GUJARAT TECHNOLOGICAL UNIVERSITY
Master of Science (Integrated-Biotechnology)
Semester: I
Subject Name: Biochemistry
Subject Code: 1310402

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	8	8	70	30	30	20	150

Prerequisite:
Biotechnology is one of the new disciplines in applied sciences and has made tremendous progress in the last four decades. In the field of Biotechnology researchers with expertise in diverse areas work towards the unified goal of creating products and techniques for the betterment of society to solve real-life problems. Biochemistry covers a range of scientific disciplines, including genetics, microbiology, forensics, plant science and medicine because of its breadth, biochemistry is very important and advances in this field of science.

Rationale:

It is an important subject of biotechnology that deals with chemistry of biomolecules and cells. It include chemical composition of living cell that and its interaction with surrounding fluid/ environment

Course Content:

Unit No.	Content	No. of Hours	Weightage (%)
1	**The foundations of biochemistry** Elements of life, chemical bonding, covalent, ionic, and weak chemical bonds. Water**:** Unique properties, weak interactions in aqueous systems, ionization of water, buffers, water as a reactant and fitness of the aqueous environment.	5	8
2	**Carbohydrates** Monosaccharaides - structure of aldoses and ketoses, ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers, structure of biologically important sugar derivatives. Formation of disaccharides, reducing and non-reducing disaccharides. Polysaccharides – homo-and hetero polysaccharides, structural and storage polysaccharides. Structure and role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharides). **Metabolism of Carbohydrate** Glycolysis, Gluconeogenesis, Regulation of glycolysis and Gluconeogenesis, Pentose Phosphate Pathway, TCA cycle, ATP Stoichiometry of the TCA Cycle, Regulation of TCA Cycle Activity, Glyoxylate Cycle	15	25
3	**Amino Acids and Proteins** Amino acids as building blocks of Proteins, Structure and classification ,essential and nonessential amino acids , physical,	15	25

	chemical and optical properties of amino acids. Classification of proteins, solubility criteria: salting in and out of protein. Primary, secondary, tertiary and quaternary structure of proteins, fibrous proteins such as keratin, collagen, and globular proteins such as haemoglobin and myoglobin, Protein denaturation. Determination of sequence of proteins **Amino acid Metabolism** Source of amino acid, Protein turn over, Transamination and deamination reaction, metabolism of ammonia, urea cycle and its regulation, link between urea cycle and TCA cycle.		
4	**Nucleic acids and Vitamins** Nucleotides - structure and properties. Nucleic acid structure – Watson-Crick model of DNA. Structure of major species of RNA -mRNA, tRNA and rRNA. Nucleic acid chemistry- UV absorption, effect of acid and alkali on DNA. Other functions of nucleotides -source of energy, component of coenzymes, second messengers. Nucleic acid as the genetic material (Griffith's experiment, Avery, MacLeod and McCarty's experiment, Hershey-Chase experiment), RNA as genetic material in viruses. Vitamins: Structure and active forms of water soluble and fat soluble vitamins, deficiency diseases and symptoms, hypervitaminosis. **Metabolism of Nucleic acid** Biosynthesis of purines and pyrimidines, Degradation of purines and pyrimidines, Regulation of purines and pyrimidines biosynthesis.	15	25
5	**Basics of Bioenergetics** Energy transformation, Laws of thermodynamics, entropy, free energy of reaction, Biological oxidation-reduction reactions, standard redox potentials, Hydrolysis of energy rich intermediates and ATP ,Respiratory transport, Electron Transport and Proton pump, Oxidative Phosphorylation and ATP synthesis, conformational changes and chemiosmotic theory, central dogma of energy transduction.	10	17
	Total Hours:	60	

Textbook:

1. Principles of Biochemistry. Nelson, D.L., Cox, M.M. 4th Edition, WH Freeman and Company, New York, USA.2004.
2. Biochemistry. U. Satyanarayan. 5th Edition. Elsevier, 2017.

Reference Books:

1. Fundamentals of Biochemistry: Life at the Molecular Level. D. Voet, J. G. Voet, and C. Pratt. Wiley publication, 2016.
2. Harper's Biochemistry: Harper, 27th Edition, McGraw-Hill Publishing Co; Robert K. Murray, Daryl K. Granner, Victor W. Rodwell, 2006.

Course Outcomes:

No.	Course Outcomes	RBT Level*
1	Understand chemical and physical characters of biomolecules to be known to the students.	RM,UN
2	Learn the structure, classification and functions of Carbohydrates, Lipid, Protein ,Nucleic acid and vitamins	RM,UN,AN
3	Understand and can apply bioenergetics and metabolism of biomolecule for energy production	RM,UN, AP

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List:

1. Identification of biomolecules: Carbohydrate, Protein & lipid.
2. Qualitative analysis of carbohydrates
3. Qualitative analysis of proteins
4. Estimation of protein.
5. Estimation of carbohydrate
6. Estimation of DNA by spectrometry

List of Laboratory/Learning Resources Required:

1. https://onlinecourses.nptel.ac.in/noc22_cy06/preview
2. https://onlinecourses.swayam2.ac.in/cec22_cy03/preview