CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2025-26

Programme: **BACHELOR OF PHARMACY (B.PHARM.)**

Semester: **III**

Course Code: **108010301**

Course Title: **Pharmaceutical Organic Chemistry-II**

Course Objectives: Upon completion of the course the student shall be able to
1. Write the structure, name and the type of isomerism of the organic compound
2. Write the reaction, name the reaction and orientation of reactions
3. Account for reactivity/stability of compounds,
4. Prepare organic compounds

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/50

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:
General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained.
To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

Sr.	Contents	Hours
1	**Benzene and its derivatives:** • Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule. • Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel crafts alkylation- reactivity, limitations, Friedel crafts acylation. • Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction. • Structure and uses of DDT, Saccharin, BHC and Chloramine	10

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2	**Phenols*:** • Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthol	**06**
3	**Aromatic Amines*:** • Basicity of amines, effect of substituents on basicity, and synthetic uses of aryl diazonium salts **Aromatic Acids*:** • Acidity, effect of substituents on acidity and important reactions of benzoic acid.	**04**
4	**Fats and Oils:** • Fatty acids – reactions. • Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils. • Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.	**10**
5	**Polynuclear hydrocarbons:** • Synthesis, reactions • Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives.	**8**
6	**Cyclo alkanes*:** • Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory, Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only.	**7**

Reference Books:

1	Organic Chemistry by Morrison and Boyd
2	Organic Chemistry by I. L. Finar, Volume-I
3	Textbook of Organic Chemistry by B. S. Bahl & Arun Bahl.
4	Organic Chemistry by 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	Organic Chemistry by Mehta Bhupinder, Mehta Manju.

Pedagogy:

1. ICT tools (LCD projector, Laptop, Smart Board)
2. Traditional method (Black board)

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20	40	25	5	5	5	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Student Leaning Outcomes (SLOs):

SLOs	Student Learning Outcome Statements	% Weightage
SLO1	Analyze the structure, aromaticity, reactivity patterns and uses of benzene and its derivatives towards various electrophilic substitution reactions.	**30**
SLO2	Evaluate the effect of substituents on the acidity/basicity of phenols, aromatic amines, and aromatic acids.	**20**
SLO3	Examine the properties, analytical constants, and reactions of fats and oils, and interpret their significance in quality control evaluation.	**20**
SLO4	Illustrate the structure, synthesis, reactions, and medicinal applications of polynuclear hydrocarbons and their derivatives.	**20**
SLO5	Compare different theories explaining the stability of cycloalkanes and predict their reactivity patterns.	**10**

Curriculum Revision:	
Version:	1
Drafted on (Month-Year):	June 2020
Last Reviewed on (Month-Year):	March 2026
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FACULTY OF PHARMACEUTICAL SCIENCE

Effective from Academic Batch: 2025-26

Programme: **BACHELOR OF PHARMACY (B.PHARM.)**

Semester: **III**

Course Code: **108010302**

Course Title: **Physical Pharmaceutics-I**

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

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

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/50

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Solubility of solids:** Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, Dissolution & drug release, principles in biological systems.	06

2	**Solubility of gases and liquids:** Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions) Raoult's law, real solutions, azeotropic mixtures, fractional distillation. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and Applications	**04**
3	**Micromeretics:** Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.	**12**
4	**Surface and interfacial phenomenon:** Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilization, detergency, adsorption at solid interface.	**8**
5	**Complexation and protein binding:** Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants	**8**
6	**pH, buffers and Isotonic solutions:** Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.	**7**

Reference Books:

1	Physical pharmacy by Alfred Martin
2	Experimental pharmaceutics by Eugene, Parott.
3	Tutorial pharmacy by Cooper and Gunn.
4	Stocklosam J. Pharmaceutical calculations, Lea &Febiger, Philadelphia.
5	Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6	Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7	Physical pharmaceutics by Ramasamy C and ManavalanR.
8	Laboratory manual of physical pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9	Bentley's Textbook of Pharmaceutics – by E. A. Rawlins
10	Remington: The Science and Practice of Pharmacy

Pedagogy:
Black board, ICT Tools: Presentation, Peer teaching,
Case based learning, Group learning

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
30	30	25	10	5	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

Student Learning Outcomes (SLOs):

SLOs	Student Learning Outcome Statements	%weightage
SLO1	Explain and apply principles of solubility, dissolution, diffusion, and distribution law in pharmaceutical systems	**25**
SLO2	Gain knowledge about micromeritic properties such as particle size distribution, surface area, porosity, density, and flow characteristics and methods of determination of these properties	**25**
SLO3	Learn surface and interfacial phenomena including surface tension, adsorption, HLB scale, and solubilization in formulation development	**20**
SLO4	Describe complexation, protein binding, and stability constants, and evaluate their influence on drug action and formulation stability.	**15**
SLO5	Understand concepts of pH, buffer systems, buffer capacity, and isotonic solutions in the design of pharmaceutical preparations	**15**

Curriculum Revision:	
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Drafted on (Month-Year):	June 2021
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FACULTY OF PHARMACEUTICAL SCIENCE

Effective from Academic Batch: 2025-26

Programme: **BACHELOR OF PHARMACY (B.PHARM.)**

Semester: **III**

Course Code: **108010303**

Course Title: **Biochemistry**

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

1. Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
2. Understand the metabolism of nutrient molecules in physiological and pathological conditions.
3. Understand the genetic organization of mammalian genome and functions of DNA in the synthesis of RNAs and proteins

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/50

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**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.	8

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2	**Carbohydrate metabolism** Glycolysis – Pathway, energetics and significance Citric acid cycle- Pathway, energetics 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	**10**
3	**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). 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.	**07**
4	**Amino acid metabolism** General reactions of amino acid metabolism: Transamination, deamination & 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.	**07**
5	**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. Structure of DNA and RNA and their functions. DNA replication (semi conservative model). Transcription or RNA synthesis. Genetic code, Translation or Protein synthesis and inhibitors.	**06**
6	**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 applications of enzymes and isoenzymes Coenzymes –Structure and biochemical functions.	**07**

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Reference 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 Stryer.
4	Biochemistry by D. Satyanarayan and U. Chakrapani
5	Textbook of Biochemistry by Rama Rao.
6	Textbook of Biochemistry by Deb.
7	Outlines of Biochemistry by Conn and Stumpf
8	Practical Biochemistry by R.C. Gupta and S. Bhargavan.
9	Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
10	Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11	Practical Biochemistry by Harold Varley.
12	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2
13	https://youtu.be/NoLD2MVjpII
14	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2
15	https://youtu.be/phdPb0NFoho
16	

Pedagogy:
ICT tools (LCD projector, Laptop, Smart Board)
Traditional method (Black board)

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
35	30	10	10	10	05	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Student Learning Outcomes (SLOs):

SLOs	Student Learning Outcome Statements	%Weightage
SLO1	Explain the structure, classification, and biological significance of biomolecules, and analyze the bioenergetics principles governing biochemical reactions	**15**
SLO2	Evaluate carbohydrate metabolic pathways, their regulation, and implications in metabolic disorders, alongside understanding biological oxidation processes	**25**
SLO3	Analyze lipid and amino acid metabolism, including their disorders, and correlate biochemical processes with disease mechanisms	**30**
SLO4	Explain nucleic acid metabolism, genetic information transfer, and gene regulation, applying concepts to molecular biology applications.	**15**
SLO5	Examine enzyme kinetics, inhibition, and regulation, and justify their pharmaceutical and diagnostic applications.	**15**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2025-26

Programme: **Bachelor of Pharmacy**

Semester: **III**

Course Code: **108010304**

Course Title: **Pathophysiology**

Course Objectives: Upon completion of the course the student shall be able to
1. Understand the mechanisms of cellular injury, adaptation, inflammation, and wound healing, emphasizing their relevance to pathological conditions.
2. Demonstrate the ability to relate the signs, symptoms, complications and prognosis of diseases.
3. Develop a comprehensive framework for understanding the interplay between multiple organ systems in complex diseases.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/50

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Basic principles of Cell injury and Adaptation:** Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intracellular accumulation, Calcification, Enzyme leakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance	6
2	**Mechanism involved in the process of inflammation and repair:** Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis	4

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3	**Cardiovascular System:** Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis) **Respiratory system:** Asthma, Chronic obstructive airways diseases **Renal system:** Acute and chronic renal failure	**10**
4	**Haematological Diseases:** Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalasemia, hereditary acquired anemia, hemophilia **Endocrine system:** Diabetes, thyroid diseases, disorders of sex hormones **Nervous system:** Epilepsy, Parkinson's disease, stroke, psychiatric disorders: depression, schizophrenia and Alzheimer's disease.	**10**
5	**Gastrointestinal system:** Peptic Ulcer, Inflammatory bowel diseases, jaundice, hepatitis (A, B, C, D, E, F) alcoholic liver disease. **Disease of bones and joints:** Rheumatoid arthritis, osteoporosis and gout **Principles of cancer:** classification, etiology and pathogenesis of cancer	**8**
6	**Infectious diseases:** Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections **Sexually transmitted diseases:** AIDS, Syphilis, Gonorrhea	**7**

Reference Books:

1	Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2	Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3	Laurence B, Bruce C, Bjorn K.; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
4	Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states;
5	William and Wilkins, Baltimore;1991 [1990 printing].
6	Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7	Guyton A, John. E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
8	Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey;
9	Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
10	V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
11	Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.
12	Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy.

Pedagogy:

1. ICT tools (LCD projector, Laptop)
2. Traditional method (Black board)
3. Multimedia Presentations
4. Google Forms / Microsoft Forms

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5. Video Resources

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
40	45	15	0	0	0	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

SLOs	Course Outcome Statements	%weightage
SLO1	Understand the mechanisms of cellular injury, adaptation, inflammation, and wound healing, emphasizing their relevance to pathological conditions.	**24**
SLO2	Describe etiopathogenesis, clinical manifestations and complication of cardiovascular, respiratory and renal systems.	**22**
SLO3	Describe etiopathogenesis, clinical manifestations and complication of haematological diseases, endocrine and nervous system.	**22**
SLO4	Describe etiopathogenesis, clinical manifestations and complication of gastrointestinal system, disease of bones and joints and Principles of cancer.	**17**
SLO5	Describe risk factors, etiology and pathogenesis of infectious diseases and sexually transmitted diseases.	**15**

Curriculum Revision:	
Version:	1
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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2025-26

Programme: **Bachelor of Pharmacy**

Semester: **III**

Course Code: **108010305**

Course Title: **Pharmacognosy & Phytochemistry-I**

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

1. To understand the techniques in the cultivation and production of crude drugs
2. To describe the crude drugs, their uses and chemical nature
3. To explain the evaluation techniques for the herbal drugs
4. To analyze the microscopic and morphological evaluation of crude drugs

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	1	-	4	25/10	75/30	-	-	100/50

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction to Pharmacognosy:** Definition, history, scope and development of Pharmacognosy Sources of Drugs – Plants, Animals, Marine & Tissue culture Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins). **Classification of drugs:** Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs.	05
2	**Quality control of Drugs of Natural Origin:** Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties. Quantitative microscopy of crude drugs including lycopodium spore method, leaf constants, camera lucida and diagrams of microscopic objects to scale with camera lucida.	05

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3	**Cultivation, Collection, Processing and storage of drugs of natural origin:** Cultivation and Collection of drugs of natural origin. Factors influencing cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants. **Conservation of medicinal plants**	**10**
4	**Plant tissue culture:** Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance. Applications of plant tissue culture in pharmacognosy. Edible vaccines.	**7**
5	**Pharmacognosy in various systems of medicine:** Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine. **Introduction to secondary metabolites:** Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids, Tannins, Volatile oil and Resins.	**10**
6	Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs. **Plant Products:** Fibers - Cotton, Jute, Hemp Hallucinogens, Teratogens, Natural allergens **Primary metabolites:** General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic uses and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites: **Carbohydrates:** Acacia, Agar, Tragacanth, Honey **Proteins and Enzymes:** Gelatin, casein, proteolytic enzymes (Papain, bromelain, serratiopeptidase, urokinase, streptokinase, pepsin). **Lipids (Waxes, fats, fixed oils):** Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax. **Marine Drugs:** Novel medicinal agents from marine sources.	**8**

Reference Books:

1	W. C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2	Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3	Mohammad Ali. Pharmacognosy, CBS Publishers & Distributors, New Delhi 2008

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4	T.E. Wallis, Textbook of Pharmacognosy, 5th edition, CBS Publishers & Distributors, New Delhi, 2005
5	C.K. Kokate, Purohit, Gokhlae. Text book of Pharmacognosy, Gokhlae (2007), 37th Edition, Nirali Prakashan, Pune, 2007
6	R.D. Choudhary, Herbal Drug Industry Ist Edn, Eastern Publisher, New Delhi, 1996 7.
7	C.K. Kokate, Practical Pharmacognosy, 5th edition, Vallabh Prakashan, New Delhi, 2016
8	M.A. Iyengar, Anatomy of Crude Drugs, Manipal Press, Manipal, 2001.
9	Biren Shah & A. K. Seth, Textbook of Pharmacognosy & Phytochemistry, 2nd edition, Elsevier Publication, New Delhi, 2011
10	Khandelwal K. R. Practical Pharmacognosy, 9th edition, Nirali Prakashan, Pune, 2009 12.
11	Vyas S. P. and Dixit V. K., Pharmaceutical Biotechnology, 1st edition, CBS Publisher & Distributors, New Delhi, 2016.
12	WHO: Quality Control Methods for Medicinal Plant Materials, World Health Organisation, Geneva, 1988.
13	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=4
14	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=3
15	Agrawal S.S., Herbal Drug Technology, 2nd edition, Orient Blackswan, New Delhi, 2012.
16	SH.Ansari, Essentials of Pharmacognosy, IInd edition, Birla publications, New Delhi, 2007
17	Ashutosh Kar. Pharmacognosy and Phytochemistry-I, New Age International (P) Ltd., New Delhi, 1st Edition, 2020.
18	M. K. Razdan. Plant Tissue Culture: Theory and Practice, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 3rd Edition, 2016.

Pedagogy:

1. Using chalk and blackboard
2. ICT tools (Powerpoint and Smart board)

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20	30	20	15	10	05	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Student Learning Outcomes (SLO):

SLOs	Student Learning Outcome Statements	%Weightage
SLO1	Identify and classify the scope, development, and sources of drugs of natural origin, and differentiate organized and unorganized drugs using appropriate classification systems.	**10**

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SLO2	Identify and evaluate crude drugs of natural origin by applying organoleptic, microscopic, physical, chemical, biological, and quantitative microscopy methods for quality control and detection of adulteration.	**10**
SLO3	Apply principles of cultivation, collection, processing, storage, conservation, and plant improvement techniques to ensure quality and sustainability of medicinal plant resources.	**20**
SLO4	Apply the concept of plant tissue culture and its application in pharmacognosy	**20**
SLO5	Investigate the role of Pharmacognosy in various systems of medicine and apply concepts of primary and secondary metabolites, plant and marine natural products including their identification, chemistry, sources, therapeutic uses and pharmaceutical applications.	**40**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2025-26

Programme: **BACHELOR OF PHARMACY (B.PHARM.)**

Semester: **III**

Course Code: **108010311**

Course Title: **Pharmaceutical Organic Chemistry-II Practical**

Course Objectives: Upon completion of the course the student shall be able to
1. Write the structure, name and the type of isomerism of the organic compound
2. Write the reaction, name the reaction and orientation of reactions
3. Account for reactivity/stability of compounds,
4. Prepare organic compounds

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/50

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

1	**Experiments involving laboratory techniques** a. Recrystallization b. Steam distillation
2	**Determination of following oil values (including standardization of reagents)** a. Acid value b. Saponification value c. Iodine value
3	**Preparation of compounds** a. Benzanilide/Phenyl benzoate/Acetanilide from Aniline/ Phenol /Aniline by acylation reaction. b. 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/Acetanilide by halogenation (Bromination) reaction c. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction d. Benzoic acid from Benzyl chloride by oxidation reaction. e. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction. f. 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions. g. Benzil from Benzoin by oxidation reaction.

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	h. Dibenzal acetone from Benzaldehyde by Claison Schmidt reaction i. Cinnamic acid from Benzaldehyde by Perkin reaction j. P-Iodo benzoic acid from P-amino benzoic acid

Reference Books:

1	Organic Chemistry by Morrison and Boyd
2	Organic Chemistry by I.L. Finar, Volume-I
3	Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4	Organic Chemistry by 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	Practical Organic Chemistry by Hitesh G Raval, Sunil Baldania, and Dimal A Shah.

Student Leaning Outcomes (SLOs):

SLOs	Student Leaning Outcome Statements	%Weightage
SLO1	Synthesize pharmaceutical intermediates through various organic reactions.	**40**
SLO2	Perform recrystallization and steam distillation for purification of organic compounds. Evaluate the purity of various oils by acid value, saponification value, and iodine value.	**30**
SLO3	Explain and justify the concepts of Pharmaceutical Organic Chemistry -II through oral communication.	**20**
SLO4	Provide written responses to questions related to various aspects of the practicals performed.	**10**

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FACULTY OF PHARMACEUTICAL SCIENCE

Effective from Academic Batch: 2025-26

Programme: **BACHELOR OF PHARMACY (B.PHARM.)**

Semester: **III**

Course Code: **108010312**

Course Title: **Physical Pharmaceutics –I Practical**

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

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

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/50

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

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

11	Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex by pH titration method

Reference Books:

1	Physical pharmacy by Alfred Martin
2	Experimental pharmaceutics by Eugene, Parott.
3	Tutorial pharmacy by Cooper and Gunn.
4	Stocklosam J. Pharmaceutical calculations, Lea &Febiger, Philadelphia.
5	Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6	Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7	Physical pharmaceutics by Ramasamy C and Manavalan R.
8	Laboratory manual of physical pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9	Practical Book of Physical Pharmaceutics-I – Ananda Kumar Chettupalli et al

Student Learning Outcomes (SLOs):

SLOs	Student Learning Outcomes	%weightage
SLO1	Perform and analyze micromeritic evaluations including particle size distribution. Determination of pKa, and apply principles of chemical kinetics and stability studies to calculate stability constants, evaluate complex formation, and estimate formulation stability parameters	**50**
SLO2	Determine and interpret key physicochemical properties of drugs such as solubility density, porosity, and angle of repose	**30**
SLO3	Explain the theoretical principles underlying each experiment in physical pharmaceutics.	**10**
SLO4	Demonstrate conceptual understanding of physicochemical principles involved in the experiments.	**10**

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Effective from Academic Batch: 2025-26

Programme: **BACHELOR OF PHARMACY (B.PHARM.)**

Semester: **III**

Course Code: **108010313**

Course Title: **Biochemistry Practical**

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

1. Develop practical skills in identifying and analyzing carbohydrates, proteins, and abnormal biomolecules using biochemical methods.
2. Perform quantitative estimations of biomolecules in biological samples using various analytical techniques.
3. Evaluate enzyme activity under different experimental conditions and interpret the results.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/50

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

1	Qualitative analysis of carbohydrates (Glucose, Fructose, Lactose, Maltose, Sucrose and Starch)
2	Identification tests for Proteins (Albumin and Casein)
3	Quantitative analysis of reducing sugars (DNSA method) and Proteins (Biuret method)
4	Qualitative analysis of urine for abnormal constituents.
5	Determination of blood creatinine
6	Determination of blood sugar
7	Determination of serum total cholesterol
8	Preparation of buffer solution and measurement of pH
9	Study of enzymatic hydrolysis of starch
10	Determination of salivary amylase activity
11	Study the effect of temperature on salivary amylase activity
12	Study the effect of substrate concentration on salivary amylase activity

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Reference 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 Stryer.
4	Biochemistry by D. Satyanarayan and U. Chakrapani
5	Textbook of Biochemistry by Rama Rao.
6	Textbook of Biochemistry by A. C. Deb.
7	Outlines of Biochemistry by Conn and Stumpf
8	Practical Biochemistry by R.C. Gupta and S. Bhargavan.
9	Introduction of Practical Biochemistry by David T. Plummer. (3rd Edition)
10	Practical Biochemistry for Medical students by Rajagopal and Ramakrishna.
11	Practical Biochemistry by Harold Varley.
12	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2
13	https://youtu.be/NoLD2MVjpII
14	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=2
15	https://youtu.be/phdPb0NFoho

Student Learning Outcomes (SLOs):

SLOs	Student Learning Outcome Statements	%weightage
SLO1	Perform qualitative identification and differentiation of carbohydrates, proteins, and abnormal biomolecules using biochemical analysis.	**40**
SLO2	Perform quantitative analysis of biomolecules, and evaluate impact of temperature and pH on enzyme activity. Prepare and evaluate buffer solutions.	**30**
SLO3	Explain and justify the concepts of biochemistry through oral communication.	**20**
SLO4	Provide written responses to questions related to various aspects of the practicals performed.	**10**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2025-26

Programme: **Bachelor of Pharmacy**

Semester: **III**

Course Code: **108010315**

Course Title: **Pharmacognosy & Phytochemistry-I Practical**

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

1. To understand the techniques in the cultivation and production of crude drugs
2. To describe the crude drugs, their uses and chemical nature
3. To explain the evaluation techniques for the herbal drugs
4. To analyze the microscopic and morphological evaluation of crude drugs

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	4	2	-	-	25/10	75/30	100/50

* **J**: Jury; **V**: Viva; **P**: Practical

List of Practicals:

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

Reference Books:

1	W. C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2	Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.

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3	Mohammad Ali. Pharmacognosy, CBS Publishers & Distributors, New Delhi 2008
4	T.E. Wallis, Textbook of Pharmacognosy, 5th edition, CBS Publishers & Distributors, New Delhi, 2005
5	C.K. Kokate, Purohit, Gokhlae. Text book of Pharmacognosy, Gokhlae (2007), 37th Edition, Nirali Prakashan, Pune, 2007
6	R.D. Choudhary, Herbal Drug Industry Ist Edn, Eastern Publisher, New Delhi, 1996 7.
7	C.K. Kokate, Practical Pharmacognosy, 5th edition, Vallabh Prakashan, New Delhi, 2016
8	M.A. Iyengar, Anatomy of Crude Drugs, Manipal Press, Manipal, 2001.
9	Biren Shah & A. K. Seth, Textbook of Pharmacognosy & Phytochemistry, 2nd edition, Elsevier Publication, New Delhi, 2011
10	Khandelwal K. R. Practical Pharmacognosy, 9th edition, Nirali Prakashan, Pune, 2009 12.
11	Vyas S. P. and Dixit V. K., Pharmaceutical Biotechnology, 1st edition, CBS Publisher & Distributors, New Delhi, 2016.
12	WHO: Quality Control Methods for Medicinal Plant Materials, World Health Organisation, Geneva, 1988.
13	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=4
14	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=3
15	Agrawal S.S., Herbal Drug Technology, 2nd edition, Orient Blackswan, New Delhi, 2012.
16	S.H.Ansari, Essentials of Pharmacognosy, IInd edition, Birla publications, New Delhi, 2007
17	Pulok K. Mukherjee. (2019). Quality control and evaluation of herbal drugs. Elsevier.
18	World Health Organization. (2007). WHO guidelines for assessing quality of herbal medicines with reference to contaminants and residues.

Student Learning Outcomes (SLOs):

SLOs	Student Learning Outcome Statements	%Weightage
SLO1	Identify and evaluate crude drugs by physical and chemical evaluation methods.	**40**
SLO2	Identify and evaluate crude drugs by microscopical evaluation methods.	**60**

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FACULTY OF PHARMACEUTICAL SCIENCES

Effective from Academic Batch: 2025-26

Programme: **Bachelor of Pharmacy**

Semester: **III**

Course Code: **900009901**

Course Title: **Creativity, Problem solving and Innovation (CPI)**

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

1. To gain familiarity with the mechanics of creativity and problem solving
2. To develop an attitude for innovation
3. To develop creative thinking skills using cone of learning components leading to understanding of strategies of creativity, problem solving and innovation
4. To explore applications of the concepts of creativity and problem-solving skills in personal, social, academic, and profession life.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
-	-	2	2	-	-	50/20	50/20	100/50

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction to Creativity, Problem Solving and Innovation** • Definitions of Creativity and Innovation • Need for Problem Solving and Innovation • Scope of Creativity in various Domains • Types and Styles of Thinking • Strategies to Develop Creativity, Problem Solving and Innovation Skills	5
2	**Thinking Styles and Creativity Development** • Types and Styles of Thinking • Divergent Vs. Convergent Thinking • Lateral Vs. Vertical Thinking • Strategies to Develop Creativity, Problem Solving and Innovation Skills	5

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3	**Questioning, Learning and Visualization** • Strategy and Methods of Questioning • Asking the Right Questions • Strategy of Learning and its Importance • Sources and Methods of Learning • Purpose and Value of Creativity Education in real life • Visualization Strategies - Making thoughts Visible • Mind Mapping and Visualizing Thinking	**5**
4	**Creative Thinking and Problem Solving** • Creative Thinking and its need • Strategy of Thinking Fluency • Generating all Possibilities • SCAMPER Technique • Fusion of Ideas for Problem Solving • Applying Strategies for Problem Solving	**5**
5	**Logic, Language and Reasoning** • Basic Concepts of Logic • Statement Vs. Sentence • Premises Vs. Conclusion • Concept of an Argument • Functions of Language: Informative, Expressive and Directive • Inductive Vs. Deductive Reasoning • Critical Thinking & Creativity • Moral Reasoning	**6**
6	**Contemporary Issues and Practices in Creativity and Problem Solving** • Cognitive Research Trust Thinking for Creatively Solving Problems • Case Study on Contemporary Issues and Practices in Creativity and Problem Solving	**4**

Reference Books:

1	R Keith Sawyer, Zig Zag, The Surprising Path to Greater Creativity, Jossy-Bass Publication 2013
2	Michael Michalko, Crackling Creativity, The Secrets of Creative Genus, Ten Speed Press 2001
3	Michael Michalko, Thinker Toys, Second Edition, Random House Publication 2006
4	Edward De Beno, De Beno's Thinking Course, Revised Edition, Pearson Publication 1994
5	Edward De Beno, Six Thinking Hats, Revised and Update Edition, Penguin Publication 1999
6	Tony Buzan, How to Mind Map, Thorsons Publication 2002
7	Scott Berkum, The Myths of Innovation, Expended and revised edition, Berkun Publication 2010
8	Tom Kelly and David Kelly, Creative confidence: Unleashing the creative Potential within Us all, William Collins Publication 2013
9	Ira Flatow, The all Laughed, Harper Publication 1992
10	Paul Sloane, Des MacHale & M.A. DiSpezio, The Ultimate Lateral & Critical Thinking Puzzle book, Sterling Publication 2002

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Supplementary learning Material:	
1	Keith Sawer, Group Genius, The Creative Power of Collaboration, Basic Books Publication 2007
2	Edward De Beno, Lateral Thinking, Creativity Step by Step, Penguin Publication 1973
3	Nancy Margulies with Nusa Mall, Mapping Inner Space, Crown House Publication 2002
4	Tom Kelly with Jonathan Littman, The Art of Innovation, Profile Publication 2001
5	Roger Von Oech, A Whack on the Side of the Head. Revised edition, Hachette Publication 1998
6	Roger Von Oech, A Kick in the Seat of the Head, William Morrow 1986
7	Jonah Lehrer, Imagine How Creativity Works, Canongate Books Publication 2012
8	James M Higgins, 101 Creative Problem Solving Techniques, New Management Publication 1994
	Soctt G Isaksen, K Brain Doval, Donald J Treffinger, Creative Approach to Problem Solving, Sage Publication 2000
9	Donald J Treffinger, scott G Isaksen, K Brain stead Dorval Creative Problem Solving An Introduction, Prufrock Press 2006
10	H Scott Fogler & Steven E. LeBlance, Strategies for Creative Problem Solving, Prentice Hall Publication 2008
11	Dave Gray, Sunni Brown and James Macanufo, Game Storming, O'reilly Publication 2010.
12	Howard Gardner, Creating minds, Basic Books Publication 1993
13	Mihaly Csikzentmihalyi, Creativity–Flow and Psychology of Discovery and Invention, Harper Publication 1996
14	Martin Gerdner, W. H., Ahal Insight, Freeman Publication 1978
15	Paul Sloane, Test Your Lateral Thinking IQ, Sterling Publication1994
16	Paul Sloane & Des Machale Intriguing, Lateral Thinking Puzzles, Sterling Publication 1996
17	Internet Search based May TED talks and other sources for videos, slide shares, problems, etc

Pedagogy:

1. Slides Presentations, Reading Material, Discussions, Case Studies, Puzzles, Videos, Task-Based Learning, Projects, Assignments and various Individual and Interpersonal activities like, Group work, Independent and Collaborative Research, Presentations.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
10	50	25	10	00	05	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Student Learning Outcomes (SLO):

SLOs	Student Learning Outcome Statements	%Weightage
SLO1	Explain the fundamental concepts of creativity, innovation, thinking styles and problem-solving strategies in academic and professional contexts.	**20**
SLO2	Apply questioning, learning and visualization techniques to improve creative thinking and idea generation.	**20**
SLO3	Utilize creative thinking approaches and problem-solving tools such as SCAMPER, lateral thinking and thinking fluency for generating innovative solutions.	**25**
SLO4	Analyze arguments, reasoning patterns and logical concepts to develop critical and moral reasoning abilities.	**20**
SLO5	Demonstrate the ability to address contemporary issues using creativity, innovation and structured problem-solving practices in real-life situations.	**15**

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