GUJARAT TECHNOLOGICAL UNIVERSITY
Master of Science (Integrated-Biotechnology)
Semester: 2
Subject Name: Biophysical Techniques
Subject Code: 1320401

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:
Students need to have some basic knowledge of basic physics and the principals of basic physics.

Rationale:
This course is designed for the students to identify the molecules present in living cells. This would help in gaining the deep knowledge on application of techniques for research purposes also.

Course Content:

Unit No.	Content	No. of Hours	Weightage (%)
1	**General Biophysical methods** Measurement of pH, Radioactive labelling& counting, Autoradiography	4	6
2	**Chromatography and electrophoresis** Concept of Chromatography (Partition Chromatography, Paper Chromatography, Adsorption Chromatography, TLC, GLC, Ion Exchange Chromatography, Gel Chromatography, HPLC, Affinity Chromatography) Electrophoresis: Principle of electrophoresis, experimental setup, methodologyand application (Gel Electrophoresis, Paper Electrophoresis, capillary electrophoresis, isoelectrofocusing)	15	25
3	**Centrifugation** Basic Principle of Centrifugation, Instrumentation of Ultracentrifuge (Preparative, Analytical), Factors affecting Sedimentation velocity, Standard Sedimentation Coefficient, Centrifugation of associating systems, Rate-Zonal centrifugation, sedimentation equilibrium Centrifugation.	13	22
4	**Microscopyand X-Ray Crystallography** Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase Contrast microscopy, TEM, SEM. X-Ray Crystallography: X-ray diffraction, Bragg equation, Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure (concept of rotating crystal method, powder method)	15	25
5	**Spectroscopy** Raman Spectroscopy – What is Raman effect, Quantum mechanical reason of Raman effect, Molecular Polarizability,	13	22

	Polarizability ellipsoid, Experimental technique of Raman effect, Basic concept of Pure Rotational & Vibrational, and Raman spectra of simple molecule (linear molecule). NMR Spectroscopy – Basic principle of NMR spectroscopy, Experimental technique & instrumentation, Chemical shift, Hyperfine splitting, Relaxation process. Absorption Spectroscopy – Simple theory of the absorption of light by molecules, Beer-Lambert law, Instrumentation for measuring the absorbance of visible light, Factors affecting the absorption properties of a Chromophore		
	Total Hours:	60	

Textbook:

1. Bioanalytical Techniques by Abhilasha Shourie and Shilpa S. Chapadgaonkar. Teri Press. 2009.
2. Fundamentals of Bioanalytical Techniques and Instrumentation by Sabri Ghoshal and A. K. Shrivastava. Prentice Hall India Learning Private Limited 2009.

Reference Books:

1. Biophysical Chemistry Principles and Techniques by Upadhyay, Upadhyay and Nath.
2. Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker.

Course Outcomes:

No.	Course Outcomes	RBT Level*
1	The students will be able to learn the basic techniques used to separate and analyze biomolecules	RM,UN,AP
2	Students will be able to understand the instrumentation and applications of a range of bioanalytical techniques	RM ,UN, AP

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

Suggested Course Practical List (Biophysical Techniques:

1. Introduction and calibration of pH meter
2. Introduction to microscopy
3. Introduction to Centrifuge Paper Chromatography
4. Separation of amino acids by TLC
5. Structure of animal and plant cell (through chart/model)
6. Observation of Prokaryotic and Eukaryotic cells (plant and animal cells)

Structure of cell organelles adopting preparations/charts/models

- Mitochondria
- Chloroplast
- Ribosomes
- Nucleus

7. Mitosis

List of Laboratory/Learning Resources Required

1. https://nptel.ac.in/courses/1021030832
2. https://www.mooc-list.com/tags/spectroscopy