Master of Science (Biotechnology)
M.Sc. (Biotechnology) Semester (I)

Course Code	PS01EBIT52	Title of the Course	Biomolecules and Bioenergetics
Total Credits of the Course	04	Hours per Week	03

Course Objectives:	Students should be able to : (1) Understand the chemistry of biomolecules (2) Understand the importance of Biomolecules n Biotechnology industries.

Course Content		
Unit	Description	Weightage* (%)
1.	Carbohydrates Introduction, natural occurrence, Physiological importance Classification: aldose and ketoses, Mono, oligo and polysaccharides, Structure of monosaccharide Physical properties of carbohydrates: Isomerism, Asymmetric carbon atom, Stereoisomerism, Optical isomerism and measurement of optical activity, enantiomers, diaterioisomers, epimers, anomers, anomeric carbon atom. Configuration in sugars, Reference carbohydrate, Fischer's projection formula and representation of various sugars, Haworth's representation of cyclic structure. Furanose and pyranose structures and representation of various sugars, Mutarotation, Conformation in sugars: boat and chair forms. Chemical properties of carbohydrate due to aldehyde and keto groups: Oxidation of sugars, Reduction of sugars, Lobry de Bruyn-von Ekenstein reaction, Reducing action of sugars in alkaline medium, Action of mineral acids, Action of hydroxylamine, Action of hydrogen cyanide, Action of hydrazine Chemical properties of carbohydrate due to hydroxyal groups: Formation of esters, ethers and glycosides, Importance of glycosides. Transformation of sugars: aldo and keto conversions, Sugars to uronic acids, Sugars to vitamin C.	25
2.	Amino acids Introduction, structure and classification of: standard amino acids, introduction to rare amino acids, non-protein amino acids, essential Vs Non-essential amino	25

	acids. Physical properties of amino acids: Stereoisomerism, Optical activity, Acid base properties or Ampholytic Nature of amino acids, Titration curve of Alanine. Chemical reactions of amino acids due to carboxyl group: Decarboxylation, Amide formation. Chemical reactions of amino acids due to amino groups: Sanger's reaction, Edman's reaction, Dansyl chloride reaction, Oxidative deamination by Ninhydrin. Protein sequencing and alignment Acid-Base Equilibrium & Henderson and Hassebach equation, Buffers and their importance, pKa of amino acid and their relevance, Common reaction mechanism in biological reaction: Peptide bond formation, oligonucleotide and oligosaccharide synthesis, disulphide bond, group-specific chemical modification for amino acid	
3.	Introduction, classification & functions of lipids, classification & structure of fatty acids, saturated, unsaturated, hydroxyl, cyclic, branched chain, PUFA, MUFA Physical properties, isomerism, geometrical (cis-trans) isomers, positional isomers, melting point, boiling point, solubility, absorption spectra. Chemical properties: salt formation, detergent, esterification, hydrogenation,halogenations, oxidation, Triglycerides:chemical properties, chemical composition, hydrolysis, saponification, hydrogenation, detergents (action and importance). Chemical constants of fat: saponification value, iodine number, reichertMeissl number, acetyl number, acid number. Rancidity of fats: Hydrolytic, oxidative and lipolytic. Prevention of rancidity Waxes: natural waxes, properties, importance Nucleic acids: Structure of major species of RNA - mRNA, tRNA and rRNA. Nucleic acid chemistry – UV absorption, effect of acid and alkali on DNA.	25
4.	Bioenergetics: The laws of thermodynamics, concept of entropy and free energy; ATP synthesis and hydrolysis, Biological oxidations-–oxygenases ,hydrolases ,dehydrogenases, free energy changes and redox potentials, Gibbs energy, The mitochondrial respiratory chain, order and organization of carriers, proton gradient, iron sulphur proteins, cytochromes and their characterization (Animals, Plants, and Bacteria),	25

	ATP- synthetase complex, Chemiosmotic theory of Energy Coupling, Inhibitors of ETC,	

Teaching-Learning Methodology	Topics will be taught and discussed in interactive sessions using conventional black board and chalk as well as ICT tools such as power point presentations and videos. Practical sessions will be conducted in a suitably equipped laboratory either individually or in groups depending on the nature of exercise as well as availability of infrastructure. Course materials will be provided from primary and secondary sources of information.

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to

1.	Student should be able to carry out laboratory experiments using biomolecules.

Suggested References:

Sr. No.	References
1.	***S. P. Bhutani***. Edition 2nd Edition. First Published 2019. eBook Published 4 October 2019. Pub. Location Boca Raton. Imprint ***CRC Press***
2.	D. L. Nelson and M. M. Cox, Lehninger's Principles of Biochemistry (6^{th} Edition), Macmillan, Worth, Pub. Inc., NY.

3.	Jeremy M. Berg, ***LubertStryer***, John Tymoczko, Gregory Gatto, ***Biochemistry*** (9th Edition). Publisher: ***WH Freeman***
4.	***Harper's biochemistry*** 24th edition by ***R K Murray***, D K Granner, P A Mayes and V W Rodwell. pp 868. ***Appleton*** & ***Lange***, Stamford, CT.
5.	Thomas M. ***Devlin,Textbook of Biochemistry With Clinical Correlations***. Fourth Edition Edited. Wiley-Liss, Inc., New York. 1997

On-line resources to be used if available as reference material
On-line Resources
Related review articles and research papers

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