

GUJARAT TECHNOLOGICAL UNIVERSITY
BIO-TECHNOLOGY
B. E. SEMESTER: VII

Subject Name: **Enzymes and Proteins**

Subject Code: **170401**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
4	0	3	7	70	30	30	20

PART– [I] ENZYMES

Sr. No	Course Content	Total Hrs.
1.	Introduction Classification of enzymes. Mechanisms of enzyme action; concept of active site and energetics of enzyme substrate complex formation; specificity of enzyme action; principles of catalysis – collision theory, transition state theory; role of entropy in catalysis	5
2.	Kinetics of Enzyme Action: Kinetics of single substrate reactions; estimation of Michelis – Menten parameters, multi substrate reactions- mechanisms and kinetics; turnover number; types of inhibition & models –substrate, product. Allosteric regulation of enzymes, Monod changeux wyman model, ph and temperature effect on enzymes & deactivation kinetics.	8
3.	Enzyme Immobilization: Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages. Analysis of Film and Pore Diffusion Effects on Kinetics of immobilized Enzyme Reactions; Formulation of dimensionless group and calculation of Effectiveness Factors	5
4.	Purification and Characterization of Enzymes from Natural Sources Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods of characterization of enzymes; development of enzymatic assays. Commercial application of enzymes in food,	6

	pharmaceutical and other industries; Enzymes for analytical and diagnostic applications	
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PART [III] PROTEINS

5.	The Ribosome-The Fulcrum of Genomics Introduction, The genetic code, The biological context of protein synthesis- the basis of evolution	2
6.	Genomics and Proteomics Genome sequences, Gene sequences Determine amino acid sequences, Amino acid sequences determine protein structures, A survey of protein structures and functions Protein folding patterns, Modular structure of proteins ,Protein evolution, Integration and control of protein function, Protein expression patterns in space and time: proteomics, Computing in protein science-brief.	8
7.	The Chemical Structure and Activity of Proteins The polypeptide chain and protein conformation, The amino acids,Protein main chain conformation,Side chain conformation,Stabilization of the native state,Spectroscopic methods of characterizing proteins in solution,Protein structure determination,Protein-ligand interaction,Catalysis by enzyme,Conformational change,Control of protein activity,Control of protein function: allosteric regulation	10
8.	Evolution of Protein Structure and Function 1. Introduction: Secondary ,tertiary and quaternary structure 2. Classification of protein folding patterns 3. Structural relationships among homologous proteins 4. Evolution of globins,Evolution of DNA-binding domains of dehydrogenases 5. Evolution of visual pigments and related molecules 6. How do proteins evolve new functions?, Classification of protein functions	8
9.	Protein Engineering, Folding , Prediction and Design 1. The significance of protein engineering 2. Protein folding – including Thermodynamics and kinetics-key concepts 3. The effect of denaturants on rates of folding and unfolding: chevron plots 4. The molten globule ,Folding funnels	10

	5. Protein misfolding and GroEL-GroES chaperone protein 6. Idea of Protein design	
10.	Proteins With Partners General properties of protein-protein interfaces, Multisubunit protein, Protein-DNA interactions, Overview of Proteins in Disease	2-3

List of Practicals:

1. Isolation and purification of Amylase from Bacterial Species.
2. Assay of acid phosphatase or alkaline phosphatase
3. Enzyme curve analysis and Substrate saturation kinetics of amylase
4. Obtain temperature optima of enzyme α -amylase
5. Thermo stability of enzyme α -amylase.
6. Assay the enzyme activity of invertase
7. The effect of pH on amylase activity
8. The effect of inhibitor(HgCl_2) on amylase
9. Immobilize enzyme (invertase) by gel-entrapment method
10. To perform SDS page of given protein sample.
11. To perform Western Blotting.
12. To perform 2D page Electrophoresis.
13. To study the effect of Chemical agents on Protein Denaturation –Renaturation Kinetics.
14. To study the effect of Physical agents on Protein Denaturation –Renaturation Kinetics.

Text Book (Enzymes):

1. T.Palmer, ENZYMES, First Edn., EW Press

Text Book (Proteins):

1. Arther M. Lesk , Introduction to Protein science: Architecture, Function and Genomics, OXFORD University Press, Second Edition.

Reference Books:

1. Buchholz-Kasche, Biocatalysts and Enzyme Technology, WILEY-VCH, First Ed.
2. (Edited by) W.Aehle, Enzymes in Industry, WILEY-VCH, First Edn.
3. Harvey W. Blanch, Douglas S. Clark, "Biochemical Engineering", Marcel Dekker, Inc
4. James. E. Bailey & David F. Ollis, "Biochemical Engineering Fundamentals", McGraw-Hill.
5. Wiseman, "Enzyme Biotechnology", Ellis Horwood Pub.
6. James M. Lee, "Biochemical Engineering", PHI, USA.
7. Moody PCE, and A J WILKINSON, "Protein Engineering", IRL Press, Oxford, 1990
8. Creighton TE, Proteins, Freeman WH, Second Edition 1993.
9. Branden C, Tooze R, "Introduction of Protein Structure", Garland, 1993.