

# GUJARAT TECHNOLOGICAL UNIVERSITY

## BIOTECHNOLOGY (04)

BASIC BIOCHEMISTRY

SUBJECT CODE: 2130403

B.E. 3<sup>rd</sup> Semester

**Type of course:** B.E. (Biotechnology)

**Prerequisite:** Basic Concepts of Chemistry and Biology

**Rationale:** It is basic subject for the students of Bio-technology. Biotechnology deals with micro- and macro-molecules which carry out all the functions in the organism. Study of these molecules is important for research related to study of action of these molecules and metabolic diseases related to these molecules.

### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	3	6	70	20	10	20	10	20	150

### Contents:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	<b>UNIT I - Carbohydrates</b> <b>Introduction and overview</b> <b>Structure, Classification and Properties:</b> Monosaccharides, Disaccharides, Polysaccharides, Glycoconjugates. <b>Metabolism:</b> Glycolysis, TCA cycle, Electron Transport chain and Oxidative Phosphorylation, Pentose Phosphate Pathway, Gluconeogenesis, Glycogen synthesis and breakdown, Glyoxalate Pathway. <b>Metabolic Disorders</b>	16	33
2	<b>UNIT II - Amino acids and Proteins</b> <b>Amino acids:</b> Structure, Physical and Chemical properties, Classification <b>Proteins:</b> Structure, Classification and Forces involved in stability of proteins <b>Metabolism:</b> Protein digestion and degradation, Urea cycle	8	17
3	<b>UNIT III – Lipids</b> <b>Lipids</b> – Biological significance, Structure and classification (simple, compound, derived and lipid associated compounds) <b>Metabolism</b> – Transport and digestion of fats, Beta oxidation of saturated fatty acids, Beta oxidation of	9	18

	unsaturated (mono – and poly -) fatty acids, Beta oxidation of odd number fatty acids, Lipid biosynthesis <b>Metabolic Disorders</b>		
4	<b>UNIT IV – Nucleic acids</b> <b>Nucleic acid</b> – Basic components, Structure and types <b>Metabolism</b> - Purine synthesis and degradation, Pyrimidine synthesis and degradation	8	17
5	<b>UNIT V – Vitamins, Minerals and Water</b> <b>Vitamins</b> – Fat soluble and Water soluble <b>Minerals</b> – Macro and micro elements <b>Water</b> - Properties of water and Ionization of water, weak acids, weak bases	7	15

### Reference Books:

1. Lehninger's Principles of Biochemistry by David L. Nelson and Michael M Cox, Macmillan Worth Publisher
2. Lubert Stryer, Biochemistry, 4th Edition, WH Freeman & Co., 2000.
3. Voet and Voet, Biochemistry, 2nd Edition, John Wiley & Sons Inc., 1995.
4. Murray, R.K., Granner, B.K., Mayes, P.A., Rodwell. V.W., Harper's Biochemistry, Prentice Hall International.
5. Creighton. T.E., Proteins, Structure and Molecular Properties, 2nd Edition, W.H. Freeman and Co., 1993

### Course Outcome:

After learning the course the students should be able:

1. Understanding of the key principles of Biochemistry at a basic level.
2. To analyze scientific concepts and think critically.
3. To understand, explain and correlate the reactions in biomolecules.
4. To design and carry out experiments (safely) and to interpret experimental data

### List of Experiments and Open Ended Projects:

Minimum **5** practicals to be performed and remaining Open-ended Projects / Study Reports / Latest outcomes in technology study:-

1. In the beginning of the academic term, faculties will have to allot their students at least one Open-ended Projects / Study Reports / Latest outcome in technology.
2. Literature survey including patents and research papers of Biochemistry
  - Design based small project **or**
  - Study report based on latest scientific development **or**
  - Technology study report/ modeling/ simulation/collection report **or**
  - Computer based simulation/ web based application/ analysis presentations of basic concept field which may help them in Biotechnology.
3. These can be done in a group containing maximum **three** students in each.
4. Faculties should cultivate problem based project to enhance the basic mental and technical level of students.
5. Evaluation should be done on **approach of the student on his/her efforts** (not on completion) to study the design module of given task.
6. In the semester student should perform **minimum 5** set of experiments and complete **one small open ended dedicated project** based on engineering applications. This project along with any performed experiment should be **EVALUATED BY EXTERNAL EXAMINER.**

**PRACTICALS (ANY FIVE):**

Sr. No.	List of Experiments
1.	Preparation of standard solutions and buffers.
2.	Estimation of monosaccharides and disaccharides by Cole's method.
3.	Estimation of starch by Anthrone method.
4.	Estimation of ketose sugar by Roe's method.
5.	Estimation of free fatty acid content of lipid.
6.	Estimation of amino acids by Ninhydrin test.
7.	Qualitative tests for carbohydrates.
8.	Qualitative tests of amino acids
9.	Comparing different methods of protein estimation.
10.	Estimation of reducing sugar by DNSA method
11.	Estimation of reducing sugar by Nelson Somogii's method

**Major Equipments:**

Spectrophotometer, Colorimeter

**Open Ended Project fields:-**

**Students are free to select any area of Basic Biochemistry** based on Biotechnological application to define Projects. Some suggested projects are listed below:

- Qualitative and quantitative analysis of components of raw food for:
  1. Carbohydrate
  2. Amino acid
  3. Lipid
  4. Starch

List of Open Source Software/learning website:

- 1) Literature available in any laboratory manual of Basic Biochemistry.
- 2) NPTEL
- 3) MIT Open course lecture on Biochemistry.

**ACTIVE LEARNING ASSIGNMENTS:** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.