

Syllabus template

Semester: II	
Course : Microbiology	
Paper Title: Biochemistry of Biomolecules	
Paper code: C1MB230211T	Credits: 4
Hours/week : 4 hours/week	
Category: Core/MDC/SEC/VAC : Core	
Theory / Practical / Composite : Theory (Non composite)	
No of Modules : No modules	
<p>Course Overview: This course provides a comprehensive study of Biochemistry of biomolecules. Starting from the biochemistry of Carbohydrates indicating the importance of carbohydrate in life, their classification the curriculum includes the families of Monosaccharides, Mutarotation, Cyclic forms of Sugars or carbohydrates, Anomers, Anomeric Effect, Epimers, Epimerization, Ene-diol Rearrangement, Reduction and Oxidation of Simple Sugars, Glycosides, Disaccharides, Polysaccharides, Sugars containing Nitrogen, Oligosaccharides as components of Lipids and Proteins, Carbohydrate as a part of Antibiotics altogether. Then the course describes the amino acids and Peptides including Definition, classification, structure and stereochemistry of amino acids, Physicochemical properties of amino acids, Amphoteric molecule, Zwitter ion, pk values, Isoelectric point, electrophoresis, Formol titration of glycine, Reaction with Ninhydrin, Reaction of carboxyl and ammo groups, Separation of amino acids by Ion exchange, Gel filtration, Paper chromatography, Thin layer chromatography, Paper Electrophoresis. Peptides: peptide bond, biologically important peptides (glutathione, oxytocin-important functions), End group analysis, dihedral angel, Ramachandran Plot. The biochemistry of Protein includes General function of Protein, Types of proteins (simple and conjugated proteins Fibrous, Globular-definition example). Structural hierarchy of protein (Primary, Secondary, Tertiary, Quaternary) Forces that stabilizes structure of proteins, Protein denaturants, Transmembrane Protein, hydropathy plot. Relation between structure and function of globular and fibrous proteins like hemoglobin, myoglobin, keratin, collagen, the Bohr effect, chaperons etc. The biochemistry of Lipids include Definition and major classes of storage and structural lipids, Storage lipids, Fatty acids structure and functions, Essential fatty acids, Triacyl glycerols structure, functions and properties of Phosphoglycerides, Saponification, Structural lipids, Structure of phosphatidylethanolamine, phosphatidylcholine, Sphingolipids, structure of sphingosine, ceramide, sphingomyelins, cerebrosides and gangliosides and functions of lipids including cell signals, cofactors, prostaglandins, Introduction of lipid micelles, monolayers, bilayers. The Nucleic acid biochemistry includes Nucleosides, Nucleotides, Ribose and Deoxyribose, Purines and Pyrimidines and their properties, Syn and Anti forms of Nucleosides, Ionization of the phosphates on Nucleotides, Sugar-Phosphate Backbone, Chemical Structure of a Polynucleotide Chain, Acidic property of Nucleic Acids, Resistance of Nucleic Acids to Nucleophilic Attack, Watson Crick Model of DNA Double Helix, Non-Covalent Forces that Influence the Double Helical Structure, A and Z forms of Double Helices, tRNA as a model for Secondary and Tertiary Structure of RNA, Modified Bases in RNA, Physicochemical Properties of Nucleic Acids.</p>	
Course Outcome:	
<ol style="list-style-type: none"> 1. Understand and explain the structures and importance of monosaccharides, disaccharides and polysachharides 	

2. Evaluate the concepts of stereochemistry and chemical reactions of of Carbohydrates including Anomers, Anomeric Effect, Epimers, Epimerization, Ene-diol Rearrangement, Reduction and Oxidation of Simple Sugars
3. Remember the classification, physicochemical properties, stereochemistry, reactions and techniques of separation of amino acids
4. Analyse the different hierarchical levels of proteins as Primary, secondary, supersecondary, tertiary, Quaternary structures and functions of proteins
5. Apply the concepts of different types of lipids according to structure and functions of phospholipid, sphingolipids
6. Analyse the basic structure and functions or properties of nucleosides, nucleotides, Polynucleotide Chain, Acidic property of Nucleic Acids, different forms of DNA and RNA

Prerequisites: Basic knowledge about any prior course

SYLLABUS

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
	Carbohydrate: Importance in Life, Classification, D and L Sugars, “+” and “-“ Sugars, Families of Monosaccharides, Mutarotation, Cyclic forms of Sugars, Anomers, Anomeric Effect, Epimers, Epimerization, Ene-diol Rearrangement, Reduction and Oxidation of Simple Sugars, Glycosides, Disaccharides, Polysaccharides, Sugars containing Nitrogen, Oligosaccharides as components of Lipids and Proteins, Carbohydrate as a part of Antibiotics.	12	CO1,CO2	K2,K5
	Amino acids and Peptides: Definition, classification, structure and stereochemistry of amino acids, Physicochemical properties of amino acids, Amphoteric molecule, Zwitter ion, pk values, Isoelectric point, electrophoresis, Formol titration of glycine, Reaction with Ninhydrin, Reaction of carboxyl and ammo groups, Separation of amino acids by Ion exchange, Gel filtration, Paper chromatography, Thin layer chromatography, Paper Electrophoresis. Peptides: peptide bond, biologically important peptides (glutathione, oxytocin-important functions), End group analysis, dihedral angel, Ramachandran Plot.	14	CO3	K1,K4
	Proteins: General function of Protein, Types of proteins (simple and conjugated proteins Fibrous, Globular-definition example).	14	CO4	K4

	Structural hierarchy of protein (Primary, Secondary, Tertiary, Quaternary) Forces that stabilizes structure of proteins, Protein denaturants, Transmembrane Protein, hydropathy plot. Relation between structure and function of globular and fibrous proteins (hemoglobin, myoglobin and keratin/collagen). Bohr effect, Cooperative binding of hemoglobin, Hill equation, Introduction to chaperons, Anfinsen cage model.			
	Lipids: Definition and major classes of storage and structural lipids. Storage lipids. Fatty acids structure and functions. Essential fatty acids. Triacyl glycerols structure, functions and properties. Saponification Structural lipids. Phosphoglycerides: Building blocks, General structure, functions and properties. Structure of phosphatidylethanolamine and phosphatidylcholine, Sphingolipids: building blocks, structure of sphingosine, ceramide. Special mention of sphingomyelins, cerebrosides and gangliosides. Lipid functions: cell signals, cofactors, prostaglandins, Introduction of lipid micelles, monolayers, bilayers.	12	CO5	K3
	Nucleic Acids: Nucleosides, Nucleotides, Ribose and Deoxyribose, Purines and Pyrimidines and their properties, Syn and Anti forms of Nucleosides, Ionization of the phosphates on Nucleotides, Sugar-Phosphate Backbone, Chemical Structure of a Polynucleotide Chain, Acidic property of Nucleic Acids, Resistance of Nucleic Acids to Nucleophilic Attack, Watson Crick Model of DNA Double Helix, Non-Covalent Forces that Influence the Double Helical Structure, A and Z forms of Double Helices, tRNA as a model for Secondary and Tertiary Structure of RNA, Modified Bases in RNA, Physicochemical Properties of Nucleic Acids.	12	CO6	K4
Text Books				
1. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company				
2. Voet, D. and Voet J.G (2004) Biochemistry 3rd edition, John Wiley and Sons,				

3. Debajyoti Das. Biochemistry.
4. Organic Chemistry by Solomons (2017)
5. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H.Freeman and Company
Suggested readings
1.
2.
3.
Web Resources
1.
2.
3.
4.
Evaluation Theory CIA:30 Semester Exam:70; No Practical component is included in the course
Paper Structure for Theory Semester Exam Module : Full Marks: 70 Short questions: 10 (each 2 mark) from 12 (10x2=20) Long questions: 5 (each 10 marks) from 7 (5x10=50)

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
CO1	Understand and explain the structures and importance of monosaccharides, disaccharides and polysaccharides	K2
CO2	Evaluate the concepts of stereochemistry and chemical reactions of Carbohydrates including Anomers, Anomeric Effect, Epimers, Epimerization, Ene-diol Rearrangement, Reduction and Oxidation of Simple Sugars	K5
CO3	Remember the classification, physicochemical properties, stereochemistry, reactions and techniques of separation of amino acids	K1
CO4	Analyse the different hierarchical levels of proteins as Primary, secondary, supersecondary, tertiary, Quaternary structures and functions of proteins	K4
CO5	Apply the concepts of different types of lipids according to structure and functions of phospholipid, sphingolipids	K3
CO6	Analyse the basic structure and functions or properties of nucleosides, nucleotides, Polynucleotide Chain, Acidic property of Nucleic Acids, different forms of DNA and RNA	K4