



FORMAT FOR COURSE CURRICULUM

Course Title: Biochemistry
Course Code: GCMB212
Credit Units: 4

L	T	P/S	Lab	TOTAL CREDIT UNITS
3	--	--	2	4

Course Objectives:

Theory: The course is aimed to give students an exposure of chemical interactions and principles of bioenergetics. It provides deeper insight into structures, properties and functions of major bio-molecules and metabolic pathways in the living systems. Practical are aimed to train students in conducting experiments for qualitative and quantitative analyses of bio-molecules.

Pre-requisites: Knowledge of biology and chemistry

Student Learning Outcomes:

- The students will have wide exposure of bio-molecular interactions and bioenergetics of biochemical pathways.
- The students will learn how all bio-molecules are composed of monomers subunits and functions in living systems.
- The students will have comprehensive knowledge of biochemical pathways leading to synthesis and catabolism of major bio-molecules.

Course Contents/Syllabus- Theory:

	Weightage (%)
Module I Chemical foundations of Biology	20
Descriptors/Topics: Covalent, non-covalent, hydrophilic and hydrophobic interactions and their influence on structure of biomolecules. Acids, bases, pH, pK, and ionization of water. Buffers, Henderson Hasselbalch equation. Biomolecules: classification and their functions in living organisms. Concepts of bioenergetics: First and second laws of thermodynamics, Gibb's free energy, calculations of standard free energy, Biological oxidation-reduction reactions, redox potential and its significance, high energy compounds (ATP, GTP, creatine phosphate).	
Module II Carbohydrates:	20
Descriptors/Topics: Structures and functions- Monosaccharide: aldoses and ketoses, configuration and conformation, concept of reducing and non-reducing sugars, stereoisomerism. Disaccharides such as maltose, lactose, sucrose. Polysaccharides: Storage (starch and glycogen) and structural (cellulose and chitin). Important sugar derivatives and glycosaminoglycans. Importance of carbohydrates.	
Metabolism: Glycolysis, formation of Acetyl Co-A from pyruvate,	

Citric acid (TCA) cycle, substrate and oxidative level phosphorylation, Total ATP formation during glycolysis and TCA cycle. Overview of glycogenesis, glycogenolysis and gluconeogenesis. Pentose phosphate pathway and its significance.	
Module III Lipids:	20
Descriptors/Topics: Structure and functions- Lipid classification: Fatty acids (saturated, unsaturated, essential, non-essential), triacylglycerols, glycerophospholipids, sphingolipids, cholesterol. Saponification and iodine, value/number. Glycolipids and lipoproteins. Lipids and biomembranes. Metabolism: Fatty acids oxidation (even and odd chain), ATP formation from complete oxidation of fatty acids. Formation of ketone bodies and its utilization. Biosynthesis of fatty acid in eukaryotes, Cholesterol metabolism.	
Module IV Proteins:	20
Descriptors/Topics: Structures and functions- The amino acids of proteins their general properties, classification and characteristics, optical properties of amino acids. Peptide bond: its configuration and properties. Protein structures: primary, secondary (alpha helices and beta pleated sheets), tertiary and quaternary (ex. Hemoglobin). Major bonds/forces which stabilize protein structures, Ramachandran Plot. Denaturation and renaturation of proteins Metabolism - Amino acid de-amination, urea cycle and its link with TCA cycle, ammonia toxicity in animals, Glycolytic and TCA cycle intermediates as precursors for amino acid biosynthesis. Pathways of non-essential (asparagines, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline, serine, Tyrosine) amino acid degradation. Degradation of heme to bilirubin.	
Module V Nucleic acids :	20
Descriptors/Topics: Structure and functions: Nucleotides, nucleosides and nitrogenous bases. Chemical structures of DNA and RNA. Double helical DNA (The Watson-Crick model), Types of DNA and RNA. Metabolism: Synthesis of purine and pyrimidine ribonucleotides. <i>de-novo</i> and salvage pathway of purines nucleotides, roles of folic acid in the biosynthesis of nucleotides. Catabolism of purines, fate of uric acid and catabolism of pyrimidines.	

Pedagogy for Course Delivery:

Lectures: 42

Tutorial: 0

Presentation/ Seminar: 1

Class Test: 2

Total: 45

Lab/ Practical details, if applicable:

Practical: 13

Tutorial: 0

Class Tests: 2

Total: 15

List of Experiments:

- Preparation of reagents, buffers and solutions
- Qualitative analysis of sugars by Molish, Fehling, Barford, Bial's and Seliwanoff Tests
- Qualitative analysis of amino acid by Ninhydrin, Xanthoproteic and Biuret tests.
- Estimation of reducing sugars by DNS method.
- Determination of Iodine number of fatty acid.
- Estimation of cholesterol by cholesterol oxidase/peroxidase method.
- Estimation of protein by Bradford/Lowry's method.
- Estimation of DNA by Di-phenyl amine (DPA) method.
- Estimation of RNA by Orcinol method
- Determination of melting temperature of DNA.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	End Term Examination
75	25	70

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment						End Term Examination
Components (Drop down)	Class Test-1	Class Test-2	Assignment	Presentation/ Seminar	Attendance	
Weightage (%)	5	10	5	5	5	70

Lab/ Practical/ Studio Assessment:

Components (Drop down)	Continuous Assessment/Internal Assessment				End Term Examination			Total
	Performance	Lab record	viva	Attendance	Lab record	Performance	Viva	
Weightage (%)	10	10	5	5	10	50	10	100

Text:

- Principles of Biochemistry, 4th Edition. Nelson, D.L. and M.M. Cox (2005). W.H. Freeman and Co.
- Fundamentals of Biochemistry: Life at the molecular level, 4th Edition. D. Voet, J.G. Voet and W. Pratt (2012). John Wiley & Sons Inc.
- Biochemistry. U. Satyanarayan
- Modern Experimental Biochemistry, 3rd Edition. Rodney Boyer
- Introductory Practical Biochemistry. S.K. Sawney and R. Singh (2000). Narosa Publisher
- Plummer DT "An Introduction to Practical Biochemistry" III Edn., Tata McGrawhill.

References:

Any other Study Material: