

<b>Name of Faculty</b>	:	Faculty of Science
<b>Name of Program</b>	:	Bachelor of Science
<b>Course Code</b>	:	1BSB01
<b>Course Title</b>	:	Introduction to Biochemistry
<b>Type of Course</b>	:	Professional Core
<b>Year of Introduction</b>	:	2023-24

<b>Prerequisite</b>	:	Ability to apply the fundamental knowledge of Biomolecules, protein, Carbohydrates, Nucleic acid and lipids as a biochemical techniques in the area of biochemistry.
<b>Course Objective</b>	:	After completion of study of the module you should be able to:- Understand the organic chemical principles in life processes. Understand the structure and function of important biological molecules such as carbohydrates, lipid, protein and DNA. To offer detailed knowledge of biomolecules for living systems. To provide basic concepts of structural organization and characterization of proteins. To learn about Oligosaccharides and lectin interactions in biochemical processes. To acquire knowledge on physicochemical properties and characterization of fats and oils. To understand the structure of DNA and RNA and their types.
<b>Course Outcomes</b>	:	At the end of this course, students will be able to:
	CO1	Understand the chemical and molecular foundations of life and the role of energy rich compound in biological systems.
	CO2	Evaluate the presence of biomolecules by experiments.
	CO3	Remember the structure, properties and roles of biomolecules. (carbohydrates, proteins, lipids and Nucleic acids)
	CO4	Applications like detection of biomolecule using analytical tools.
	CO5	Create a variety of models to understand and explain chemical and biochemical strengths and weakness.

### Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
L	T	P		Theory Marks		Practical Marks		Total Marks
			C	SEE	CIA	SEE	CIA	
3	0	2	4	50	25	50	25	150

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P – Practical, C – Credit, SEE – Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

**Course Content**

Unit No.	Topics	Teaching Hours	Weightage	Mapping With Cos
1	<p><b>Nature and Scope of Biochemistry</b></p> <p>What is biochemistry, development of biochemistry, What is biochemical approach, scope of biochemistry, applications of biochemistry, Biochemical literature (how to conduct a literature search and how to read a research article). Origin of life Living matter, early history, Chemical evolution, Origin of living systems (molecules to first cell), RNA world, development of metabolic pathways, central dogma of life, mutation and evolution .</p> <p>Carbohydrates</p> <p>Structure of monosaccharides, stereoisomerism and optical isomerism of sugars, reactions of aldehydes and ketone groups, ring structure and anomeric forms, mutarotation. Chemical reactions of sugars, important derivatives of monosaccharides, di- and tri-saccharides</p> <p>Structure, occurrence and biological importance of monosaccharides, oligosaccharides and polysaccharides, e.g. glycogen, Starch, cellulose, blood group polysaccharides, inulin, chitin, glycosaminoglycans.</p>	15	33.43%	CO1 CO3 CO4
2	<p><b>Lipids</b></p> <p>Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids. Triacylglycerols: nomenclature, physical properties, chemical properties and characterization of fats - hydrolysis, saponification value, acid value, rancidity of fats, Reichert-Meissel number and reaction of glycerol. Biological significance of fats. Glycerophospholipids (lecithins, lysolecithins, cephalins. Phosphatidyl serine, phosphatidyl inositol, plasmalogens), sphingomyelins, glycolipids -cerebrosides, gangliosides.</p>	10	22.22%	CO1 CO3 CO2 CO4

3	<b>Amino Acids and Proteins</b> <b>Amino Acids:</b> Classification, structure, stereochemistry, chemical reactions of amino acids due to carbonyl and amino groups. Titration curve of glycine and p <sub>x</sub> values. Essential and nonessential amino acids, non-protein amino acids. Peptide bond - nature and conformation. Naturally occurring peptides - glutathione, enkephalin. <b>Proteins:</b> Classification based on solubility, shape and function. Determination of amino acid composition of proteins. General properties of proteins, denaturation and renaturation of proteins. Structural organization of proteins- primary, secondary, tertiary and quaternary structures (Eg. Hemoglobin and Myoglobin).	10	22.22%	CO1 CO3 CO4 CO5
4	<b>Nucleic acids and porphyrins</b> Types of RNA and DNA. Structure of purines and pyrimidines, nucleosides, nucleotides. Stability and formation of phosphodiester linkages. Effect of acids, alkali and nucleases on DNA and RNA. Structure of Nucleic acids- Watson-Crick DNA double helix structure, denaturation and renaturation kinetics of nucleic acids-, T <sub>m</sub> -values and their significance, cot curves and their significance, Introduction to porphyrins with examples	10	22.22%	CO1 CO2 CO3 CO4 CO5

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	20	20	20	-	20	20

NOT: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

#### Suggested List of Experiments/Tutorials

Sr. No.	Name of Experiment/Tutorial	Teaching Hours
1	Biochemical reagent preparations for various solutions with respect to different Normality, Molarity etc	02
2	Preparation of distilled water and water analysis (pH, Hardness, Alkalinity, Nitrite, Chloride).	02
3	Analysis for physical and chemical properties of lipids e.g. solubility, cholesterol reaction, saturation and un saturation of lipids.	02
4	Qualitative tests for monosaccharides, disaccharides, polysaccharides.	02
5	Qualitative analysis of Proteins, Urea, Creatinine, Cholesterol.	02
6	Estimation of amino acid by formal titration.	02



7	Estimation of ascorbic acid by 2,6 dichlorophenol indophenol.	02
8	Estimation of unsaturated fat by iodine value of oil.	02
9	Estimation of sugar from biological fluid by Cole's method.	02
10	Colorimetric estimation of proteins by biuret method.	02
11	Extraction of total lipids by Folch Method.	02
12	Determination saponification value, Acid value of fats.	02
13	Preparation of starch from potato and its hydrolysis by salivary amylase.	02
14	Qualitative tests for sugar mixtures which includes reducing and non-reducing sugars and monosaccharides with mono, di or polysaccharides	02
15	Qualitative analysis of proteins like gelatin, egg albumin and its identification.	02

#### Major Equipment/Instruments and Software Required

Sr. No.	Name of Major Equipment/ Instruments and Software
1	Colori meter
2	Ultraviolet-visible spectroscopy
3	Autoanalyser
4	Electrophoresis
5	Test tube
6	Retorts
7	Crucibles
8	Thermometers
9	Freezer
10	Micro Pipettes
11	pH meter
12	Burettes and volumetric burette
13	Beakers
14	Bulb and graduated pipettes
15	Volumetric flasks.
16	Funnels
17	Desiccators
18	Vials
19	Stirring or glass rods
20	Watch glass
21	Weight balance

#### Suggested Learning Websites

Sr. No.	Name of Website
1	<a href="https://archive.nptel.ac.in/courses/104/103/104103121/">https://archive.nptel.ac.in/courses/104/103/104103121/</a>
2	<a href="https://archive.nptel.ac.in/courses/104/105/104105076/">https://archive.nptel.ac.in/courses/104/105/104105076/</a>

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**Reference Books**

<b>Sr. No.</b>	<b>Name of Reference Books</b>
1	Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
2	Biochemistry – Lehninger – CBS Publishers.
3	Biochemistry – Stryer – W. H. Freeman & Co. – New York.
4	Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
5	Text Book of Medical Physiology – Guyton – Prism Books Pvt. Ltd. – Bangalore.
6	Concise Medical Physiology – Choudhary – New Central Book Agency – Calcutta.
7	Human Physiology, Vol. I & II, - C. C. Chatterjee – Medical Allied Agency – Calcutta.
8	Physical Biochemistry: Applications to Biochemistry and Molecular Biology, David, M. Freifelder, ACS publication, 1983.
9	Laboratory Manual for Practical Biochemistry: Ganesh M. K. & Shivashankara, A. R., Jaypee publications, 2 nd Ed. 2012.
10	A Manual of Laboratory Techniques, MIN, ICMR Publications
11	Jayaraman, J: Laboratory manual in Biochemistry
12	Malhotra VK: Handbook of practical biochemistry
13	Mukherjee L: Medical Laboratory Technology, Vol 1,2,3.
14	Eaton AD, Clesceri LS, Greenberg, AE: Standard methods for the examination of water and waste water (13th ed), (1995).