds.

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	
R25PPCO104.1	Capable to give nomenclature and identify isomerism of organic compounds.	2	2	-	2	1	-	2	L1, L2
R25PPCO104.2	Understand the mechanism, reactivity of free radicals chain reactions, nucleophilic aliphatic substitution reaction.	2	3	-	1	-	2	2	L2, L3
R25PPCO104.3	Study the kinetics, mechanism, stereochemistry of free radicals, electrophiles, dehydrogenation of alkyl halides reactions.	2	2	3	1	-	2	2	L2, L3
R25PPCO104.4	Capable to learn concepts of resonance, hyperconjugation and various effects on reactions.	2	2	3	1	-	2	2	L3, L4
R25PPCO104.5	Understand mechanisms of Named reactions eg: aldol condensation, Hoffmann rearrangement oxidation, reduction reactions. Identify the tests for purity, medical uses of some pharmaceutical products.	2	2	3	1	-	2	2	L5, L6

SYLLABUS

UNIT I: **15 Hours**

Introduction:

Structures and Physical properties:

a. Polarity of bonds, polarity of molecules, M.P, Inter molecular forces, B.P, Solubility, non ionic solutes and ionic solutes, protic and aprotic Solvents, ion pairs,

b. Acids and bases, Lowry bronsted and Lewis theories,

c. Isomerism

Nomenclature of organic compounds belonging to the following classes Alkanes, Alkenes, Dienes, Alkynes, Alcohols, Aldehydes, Ketones, Amides, Amines, Phenols, Alkyl Halides, Carboxylic Acid, Esters, Acid Chlorides And Cycloalkanes.

Free radicals chain reactions of alkane : Mechanism, relative reactivity and stability

CO's–CO1

Self Learning Topics: Relationship between bond polarity and molecular polarity with examples. Geometrical isomerism in alkenes and cycloalkanes. Stability of free radicals

UNIT II: **15 Hours**

Alicyclic compounds : Preparations of cyclo alkanes, Bayer strain theory and orbital picture of angle strain.

Nuclophilic aliphatic substitution mechanism: Nucleophiles and leaving groups, kinetics of second and first order reaction, mechanism and kinetics of SN2 reactions. Stereochemistry and steric hindrance, role of solvents, phase transfer catalysis, mechanism and kinetics of SN1 reactions, stereochemistry, carbocation and their stability, rearrangement of carbocation, role of solvents in SN1 reaction, Ion dipole bonds, SN2 versus SN1 solvolyses, nucleophilic assistance by the solvents.

Dehydro halogenation of alkyl halides: 1,2 elimination, kinetics, E2 and E1 mechanism, elimination via carbocation, evidence for E2 mechanism, absence of rearrangement isotope effect, absence hydrogen exchange, the element effect, orientation and reactivity, E2 versus E1, elimination versus substitution, dehydration of alcohol, ease of dehydration, acid catalysis, reversibility, orientation.

Electrophillic and free radicals addition: Reactions at carbon-carbon, double bond, electrophile, hydrogenation, heat of hydrogenation and stability of alkenes, markownikoff rule, addition of hydrogen halides, addition of hydrogen bromides, peroxide effect, electrophillic addition, mechanism, rearrangement, absence of hydrogen exchange, orientation and reactivity, addition of halogen, mechanism, halohydin formation, mechanism of free radicals additon, mechanism of peroxide initiated addition of hydrogen bromide, orientation of free addition, additions of carbene to alkene, cyclo addition reactions.

CO's–CO2

Self Learning Topics: Baeyer strain theory: limitations and modern concepts. Stereochemistry of SN2, Carbocation stability and rearrangements in SN1. E1 vs E2 comparison (orientation, reactivity, rearrangement). Free radical addition: peroxide-initiated addition of HBr.

UNIT III: **15 Hours**

Carbon-carbon double bond as substituents: Free radical halogenations of alkenes, comparision of free radical substitution with free radical addition, free radical substitution in alkenes, orientation and reactivity, allylic rearrangements.

Theory of resonance: Allyl radical as a resonance hybrid, stability, orbital picture, resonance stabilisation of allyl radicals, hyper conjugation, allyl cation as a resonance hybrid, nucleophyllic

substitution in allylic substrate, SN1 reactivity, allylic rearrangement, resonance stabilisation of allyl cation, hyper conjugation, nucleophilic substitution in allylic substrate, SN2 nucleophilic substituion in vinylic substrate, vinylic cation, stability of conjugated dienes, resonance in alkenes, hyper conjugation, ease of formation of conjugated dienes, orientation of elimination, electrophilic addition to conjugated dienes, 1,4- addition, 1,2-versus 1,4-addition, rate versus equilibrium, orientation and reactivity of free radical addition to conjugated dienes.

Elecrophilic aromatic substitution: Effect of substituent groups, determination of orientation, determination of relative reactivity, classification of substituent group, mechanism of nitration, sulphonation, halogenation, friedel craft alkylation, friedel craft acylation, reactivity and orientation, activating and deactivating O,P,M directing groups, electron release via resonance, effect of halogen on electrophilic aromatic substitution in alkyl benzene, side chain halogination of alkyl benzene, resonance stabilization of benzyl radical.

CO's–CO3

Self Learning Topics: Free radical halogenation of alkenes, Allylic rearrangements and product prediction. Hyperconjugation, Resonance in conjugated dienes and orbital picture, Effect of substituents on reactivity and orientation.

UNIT IV: **15 Hours**

Nucleophilic addition reaction: Mechanism, ionisation of carboxylic acids, acidity constants, acidity of acids, structure of carboxylate ions, effect of substituent on acidity, nucleophilic acyl substitution reaction, conversion of acid to acid chloride, esters, amide and anhydride. Role of caboxyl group, comparison of alkyl nucleophilic substitution with acyl nucleophilic substitution.

Mechanism of aldol condensation, claisen condensation, cannizzaro reaction, crossed aldol condensation, crossed cannizzaro reaction, benzoin condensation, perkin condensation. Knoevenagel, Reformatsky reaction, Wittig reaction, Michael addition.

Hoffman rearrangement: Migration to electron deficient nitrogen, Sandmeyer's reaction, basicity of amines, diazotisation and coupling, acidity of phenols, Williamson synthesis, Fries rearrangement, Kolbe reaction, Reimer tieman's reactions.

CO's–CO4

Self Learning Topics: Nucleophilic acyl substitution mechanism, Carbonyl Condensation Reactions, **Diazotization & coupling reactions,** Phenols & Aromatic Substitutions

UNIT V: **15 Hours**

Nucleophilic aromatic substitution: Bimolecular displacement mechanisms, orientation, comparison of aliphatic nucleophilic substitution with that of aromatic.

Oxidation reduction reaction.

Study of the following official compounds- preparation, test for purity, assay and medicinal uses of Chlorbutol, Dimercaprol, Glyceryl trinitrate, Urea, Ethylene diamine dihyrate, Vanillin, Paraldehyde, Ethylene chloride, Lactic acid, Tartaric acid, citric acid, salicylic acid, aspirin, methyl salicylate, ethyl benzoate, benzyl benzoate, dimethyl pthalate, sodium lauryl sulphate, saccharin sodium, mephensin.

CO's–CO5

Self Learning Topics: Nucleophilic Aromatic Substitution, Oxidation–Reduction Reactions,

Official Compounds (Pharmaceutical Importance).

Board of Studies: Pharmacy

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

Approved in ACM No: 01

Text Books:

- T.R.Morrison and R. Boyd - Organic chemistry
- Bentley and Driver-Text book of Pharmaceutical Chemistry
- I.L.Finer- Organic chemistry, the fundamentals of Chemistry

Reference Books:

a. Organic chemistry – J.M.Cram and D.J.Cram

b. Organic chemistry- Brown

c. Advanced organic chemistry- Jerry March, Wiley

d. Organic chemistry- Cram and Hammered, Pine Hendrickson

Web References:

1. Pharmaceutical Organic Chemistry - PHARMD GURU
2. Organic Chemistry Notes - Chemistry Notes
3. https://www.pharmaguidcline.com/2022/02/
4. https://onlinecourses.nptel.ac.in/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)	Internal Assessment #3(%)
L1	35%	--	--
L2	40%	--	--
L3	25%	25%	25%
L4	--	35%	35%
L5	--	25%	25%
L6		15%	15%
Total (%)	100%	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1: Remember

1. Define Isomerism and explain the structural Isomerism with suitable examples.
2. Explain Classification of organic compounds with examples.
3. Explain the Nomenclature of Ester & Amines.
4. State Saytzeff's rule

5. Write a note on Orbital picture of Angle strain.
6. Write a note on Sasche mohr theory.
7. Write a short note on Peroxide effect.
8. Write a short note on Markonikoff rule
9. Write a note on heat of hydrogenation and stability of alkenes.
10. Write a note on carbon – Carbon double bond as Substituents
11. Write a short notes on Allylic rearrangement
12. Write a note on orientation and reactivity of free radical substitution of alkenes
13. Give an example of Free radical halogenation of alkenes with respect to carbon- carbon double bond acting as substituent
14. Write a note on Diles alder reaction
15. Write a note on resonance in benzyl radical.
16. Write a note on Perkin reaction
17. Write a note on Benzoin Condensation.
18. Write a note on Knoevenagel reaction.
19. Write the reaction and mechanism of Reformatsky reaction.
20. Write a note on Wittig Reaction.
21. Write a note on Kolbe reaction
22. Write a note on William's son synthesis.

L2: Understand

1. Explain Lewis Acid-Base concepts with examples.
2. Explain Bronsted-Lowry Acid- Base Concept with examples.
3. Explain Intermolecular Forces.
4. Explain Physical factors which effect organic reactions.
5. Explain Bayer's Strain theory and its limitations.
6. Explain SN1 Kinetics, order of reactivity of alkyl Halides.
7. Explain SN2 Kinetics, Stereochemistry, order of reactivity of Alkyl Halides.
8. Explain factors affecting SN1 & SN2 reactions.
9. Differentiate SN1 & SN2
10. Differentiate E1& E2
11. Explain the mechanism of dehydration of alcohol
12. Explain Halohydrin formation.
13. Explain Cycloaddition reactions
14. Explain hybridization & stability of dienes
15. Explain the mechanism of electrophilic addition to conjugated dienes.

L3: Apply

1. Explain the reaction and mechanism of Aldol Condensation reaction and crossed Aldol condensation reaction.
2. Explain the reaction and mechanism of Michael Addition reaction.
3. Explain the reaction and mechanism of Hoffmann rearrangement
4. Explain the reaction and mechanism of Fries rearrangement
5. Explain the reaction and mechanism of Cannizzaro reaction and crossed Cannizzaro reaction.
6. Explain the reaction and mechanism of Birch reduction reaction.
7. Discuss the reaction and mechanism of Metal Hydride reaction.
8. Explain the reaction and mechanism of Nucleophilic Aromatic Substitution reaction.
9. Compare Aliphatic Nucleophilic Substitution and Aromatic nucleophilic Substitution reaction.
10. Explain the acidity of carboxylic acids and effect of substituents on acidity of aliphatic and aromatic acids.
11. Explain the Basicity of Amines and effect of substituents on basicity of Aliphatic and Aromatic Amines.
12. Explain the acidity of phenols and effect of substituents on acidity of Phenols.
13. Write the preparation and medicinal uses of Sodium lauryl sulphate and Methyl salicylate.

L4: Analyze

1. Compare the mechanism of free radical substitution with free radical addition.
2. Explain the factors affecting E1 & E2 reactions.
3. Explain the limitations of Bayer's Strain theory.
4. Analyze the differences between SN1 and SN2 reactions.
5. Analyze the differences between E1 and E2 reactions.
6. Explain the theory of resonance and describe in detail resonance hybrid, stability, orbital picture of Allyl radical.
7. Explain the mechanism of Acid Catalysis in Dehydration of alcohol.
8. Explain the mechanism of Oppenauer oxidation reaction.
9. Explain the mechanism of Wolf-Kishner reduction reaction.
10. Analyze the differences between Aliphatic and Aromatic nucleophilic substitution reactions.

L5: Evaluate

1. Evaluate the importance of Lewis Acid-Base concepts in organic chemistry.
2. Evaluate the significance of Bronsted-Lowry Acid-Base Concept in organic reactions.
3. Evaluate the role of Intermolecular Forces in organic reactions.
4. Evaluate the impact of Physical factors on organic reactions.

5. Evaluate the limitations of current theories and models in organic chemistry.

L6: Creating

1. Design models of orbital strain theory.

M. pavani

Chairperson
Board of Studies

Chairperson
Board of Studies (AIPS)
Avanthi Institute of Pharmaceutical Sciences (A)
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R25PP105 **PHARMCEUTICAL INORGANIC CHEMISTRY** **3 1 0 4**

Course Objectives:

1. To understand the basic concepts of inorganic chemistry.
2. To study the medicinal and pharmaceutical importance of inorganic compounds.
3. To familiarize students with official standards and tests for purity.
4. To develop practical knowledge of the qualitative and quantitative analysis of inorganic substances used in pharmaceutical formulations.
5. To understand the physiological roles, therapeutic applications of inorganic compounds used 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	PO2	PO3	PO4	PO5	PO11	PSO1	PSO2	
R25CO105.1	Identify impurities of compounds by limit tests. Understand the physiochemical concepts of analysis and gain knowledge of sources of errors and minimizing techniques.	3	2	-	1	2	2	3	-	L1, L2
R25CO105.2	Employ volumetric titrations in quality control of pharmaceuticals. Analyze the techniques of acid- base titrations and non-aqueous titrations.	3	3	3	1	2	2	3	1	L2, L3
R25CO105.3	Analyze the techniques of gravimetry in quality control of pharmaceuticals	3	2	2	1	3	2	3	1	L 3, L4
R25CO105.4	Classify the gastrointestinal agents and described the methods of preparation, properties, storage, assay and uses with marketed formulations of inorganic compounds in gastrointestinal agents. Analyze the importance of Cathartics and anti-microbials in treatment of gastric diseases or disorders.	3	2	2	2	3	2	3	-	L2, L5
R25CO105.5	Classify the miscellaneous Compounds and know the Monographs of inorganic compounds in each category. Appreciate the importance of inorganic compounds in preventing Diseases. Understand the radioactivity and study of different radioisotopes	3	3	2	3	3	2	3	-	L1, L6

SYLLABUS

UNIT I: **15 Hours**

Introduction:

Pharmceutical Inorganic Chemistry & Pharmaceutical analysis- Definition and scope

i) Different techniques of analysis ii) Methods of expressing concentration iii) Primary and secondary standards.

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

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

(c)Limit tests: Sources of impurities in medicinal agents,limit tests.Impurities in pharmaceutical substances: Sources and types of impurities, principle involved in the limit test for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, modified limit test for Chloride and Sulphates

CO's–CO1

Self Learning Topics: Pharmacopeial standards and principles behind impurity testing, statistical tools for evaluating accuracy and precision

UNIT II: **15 Hours**

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

Non aqueous titrations: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HCl

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

Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate. **CO's–CO2**

Self Learning Topics: Neutralization curves with examples of indicators and titration principles

UNIT III: **15 Hours**

Redox titrations:(a) Concepts of oxidation and reduction (b) Types of redox titrations (Principles and applications) Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodate

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

Major extra and intracellular electrolytes: Functions of major physiological ions, Electrolytes used in the replacement therapy: Sodium chloride*, Potassium chloride, Calcium gluconate* and Oral Rehydration Salt (ORS), Physiological acid base balance **CO's–CO3**

Self Learning Topics: Titration method and their real-world applications, Differentiate between iodimetry (direct) and iodometry (indirect).

UNIT IV: **15 Hours**

Gastrointestinal agents

Acidifiers: Ammonium chloride* and Dil. HCl

Antacids: Ideal properties of antacids, combinations of antacids, Sodium Bicarbonate*, Aluminum hydroxide gel, Magnesium hydroxide mixture

Cathartics: Magnesium sulphate, Sodium orthophosphate, Kaolin and Bentonite

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

Expectorants: Potassium iodide, Ammonium chloride*.
Emetics: Copper sulphate*, Sodium potassium tartarate **CO's–CO4**

Self Learning Topics: Mechanism of action of inorganic antimicrobials, differentiate expectorants and emetics

UNIT V: **15 Hours**

Miscellaneous compounds

Haematinics: Ferrous sulphate*, Ferrous gluconate

Poison and Antidote: Sodium thiosulphate*, Activated charcoal, Sodium nitrite333

Astringents: Zinc Sulphate,Potash Alum

Essential Trace Elements: Iron, Copper and zinc compounds

Medicinal Gases: O_2 , N_2, N_2O, CO_2

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

Pharmaceutical Aids: Ideal properties and classification with examples

Radiopharmaceuticals: Radio activity, Measurement of radioactivity, Properties of α, β, γ radiations, Half life, radio isotopes and study of radio isotopes - Sodium iodide I131, Storage conditions, precautions & pharmaceutical application of radioactive substances. **CO's–CO5**

Self Learning Topics: Applications of dental products, and miscellaneous compounds.

Board of Studies: Pharmacy

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

Approved in ACM No: 01

Text Books:

1. A text book Inorganic medicinal chemistry by Surendra N. Pandeya
2. A. H. Beckett and J. B. Stanlake's Practical Pharmaceutical chemistry Vol-I &Vol-II
3. Inorganic Pharmaceutical Chemistry III-Edition P.Gundu Rao
4. M.L Schroff, Inorganic Pharmaceutical Chemistry
5. Bentley and Driver's Textbook of Pharmaceutical Chemistry
6. Anand & Chatwal, Inorganic Pharmaceutical Chemistry

Reference books

1. Inorganic Pharmaceutical Chemistry by Anand & Chetwal
2. Pharmaceutical Inorganic chemistry by Dr.B.G.Nagavi
3. Analytical chemistry principles by John H. Kennedy
4. I.P.1985 and 1996, Govt. of India, Ministry of health
5. Indian Pharmacopoeia
6. United State Pharmacopoeia

Web References:

1. Pharmacy Times — https://www.pharmacytimes.com/
2. NPTEL - Pharmaceutical Chemistry Courses — https://nptel.ac.in/
3. Indian Pharmacopoeia Commission — https://ipc.gov.in/
4. British Pharmacopoeia — https://www.pharmacopoeia.com/
5. United States Pharmacopeia (USP) — https://www.usp.org/
6. Science Direct articles on inorganic pharmaceutical compounds - *https://www.sciencedirect.com/*

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1(%)	Internal Assessment #2(%)	Internal Assessment #3(%)
L1	20%	20%	20%
L2	25%	25%	25%
L3	20%	20%	20%
L4	15%	15%	15%
L5	10%	10%	10%
L6	10%	10%	10%
Total (%)	100%	100%	100%

Sample Short and Long Answers questions of Various Cognitive Levels

L1. Remember

1. Define pharmaceutical inorganic chemistry.
2. List three examples of primary standards used in volumetric analysis.
3. State two types of errors commonly encountered in pharmaceutical analysis.
4. What is pharmaceutical analysis?
5. Name two types of errors in analytical chemistry.
6. List any four acid-base indicators.
7. What are primary and secondary standards?
8. Mention two non-aqueous solvents used in titrations.
9. Write the formula of potassium permanganate and its role in titration.
10. Name any two methods of expressing concentration.
11. List the major physiological electrolytes in the body.
12. Name four radiopharmaceuticals used in therapy.
13. Give examples of systemic and non-systemic antacids.
14. What are the ideal properties of pharmaceutical aids?
15. List any three antimicrobial inorganic compounds.

L2. Understand

1. Explain the significance of impurities in pharmaceutical substances.
2. Describe the theory of acid-base indicators with examples.
3. Discuss the modified limit test for chloride.
4. Explain the role of masking and demasking agents in complexometric titrations.
5. Describe the mechanism of action of hydrogen peroxide as an antimicrobial.
6. Discuss the role of fluoride in dental preparations.
7. Differentiate between accuracy and precision.
8. Explain the principle behind iodometry.
9. Describe the function of potassium chloride in the human body.
10. Summarize the ideal properties of astringents.
11. Describe the properties of α, β, and γ radiation.
12. Explain the physiological acid-base balance.
13. Describe the classification of acid-base titrations.

L3. Apply

1. Calculate the normality of a sulfuric acid solution from a given titration reading.
2. Perform standardization of sodium thiosulfate using potassium dichromate.
3. Prepare and standardize 0.1 N HCl.
4. Apply Mohr's method to estimate the amount of sodium chloride in a sample.
5. Identify the errors in gravimetric estimation of barium sulphate.
6. Use a complex metric titration to estimate calcium gluconate.
7. Prepare ORS formulation based on WHO guidelines.
8. Perform a limit test for iron in a pharmaceutical sample.
9. Use potassium permanganate to oxidize oxalic acid in a redox titration.
10. Prepare a dentifrice formulation with calcium carbonate.
11. Apply non-aqueous titration principles to estimate ephedrine HCl.
12. Estimate ferrous sulphate content in a sample using redox titration.
13. Demonstrate the estimation of sodium benzoate by titration.

L4. Analyzing

1. Compare primary and secondary standards in terms of properties and uses.
2. Distinguish between random and systematic errors in laboratory analysis.
3. Identify possible sources of impurities in pharmaceutical substances during manufacturing.
4. Compare acidimetry and alkalimetry in non-aqueous titrations.
5. Analyze the limitations of precipitation titrations.
6. Differentiate between masking and demasking agents with examples.
7. Compare cerimetry and dichrometry in terms of principles and applications.
8. Analyze the effect of co-precipitation on the purity of gravimetric results.
9. Differentiate between extracellular and intracellular electrolytes.
10. Compare the mechanism of action of expectorants and emetics.
11. Analyze the differences between chemical and physical cathartics.
12. Differentiate between oxygen and nitrous oxide in medicinal applications.
13. Analyze the importance of trace elements like copper and zinc in the human body.

L5. Evaluating

1. Assess the reliability of using secondary standards compared to primaty standards.
2. Evaluate the accuracy of analytical results if both precision and significant figures are ignored.
3. Critically evaluate the use of different indicators in weak acid–strong base titrations.
4. Justify why Volhard's method is preferred over Mohr's method in certain cases.
5. Judge the importance of iodometry in pharmaceutical assays.
6. Assess the advantages and disadvantages of magnesium hydroxide mixture as an antacid.
7. Critically evaluate the role of iodine in antimicrobial therapy.

L6. Creating

1. Design a protocol to perform limit tests for heavy metals in a new pharmaceutical batch.
2. Design a flowchart showing classification and uses of miscellaneous compounds.
3. Propose guidelines for safe storage of radiopharmaceuticals in a hospital setting.
4. Develop a formulation plan for a new dentifrice containing fluoride and desensitizing agents.

M. Pawani

Chairperson
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R25PP106 COMPUTATIONAL TOOLS IN PHARMACY PRACTICE 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	
R25CO106.1	Describe use of web technologies such as HTML, XML, CSS, Programming languages, Web servers and pharmacy drug database.	2	2	-	2	1	-	-	L 1, L2
R25CO106.2	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	-	1	-	2	-	L1, L3
R25CO106.3	Analyze computers as data analysis in preclinical development.	2	2	3	1	-	2	1	L2, L3
R25CO106.4	Illustrate the applications of AI/ML in pharmacy practice.	2	2	3	1	-	2	-	L3, L5
R25CO106.5	Illustrate bioinformatics and its impact in vaccine discovery and database, Cheminformatics and Pharmacogenomics.	2	3	3	1	-	2	-	L4, L6

SYLLABUS

UNIT I: **09 Hours**

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.

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–CO1

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

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

CO's–CO2

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

UNIT III: **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–CO3

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

UNIT IV: **09 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–CO4

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 V: **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–CO5

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

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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R25PP107 HUMAN ANATOMY & PHYSIOLOGY PRACTICAL 0 0 4 2

Course Objectives:

- To impart fundamental knowledge on the structure and functions of the human body.
- To understand both homeostasis mechanisms and homeostatic imbalances of various body systems.
- To correct the deviations in human body, since a medicament, which is produced by pharmacist.
- To understand how the drugs act on the various body systems in correcting the disease state of the organs.

Course Outcomes

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

Course Code	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	DOK
R25C0107.1	Recall handling of compound microscope and to outline the microscopic characteristics of various tissues.	3	2	1	2	1	L 1, L2
R25C0107.2	Summarize the characteristics of different bones (skeletal system) & types of joints. Estimate ESR, and their own blood group.	3	2	2	2	1	L1, L2
R25C0107.3	Determine various physical parameters such as heart rate, ECG, BP.	3	2	2	2	1	L 2, L3
R25C0107.4	Estimate the various haematological parameters such as WBC, RBC count, bleeding, clotting time Hb.	3	2	2	2	1	L3, L4
R25C0107.5	Apply knowledge of endocrine, respiratory, and feedback systems to analyze physiological functions using models, simulations, and practical measurements.	3	2	2	2	1	L5, L6
R25C0107.6	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	L5, L6

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COURSE CONTENTS

Experiment No	Name of the Experiment	Course Outcome
	Study of tissues of Human Body	
1	Epithelial tissue	CO1
2	Muscular tissue	Co1
3	Connective tissue	CO1
4	Nervous tissue	CO1
	Haematology	
5	Study of appliances used in haematological experiments	CO2
6	Determination of W.B.C. count of blood.	CO2
7	Determination of R.B.C. count of blood.	CO2
8	Determination of differential count of blood.	CO2
9	Determination of Erythrocyte Sedimentation Rate.	CO2
10	Determination of Haemoglobin content of Blood.	CO2
11	Determination of Bleeding time & Clotting time.	CO2
12	Determination of Blood Pressure.	CO3
13	Determination of Blood group.	CO3
	Study of various systems with the help of charts, models & specimens	
14	Skeleton system part I-axial skeleton.	CO3
15	Skeleton system part II- appendicular skeleton.	CO3
16	Cardiovascular system	CO3
17	Respiratory system	CO3
18	Digestive system.	CO4
19	Urinary system.	CO4
20	Nervous system.	CO4
21	Special senses.	CO4
22	Reproductive system.	CO4
	Experimental Physiology	
23	Study of different family planning appliances.	CO5
24	Perform pregnancy diagnosis test.	CO5
25	Study of appliances used in experimental physiology.	CO5
26	Record simple muscle curve using gastroenemius sciatic nerve preparation.	CO5

27	Record simple summation curve using gastroenemius sciatic nerve preparation.	CO6
28	Record simple effect of temperature using gastroenemius sciatic nerve preparation.	CO6
29	Record simple effect of load & after load using gastroenemius sciatic nerve preparation.	CO6
30	Record simple fatigue curve using gastroenemius sciatic nerve preparation.	CO6

Textbooks:

1. Goyal, R. K, Natvar M.P, and Shah S.A, Practical anatomy, physiology and biochemistry, latest edition, Publisher: B.S Shah Prakashan, Ahmedabad.

Reference Books:

- Ranade VG, Text book of practical physiology, Latest edition, Publisher: PVG, Pune
Anderson Experimental Physiology, Latest edition, Publisher: NA.

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R25PP108 **GENERAL DISPENSING PRACTICAL** **0 0 4 2**

Course Objectives:

1. 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).
2. To develop the ability to formulate, compound, and evaluate suspensions and linctuses.
3. To gain knowledge of powder and granule formulations including their types, methods of preparation, and applications in pharmacy practice.
4. To acquire skills to prepare and evaluate topical and mucosal preparations such as syrups, elixirs, suppositories, ointments, 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 prepare various solid dosage using different techniques and equipment's.	2	3	2	3	2	1	L1, L2
R25CO108.2	Able to formulate skills of preparing syrups and elixirs	2	3	2	3	2	1	L2, L3
R25CO108.3	Gain knowledge on preparation of Monophasic liquid dosage forms.	2	3	2	3	2	1	L3, L4
R25CO108.4	Gain knowledge on preparation of biphasic liquid dosage forms.	2	3	2	3	2	1	L5, L6
R25CO108.5	Understand the preparation of Semisolid dosage forms	2	3	2	3	2	1	L3, L4
R25CO108.6	Incorporate the strategies for adjusting the incompatibilities of dosage forms.	2	3	2	3	2	1	L5, L6

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COURSE CONTENTS

Experiment No	Name of the Experiment	Course Outcome
	Powders	
1	Preparation of Eutectic powders	CO1
2	Preparation of Explosive powders	CO1
3	Preparation of Dusting powders	CO1
4	Preparation of Insufflations	CO1
	Granules	
5	Preparation of Sodium hydrogen carbonate granules	CO1
	Syrups	
6	Preparation of Syrup IP'66	CO1
7	Preparation of Compound syrup of Ferrous Phosphate BPC'68	CO2
8	Preparation of Orange syrup	CO2
9	Preparation of	CO2
10	Preparation of Vasaka Syrup	CO2
	Elixirs	
11	Preparation of Paracetamol paediatric elixir	CO2
12	Preparation of Cascara Elixir	CO2
13	Preparation of Cascara Elixir	CO2
	Linctus	
14	Preparation of Simple linctus	CO2
15	Preparation of Paediatric simple linctus	CO2
	Solutions	
16	Preparation of Aqueous Iodine solution	CO3
17	Preparation of Strong Iodine solution	CO3
18	Preparation of Strong solution of ammonium acetate	CO3
19	Preparation of Cresol with soap solution	CO3
20	Preparation of Ferric chloride solution	CO3
	Lotions	

21	Preparation of Calamine lotion	CO3
	Liniments	
22	Preparation of Camphor Liniment	CO3
23	Preparation of Turpentine oil Liniment	CO3
	Mouth washes	
24	Preparation of Compound sodium chloride Mouthwash	CO3
	Gargles	
25	Preparation of Phenol Gargle	CO3
	Throat Paints	
26	Preparation of Iodine throat paint	CO3
	Suspensions	
27	Preparation of Magnesium Hydroxide Suspension	CO4
28	Preparation of Paracetamol Suspension	CO4
	Emulsions	
29	Preparation of Arachis oil emulsion	CO4
30	Preparation of Liquid paraffin emulsion	CO4
	Semisolids	
31	Preparation of Sulphur ointment	CO5
32	Preparation of non-staining-iodine ointment	CO5
33	Preparation of Carbopol gel	CO5
	Suppositories	
34	Preparation of Boric acid suppository	CO6
35	Preparation of Zinc Oxide suppository	CO6
	Incompatibilities	
36	Physical Incompatibilities	CO6
37	Chemical Incompatibilities	CO6
	Tinctures and extracts	
38	Preparation of orange tincture	CO6

Textbooks:

1. Das N. Practical Manual of Dispensing Pharmacy.
2. Chatterjee Ganguly S. Lab Manual of Pharmaceutics I.
3. Varma AK, Saxena J, Bairagee D. Practical Manual of Pharmaceutics – I.

Reference Books:

1. Mohanta GP, Manna PK. Pharmaceutics: A Practical Manual.
2. Sharma S. Pharmaceutics Laboratory Manual.

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R25PP109 **Medicinal Biochemistry Practical** **0 0 4 2**

Course Objectives:

1. To understand the principles, Qualitative analysis of normal constituents of urine,abnormal constituents of urine.
2. To develop the ability to estimateurine sugar by Benedict's reagent method, urine chlorides by Volhard's method, urine creatinine by Jaffe's method.
3. To gain knowledge on estimation of SGOT, SGPT, Urea, Protein, in serum.
4. To acquire skills to determine Serum bilirubin, Glucose by means of Glucoseoxidase and sodium, calcium and potassium in serum for diagnosis of disease condition.

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	PO10	PO11	PSO1	PSO2	
R25CO109.1	Able to perform qualitative analysis of constituents of urine.	-	3	3	3	2	1	1	L1, L2
R25CO109.2	Able to perform quantitative analysis of constituents of urine.	-	3	3	3	2	1	-	L1, L4
R25CO109.3	Able to perform quantitative analysis of constituents of blood	2	3	3	3	2	1	-	L3, L5
R25CO109.4	Gain knowledge on estimation serum enzymes	2	3	3	3	2	2	1	L1, L2
R25CO109.5	Able to determine variouslipid profile and selected enzymes tests.	2	3	3	3	2	2	1	L3, L5
R25CO109.6	Able to determine various lipid profile and selected enzymes tests.	2	3	3	3	2	2	1	L1, L4

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COURSE CONTENTS

Experiment No	Name of the Experiment	Course Outcome
1	Qualitative analysis of normal constituents of urine	CO1
2	Qualitative analysis of abnormal constituents of urine	CO1
3	Quantitative estimation of urine sugar by Benedict's reagent method	CO2
4	Quantitative estimation of urine chlorides by Volhard's method	CO2
5	Quantitative estimation of urine creatinine by Jaffe's method	CO2
6	Quantitative estimation of urine calcium by precipitation method.	CO2
7	Quantitative estimation of serum cholesterol by Liebermann Burchard's method	CO3
8	Preparation of Folin Wu filtrate from blood.	CO3
9	Quantitative estimation of blood creatinine.	CO3
10	Quantitative estimation of blood sugar Folin-Wu tube method	CO3
11	Estimation of SGOT in serum	CO4
12	Estimation of SGPT in serum	CO4
13	Estimation of Urea in Serum	CO4
14	Estimation of Proteins in Serum.	CO4
15	Determination of serum bilirubin	CO4
16	Determination of Glucose by means of Glucoseoxidase	CO5
17	Enzymatic hydrolysis of Glycogen/Starch by Amylases.	CO5
18	Study of factors affecting Enzyme activity. (pH & Temp.)	CO5
19	Preparation of standard buffer solutions and its pH measurements	CO6
20	Experiment on lipid profile tests	CO6
21	Determination of sodium, calcium and potassium in serum.	CO6

Textbooks:

1. Practical Biochemistry-David T.Plummer.
2. Practical Biochemistry-Pattabhiraman.

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R25PP110 PHARMCEUTICAL ORGANIC CHEMISTRY PRACTICAL 0 0 4 2

Course Objectives:

1. To understand and Apply Organic Synthesis Techniques.
2. To develop Skills in Qualitative Organic Analysis.
3. To foster Competence in Laboratory Safety and Good Practices.
4. To introduce Concepts of Stereochemistry Using Models.
5. To bridge Theory with Practical Applications and to Cultivate Problem-Solving and Analytical Thinking.

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	PO2	PO4	PO9	PO10	PO11	PSO1	PSO2	
R25CO110.1	Demonstrate basic laboratory Techniques (acetylation, benzoylation, bromination, condensation, diazotisation, nitration, oxidation, reduction, hydrolysis, etc.) for the synthesis of simple organic compounds.	3	2	2	2	2	2	2	2	L3, L4
R25CO110.2	Apply systematic qualitative organic analysis to identify unknown organic compounds belonging to different functional classes (phenols, amides, amines, acids, aldehydes, ketones, alcohols, esters, hydrocarbons, nitrocompounds, etc.).	3	3	2	2	2	3	2	2	L2, L3
R25CO110.3	Correlate reaction mechanisms and functional group transformations with practical experiments (e.g., acetylation, hydrolysis, condensation, rearrangements).	2	2	3	2	2	2	3	2	L4, L5
R25CO110.4	Develop skills in purification, recrystallisation, derivative preparation, and purity testing of organic compounds.	2	2	3	2	2	2	2	3	L4, L5
R25CO110.5	Interpret stereochemical aspects of organic molecules using stereo models (cis/trans isomerism, conformational	2	2	2	2	2	2	2	3	L3, L4

	inversion, bond representation).									
R25CO110.6	Record, analyze, and present experimental data following good laboratory practices, documentation, and safety norms.	2	3	3	3	2	2	2	2	L3, L5

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COURSE CONTENT

S.No	Name of the Experiment	Course Outcomes
	Synthesis of compounds	
1.	Acetanilde / aspirin (Acetylation)	CO1
2.	Benzanilide / Phenyl benzoate (Benzoylation)	CO1
3.	P-bromo acetanilide / 2,4,6 – tribromo aniline (Bromination)	CO1
4.	Dibenzylidene acetone (Condensation)	CO3
5.	1-Phenylazo-2-napthol (Diazotisation and coupling)	CO3
6.	Benzoic acid / salicylic acid (Hydrolysis of ester)	CO3
7.	M-dinitro benzene (Nitration)	CO3
8.	9, 10 – Antharaquinone (Oxidation of anthracene) / preparation of benzoic acid from toluene or benzaldehyde	CO3
9.	M-phenylene diamine (Reduction of M-dinitrobenzene) / Aniline from nitrobenzene	CO4
10.	Benzophenone oxime	CO4
11.	Nitration of salicylic acid	CO4
12.	Preparation of picric acid	CO6
13.	Preparation of O-chlorobenzoic acid from O-chlorotolune	CO6
14.	Preparation of cyclohexanone from cyclohexanol	CO6
	Systematic Qualitative Organic Analysis	
15.	Identification of functional groups (phenols, amides, carbohydrates, amines, acids, aldehydes, ketones, alcohols, esters, hydrocarbons, anilides, nitrocompounds)	CO2, CO4
	Stereo Models	
16.	Methane, Ethane, Ethylene, Acetylene, Cis alkene, Trans alkene, inversion of configuration.	CO5, CO6

Text books

a. T.R.Morrison and R. Boyd - Organic chemistry,
b. Bentley and Driver-Text book of Pharmaceutical chemistry
c. I.L.Finer- Organic chemistry, the fundamentals of chemistry

Reference books

a. Organic chemistry – J.M.Cram and D.J.Cram
b. Organic chemistry- Brown
c. Advanced organic chemistry- Jerry March, Wiley
d. Organic chemistry- Cram and Hammered, Pine Hendrickson

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R25PP111 **PHARMCEUTICAL INORGANIC CHEMISTRY 0 0 4 2**

Course Objectives:

1. To study the preparation and assessment of inorganic compounds.
2. To determine the assay of various inorganic compounds in pharmaceutical use.
3. 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 with POs and PSOs								DoK
		PO1	PO3	PO4	PO6	PO9	PO11	PSO1	PSO2	
R25CO111.1	Know the source of impurities and perform the limit tests for qualitative analysis of impurities for the given sample	2	2	-	2	1	-	-	1	L1, L2
R25CO111.2	Identify the test for purity of compounds	2	3	-	1	-	2	-	1	L1, L2, L3
R25CO111.3	Identify the test for purity of compounds by Precipitation and complexometry titrations.	2	2	3	1	-	2	1	1	L 2, L3
R25CO111.4	Identify the test for purity of compounds by garavimetry.	2	2	3	1	-	2	-	1	L2, L6
R25CO111.5	Estimate the qualitative analysis of unknown inorganic compounds mixture.	2	2	3	1	-	2	1	1	L4, L3
R25CO111.6	Perform the identification tests for the pharmaceutical compounds	2	2	3	1	-	2	-	1	L5, L6

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COURSE CONTENT

S.No	Name of the Experiment	Course Outcomes
	Limit tests	
1.	Limit test for chlorides	CO1
2.	Limit test for sulphates	CO1
3.	Limit test for iron	CO1
4.	Limit test for heavy metals	CO1
5.	Limit test for arsenic	CO1

6.	Modified limit tests for chlorides and sulphates	CO2
	Assays	
7.	Ammonium chloride- Acid-base titration	CO2
8.	Ferrous sulphate- Cerimetry	CO2
9.	Copper sulpahte- Iodometry	CO2
10.	Calcilugluconate- Complexometry	CO3
11.	Hydrogen peroxide – Permanganometry	CO3
12.	Sodium benzoate – Nonaqueous titration	CO3
13.	Sodium chloride – Modified volhard's method	CO3
14.	Assay of KI – KIO3 titration	CO4
15.	Gravimetric estimation of barium as barium sulphate	CO4
16.	Sodium antimony gluconate or antimony potassium tartarate	CO4
	Estimation of mixture	
17.	Sodium hydroxide and sodium carbonate	CO5
18.	Boric acid and Borax	CO5
19.	Oxalic acid and sodium oxalate	CO3
	Test for identity (Any three exercises)	
20.	Sodium bicorbonate	CO6
21.	Barium sulphate	CO6
22.	Ferrous sulphate	CO6
23.	Potassium chloride	CO6

Textbooks:

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

Reference Books:

1. Indian Pharmacopoeia
2. United States Pharmacopoeia

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R25PP112 COMPUTATIONAL TOOLS IN PHARMACY PRACTICE 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	
R25CO112.1	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
R25CO112.2	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
R25CO112.3	Create a database, Design a form, Generating report and printing the report in MS Access	2	2	3	1	-	1	1	L1, L5
R25CO112.4	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
R25CO112.5	Understand basic concepts of Artificial Intelligence, Machine Learning, and Deep Learning in healthcare and pharmacy.	2	2	-	2	1	-	-	L1, L2
R25CO112.6	Implement simple Python-based AI applications for drug discovery, formulation, or pharmacy practice.	2	3	-	1	-	1	-	L4, L5

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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 label in MS WORD	CO1
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
13.	Build a simple drug classification model (e.g., antibiotic vs. analgesic) using logistic regression/decision tree.	CO5
14.	Apply text mining to extract keywords (like drug names, diseases) from abstracts of pharmaceutical research papers.	CO5
15.	Develop a predictive model to estimate drug solubility or drug-likeness from molecular property datasets.	CO5
16.	Create a simple medicine reminder chatbot using Python basics.	CO6
17.	AI-based prediction of patient risk (e.g., diabetes dataset).	CO6
18.	Python-based prescription analysis system.	CO6

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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R25PP113 EFFECTIVE COMMUNICATION SKILLS PRACTICAL 0 0 2 0

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	
R25CO113.1	Demonstrate effective verbal and non-verbal communication in professional settings	-	-	3	1	2	1	2	L1, L2
R25CO113.2	Exhibit confidence in delivering structured oral presentations and public speaking.	1	1	3	-	2	1	2	L2, L4
R25CO113.3	Participate actively in group discussions and interviews using appropriate language.	-	-	3	-	2	1	2	L2, L3
R25CO113.4	Apply active listening, summarizing, and note-taking skills in academic contexts	-	-	3	-	2	1	2	L2, L6

Board of Studies: B Pharmacy

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

Approved in ACM No: 01

COURSE CONTENT

S.No	Name of the Experiment	CO's
01	Introduction to Communication – Types, Process, Barriers, and Importance of Feedback	CO1
02	Listening Skills – Audio-based practice and listening to TED talks	CO4
03	Speaking Skills – Self-introduction, JAM sessions	CO1
04	Group Discussions – Practice and Evaluation	CO3
05	Oral Presentations – Preparation and Delivery	CO2

06	Interview Skills – Mock interviews and role-plays	CO3
07	Non-verbal Communication – Gestures, Posture, Eye contact, and Body language	CO1
08	Note-taking from lectures and videos	CO4
09	Reading Aloud and Pronunciation Practice – Phonetics Lab sessions	CO1
10	Public Speaking – Speech preparation and delivery	CO2
11	Email, Letter, and Report Writing Exercises	CO2
12	Extempore and Debate Practice	CO3

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.

M. pavani

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