GUJARAT TECHNOLOGICAL UNIVERSITY

BIO TECHNOLOGY (04)
BIOCHEMICAL CALCULATIONS
SUBJECT CODE: 2180409
B.E. 8th SEMESTER

Type of course: B.E. (Biotechnology)

Prerequisite: Basic concept of Biochemistry and Biochemical Engineering

Rationale:

The objective of this course is to introduce the students to the mathematical aspects of biochemistry.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	2	0	6	70	20	10	30	0	20	150

Course Contents:

Sr. No.	Topics	Teaching Hours	Module Weightage
1	**UNIT I: Acid Base Chemistry:** Aqueous solutions, Equillibrium constants, Acids and Bases, Laboratory Buffers, Amino acids and peptides, Blood Buffers, Practice Problems	**10**	**16%**
2	**UNIT II: Chemistry of Biological Molecules:** Amino acids, peptides and proteins, Carbohydrates, Lipids, Nucleotides and Nucleic acids, Practice Problems	**10**	**16%**
3.	**UNIT III: Biochemical Energetics:** Energy yielding and energy requiring reactions, Calculations of Equillibrium Concentrations, Oxidation Reduction Reactions, Metabolism and ATP yield, Photosynthetic phosphorylation, Active Transport, Enthalpy and Entropy, Activation Energy, Practice Problem	**18**	**27%**
4.	**UNIT IV: Enzymes:** Enzymes as Biological Catalysts, enzyme kinetics, reaction order, methods of plotting enzyme kinetics data, enzyme inhibition, effect of pH on enzyme stability and activity, enzyme assays, multisubstrate enzymes and kinetic mechanisms, multisite and allosteric enzymes, enzyme turnover, Practice problems	**16**	**25%**

5.	**UNIT V: Spectrophotometry and other optical methods:** Spectrophotometry, Fluorometry, Optical Rotation, Practice Problems	**10**	**16%**

Suggested Specification table with marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
12	15	15	10	10	8

Legends: R= Remembrance**; U=** Understanding**; A=** Application**; N =** Analyze**;**
E = Evaluate; **C** = Create and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Biochemical Calculations by Irwin Segel, Wiley India Publications
2. Lehninger's Principles of Biochemistry by David L. Nelson and Michael M Cox, Macmillan Worth Publisher
3. Lubert Stryer, Biochemistry, 4th Edition, WH Freeman & Co., 2000.
4. Voet and Voet, Biochemistry, 2nd Edition, John Wiley & Sons Inc., 1995

Course Outcome:

After learning the course, the students should be able to:

1. To understand mathematical aspects of biochemical discoveries.
2. To prepare different solutions and buffers.
3. To analyze and evaluate modern biochemistry completely in a different manner rather than memorizing of structure and pathways.

List of Tutorials:

1. Problems related to concentrations based on volume and weight
2. Tutorial based on acid – base ionization and calculations of pH
3. Preparation of buffers
4. Concept and numericals related to oxidation and reduction reactions
5. Problems related to molecular weight determination.
6. Problems related to carbohydrates, lipids and nucleic acids
7. Basic concepts of thermodynamics and free energy
8. Problems related to enzyme kinetics
9. Problems related to spectrophotometry

List of Open Source Software/learning website:

Students can refer to video lectures available on the websites including NPTEL. Students can refer to the CDs which are available with some reference books.

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.