

Semester: 1	
Course: Major 1	
Paper Title: Biological Macromolecules and Bioenergetics	
Paper code: C1BT230111T	Credits: 4
Hours/week: 4	
Category: Core/MDC/SEC/VAC: Core	
Theory / Practical / Composite: Theory	
No of Modules: Theory: 2	
Course Overview:	
<p>This course provides a comprehensive understanding of the molecular basis of life, focusing on the structure, properties, functions, and interactions of biomolecules such as amino acids, proteins, carbohydrates, lipids, nucleic acids, and enzymes. It also introduces the principles of bioenergetics and carbohydrate metabolism, highlighting how biochemical reactions are catalyzed, regulated, and integrated within living systems. Emphasis is placed on structure–function relationships, mechanistic understanding, and biological relevance, enabling learners to connect molecular details with physiological and cellular functions. The course builds foundational knowledge while fostering analytical thinking, problem-solving skills, and the ability to apply biochemical principles in academic, research, and applied contexts.</p>	
Course Outcome:	
Module A	
1. Remember the structures, classification, nomenclature, and basic properties of amino acids, proteins, carbohydrates, and lipids.	
2. Understand the relationship between chemical structure and biological function of proteins, carbohydrates, and lipids.	
3. Apply knowledge of biomolecular properties to explain their roles in cellular organization, membrane structure, and physiological processes.	
4. Analyze the forces stabilizing protein structure and compare fibrous and globular proteins, as well as different classes of carbohydrates and lipids.	
5. Evaluate the biological significance of specific biomolecules such as keratin, collagen, hemoglobin, glycoproteins, and membrane lipids.	
6. Create structural–functional correlations or schematic representations to illustrate how variations in biomolecular structure influence biological function.	
Module B	
1. Remember the structural components, classification, and terminology related to nucleic acids, enzymes, cofactors, and bioenergetic pathways.	
2. Understand the molecular principles governing nucleic acid structure and function, enzyme catalysis, and energy transformations in carbohydrate metabolism.	
3. Apply biochemical concepts to explain DNA/RNA behaviour, enzyme specificity and catalysis, and the flow of energy through metabolic reactions.	
4. Analyze structure–function relationships in nucleic acids and enzymes, including DNA conformations, RNA folding, active site architecture, and coenzyme action.	
5. Evaluate the biological significance and regulatory efficiency of nucleic acid functions, enzymatic mechanisms, and bioenergetic processes.	

6. **Create** integrated conceptual models, pathway maps, or mechanistic representations linking genetic information, enzymatic activity, and cellular energy metabolism.

Prerequisites: Basic knowledge about biology

SYLLABUS

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
Module A	<p>UNIT I: Amino acids & Proteins: Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape. Different Level of structural organization of proteins, Structure of Fibrous and globular proteins: Keratin, Collagen, Haemoglobin.</p> <p>UNIT II: Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. Homo & Hetero Polysaccharides, Mucopolysaccharides, Bacterial cell wall polysaccharides, Glycoproteins and their biological functions.</p> <p>UNIT III: Lipids: Structure and functions –Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids, sphingolipids, glycolipids, cholesterol.</p>	2 class per week	CO1-CO6	K1-K6
Module B	UNIT IV: Nucleic acids: Structure and functions - Physical & chemical properties of nucleic acids - Purines & pyrimidines,	2 classes per week	CO1-CO6	K1-K6

	<p>nucleosides & nucleotides, biologically important nucleotides, double helical model of DNA structure and forces responsible for A, B & Z – DNA, denaturation and renaturation of DNA. RNA - folding of RNA into higher order structures; types of RNAs - mRNA, tRNA, rRNA in ribosome; modified nucleotides in tRNA and their importance.</p> <p>UNIT V: Enzymes: Nomenclature and classification of enzymes, holoenzyme, apoenzyme, cofactors, coenzyme, prosthetic groups, metalloenzymes, activation energy and transition state, enzyme activity, specific activity, common features of active sites, enzyme specificity - types & theories; Role of coenzymes: NAD⁺ , NADP⁺ , FMN/FAD.</p> <p>UNIT VI: Bioenergetics of Carbohydrate Metabolism including glycolysis, gluconeogenesis and hexose monophosphate pathway</p>			
Text Books				
1. Biochemistry - Lubert Stryer				
2. Lehninger Principles of Biochemistry - David L. Nelson and Michael Cox				
Suggested readings				
1. Biochemistry – Voet & Voet				
<p>Evaluation: Theory CIA: 30 Semester Exam: 70</p>				
<p>Paper Structure for Theory Semester Exam: Module A (35 marks) Q.1. Compulsory – 10 marks Any two from three questions (Q.2.-Q.4.) – each 12.5 marks [No sub-part will be less than 1 mark and more than 5 marks] Module B (35 marks)</p>				

Q.5. Compulsory – 10 marks
 Any two from three questions (Q.6.-Q.8.) – each 12.5 marks
 [No sub-part will be less than 1 mark and more than 5 marks]

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
	Module 1	
CO1	Remember the structures, classification, nomenclature, and basic properties of amino acids, proteins, carbohydrates, and lipids.	K1
CO2	Understand the relationship between chemical structure and biological function of proteins, carbohydrates, and lipids.	K2
CO3	Apply knowledge of biomolecular properties to explain their roles in cellular organization, membrane structure, and physiological processes.	K3
CO4	Analyze the forces stabilizing protein structure and compare fibrous and globular proteins, as well as different classes of carbohydrates and lipids.	K4
CO5	Evaluate the biological significance of specific biomolecules such as keratin, collagen, hemoglobin, glycoproteins, and membrane lipids.	K5
CO6	Create structural–functional correlations or schematic representations to illustrate how variations in biomolecular structure influence biological function.	K6
	Module 2	
CO1	Remember the structural components, classification, and terminology related to nucleic acids, enzymes, cofactors, and bioenergetic pathways.	K1
CO2	Understand the molecular principles governing nucleic acid structure and function, enzyme catalysis, and energy transformations in carbohydrate metabolism.	K2
CO3	Apply biochemical concepts to explain DNA/RNA behaviour, enzyme specificity and catalysis, and the flow of energy through metabolic reactions.	K3
CO4	Analyze structure–function relationships in nucleic acids and enzymes, including DNA conformations, RNA folding, active site architecture, and coenzyme action.	K4
CO5	Evaluate the biological significance and regulatory efficiency of nucleic acid functions, enzymatic mechanisms, and bioenergetic processes.	K5
CO6	Create integrated conceptual models, pathway maps, or mechanistic representations linking genetic information, enzymatic activity, and cellular energy metabolism.	K6