

Semester: 5	
Course: Minor 1	
Paper Title: CELL BIOLOGY AND BIOCHEMISTRY	
Paper Code: B3BT230512T/P	Credits: 4 (3 Th + 1 Pr)
Hours/week: 3 + 2	
Category: Core/MDC/SEC/VAC: Minor	
Theory / Practical / Composite: Composite	
No of Modules: 2	
COURSE OVERVIEW:	
<ol style="list-style-type: none"> 1. Understanding the basics of cellular organization and functionality 2. Gaining a comprehensive overview of diverse biomolecules, their properties and functional relevance 3. Acquiring a comprehensive concept of cellular metabolism 4. Identifying the biophysical and biochemical techniques required to study biomolecules 5. Understanding the basics of chromosome biology, DNA packaging, and the flow of genetic message from DNA to protein 6. Understanding the fundamental aspects of recombinant DNA technology 7. Familiarizing with laboratory techniques and equipment used in cell biology and biochemistry studies (Practical) 	
COURSE OUTCOME: THEORY	
Module A	
<ol style="list-style-type: none"> 1. Recall and identify key features of cells, cell membrane dynamics, organelles, biological macromolecules and vitamins, basic metabolic processes, and chromosome organization and mutations. 2. Explain the structure-function relationships across cell organelles, membrane dynamics, physiological relevance of macromolecules and vitamins, significance of metabolic processes, and chromosome basics including mutations. 3. Apply knowledge of cellular organization, macromolecules, vitamins, metabolic processes, and chromosome biology to solve problems in human physiological contexts. 4. Analyse interconnections between prokaryotic/eukaryotic structures, membrane/organelle functions, macromolecule/vitamin roles, metabolic pathways, and chromosome structure and mutations. 5. Evaluate the impact of cellular components, metabolic processes, macromolecules, vitamins, and chromosomal organization and mutations on physiological functions and health. 6. Develop a comprehensive overview of the principles of cell biology and biochemistry, integrating cellular organization, metabolism, macromolecules, vitamins, and chromosome biology. 	
Module B	
<ol style="list-style-type: none"> 1. Recall fundamental features of molecular design of life, genetic code, central dogma, including replication, transcription, translation, recombinant DNA tools and various techniques like microscopy, isotopes, electrophoresis, chromatography, and spectroscopy 2. Explain the molecular design of life integrating biochemical evolution with water properties and Henderson-Hasselbalch equation, chemical bonds alongside entropy and thermodynamics, genetic code and central dogma, rDNA technology, and cell biology techniques 3. Apply thermodynamic laws, pKa calculations via Henderson-Hasselbalch, genetic code in central dogma processes, recombinant DNA methods, and practical techniques such 	

as microscopy for visualization, isotope labeling, electrophoresis for separation, chromatography for purification, and spectroscopy for analysis.				
4. Analyze interactions between chemical bonds, entropy-driven biochemical evolution, flow from genetic code through central dogma to recombinant DNA applications, and comparative efficiencies of techniques like electrophoresis versus chromatography or UV-visible versus NMR spectroscopy in practical settings.				
5. Evaluate the suitability of water properties and bonds in biochemical contexts, fidelity of genetic code in replication/transcription/translation, methods for recombinant DNA, and effectiveness of cell biology tools (microscopy, isotopes, electrophoresis, chromatography, spectroscopy) in experimental design and outcomes.				
6. Create experimental designs integrating molecular principles (thermodynamics, bonds), genetic processes (central dogma, recombinant DNA), and practical protocols using microscopy, isotopes, electrophoresis, chromatography, and spectroscopy to investigate biochemical phenomena.				
COURSE OUTCOME: PRACTICAL				
1. Prepare and observe microscopic slides of onion epidermal cells, applying basic principles of plant cell biology.				
2. Analyze histological sections of mammalian tissues, through prepared slides, correlating microscopic observations with tissue function and organization.				
3. Perform blood grouping using slide agglutination tests with anti-sera and interpret the results.				
4. Measure pH of buffer solutions experimentally and understand the importance of buffering in biological systems.				
5. Conduct qualitative biochemical identification tests for major biochemical substances.				
6. Quantify proteins via UV absorbance and Modified Lowry Method, using spectrophotometer.				
Prerequisites: Basic knowledge about biology				
SYLLABUS				
UNIT/ Module	CONTENT	HOURS or NUMBER of CLASSES	CO Mapping	COGNIT IVE LEVEL
Module A	UNIT I: Basic cell organization: (i) Prokaryotic and eukaryotic cells, (ii) Cell membrane and membrane dynamics (iii) Cell organelles: structure and functions. UNIT II: Biological macromolecules and vitamins: Functional relevance in human physiology. UNIT III: Cellular metabolism: Overview of basic metabolic processes. UNIT IV: Chromosome biology: Chromosome (basic organization, mutations).	14 classes per week	CO1-CO6	K1-K6
Module B	UNIT I: The molecular design of life: (i) Biochemical evolution (ii) Properties of water, Henderson Hasselbach equation, (iii) Chemical bonds in biochemistry, reversible and irreversible interaction, (iv) Entropy and laws of thermodynamics.	14 classes per week	CO1-CO6	K1-K6

	<p>Unit II: Genetic code and central dogma: (i) Genetic code (salient features), central dogma, (ii) Replication, transcription and translation.</p> <p>Unit III: Recombinant DNA Technology</p> <p>UNIT IV: Some Techniques in cell biology and biochemistry: (i) Microscopy, (ii) Isotopes in biology, (iii) Electrophoresis, (iv) Chromatography, (v) Spectroscopy (UV visible, fluorescence, NMR, IR).</p>		
Practical	<ol style="list-style-type: none"> 1. Study of onion epidermal cells 2. Study of histology of mammalian tissues 3. Determination of human blood groups 4. Determination of the pH of a given buffer solution 5. Qualitative tests for important biochemical substances 6. Estimation of protein concentration by taking absorbance at 280 nm 7. Estimation of protein concentration by Modified Lowry Method 	2 classes	
TEXT BOOKS			
<p>Theory</p> <ol style="list-style-type: none"> 1. Biochemistry - Voet & Voet. 2. Lehninger Principles of Biochemistry - Cox & Nelson 3. Biochemistry - Tymoczko & Stryer 4. The Cell – A Molecular Approach – G.M. Cooper, R.E. Hausman 5. Cell and Molecular Biology: Concepts and Experiments. Karp, G. 6. Molecular Biology of the cell - Bruce Alberts 7. Cell and Molecular Biology- De Robertis, E.D.P. and De Robertis, E.M.F. <p>Practical</p> <ol style="list-style-type: none"> 1. Practical Zoology by S.S. Lull 2. Biochemistry Laboratory: Modern Theory and Techniques by Rodney Boyer 			
<p>EVALUATION:</p> <p>Theory: CIA- 10 marks; Assignment -2 marks, Attendance- 3 marks; Semester Exam: 45 marks</p> <p>Practical: 40 marks (30 marks Continuous Assessment; End Semester Viva: 8 Marks; Attendance: 2 marks)</p>			
<p>PAPER STRUCTURE FOR THEORY SEMESTER EXAM MODULE:</p> <p>Module A: 25 marks 1 compulsory question of 5 marks 2 questions of 10 marks each (Any 2 out of 3 questions) [No subpart will be less than 2 marks and more than 6 marks]</p> <p>Module B: 20 marks 1 compulsory question of 5 marks 3 questions of 5 marks each out of 5 questions. [Minimum 1 mark and maximum 5 marks]</p>			

COURSE OUTCOMES (COS) AND COGNITIVE LEVEL MAPPING

COs	CO Description	Cognitive levels
	Module A	
CO1	Recall and identify key features of cells, cell membrane, organelles, biological macromolecules and vitamins, basic metabolic processes, and chromosome organization and mutations.	K1
CO2	Explain the structure-function relationships across cell organelles, membrane dynamics, physiological relevance of macromolecules and vitamins, significance of metabolic processes, and chromosome basics including mutations.	K2
CO3	Apply knowledge of cellular organization, macromolecules, vitamins, metabolic processes, and chromosome biology to solve problems in human physiological contexts.	K3
CO4	Analyse interconnections between prokaryotic/eukaryotic structures, membrane/organelle functions, macromolecule/vitamin roles, metabolic pathways, and chromosome structure and mutations.	K4
CO5	Evaluate the impact of cellular components, metabolic processes, macromolecules, vitamins, and chromosomal organization and mutations on physiological functions and health.	K5
CO6	Develop a comprehensive overview of the principles of cell biology and biochemistry, integrating cellular organization, metabolism, macromolecules, vitamins, and chromosome biology.	K6
	Module B	
CO1	Recall fundamental features of molecular design of life, genetic code, central dogma, including replication, transcription, translation, recombinant DNA tools and various techniques like microscopy, isotopes, electrophoresis, chromatography, and spectroscopy	K1
CO2	Explain the molecular design of life integrating biochemical evolution with water properties and Henderson-Hasselbalch equation, chemical bonds alongside entropy and thermodynamics, genetic code and central dogma, rDNA technology, and cell biology techniques	K2
CO3	Apply thermodynamic laws, pKa calculations via Henderson-Hasselbalch, genetic code in central dogma processes, recombinant DNA methods, and practical techniques such as microscopy for visualization, isotope labeling, electrophoresis for separation, chromatography for purification, and spectroscopy for analysis.	K3
CO4	Analyze interactions between chemical bonds, entropy-driven biochemical evolution, flow from genetic code through central dogma to recombinant DNA applications, and comparative efficiencies of techniques like electrophoresis versus	K4

	chromatography or UV-visible versus NMR spectroscopy in practical settings.	
CO5	Evaluate the suitability of water properties and bonds in biochemical contexts, fidelity of genetic code in replication/transcription/translation, methods for recombinant DNA, and effectiveness of cell biology tools (microscopy, isotopes, electrophoresis, chromatography, spectroscopy) in experimental design and outcomes.	K5
CO6	Create experimental designs integrating molecular principles (thermodynamics, bonds), genetic processes (central dogma, recombinant DNA), and practical protocols using microscopy, isotopes, electrophoresis, chromatography, and spectroscopy to investigate biochemical phenomena.	K6