



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Bachelor of Science**

**Level: Under Graduate**

**Branch Name: Honors/ Honors With Research (Biotechnology)**

**Course / Subject Code: BS02001031**

**Course / Subject Name: Biophysical Techniques**

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Minor Elective Subject

<b>Prerequisite:</b>	Students in previous classes must studied about the different kinds of nucleic acid. They have basic knowledge about the fundamentals of biochemistry and genetics
<b>Rationale:</b>	Molecular biology is the branch science that deals with the molecular basis of living cells. This will allow students to understand the molecules present in living cells and their role in the functioning of life

### Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	70	30	30	200

### Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	<b>General Biophysical methods</b> Measurement of pH, Radioactive labelling& counting, Autoradiography,	5	15
2	<b>Chromatography and electrophoresis</b> 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, methodology and application (Gel Electrophoresis, Paper Electrophoresis, capillary electrophoresis, isoelectrofocusing)	10	21
3	<b>Centrifugation</b> Basic Principle of Centrifugation, Instrumentation of Ultracentrifuge (Preparative, Analytical), Factors affecting	10	21



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	Sedimentation velocity, Standard Sedimentation Coefficient, Centrifugation of associating systems, Rate-Zonal centrifugation, sedimentation equilibrium Centrifugation..		
<b>4</b>	<b>Microscopy and X-Ray Crystallography</b> 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)	<b>10</b>	<b>22</b>
<b>5</b>	<b>Spectroscopy</b> Raman Spectroscopy – What is Raman effect, Quantum mechanical reason of Raman effect, Molecular Polarizability, 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	<b>10</b>	<b>20</b>
	<b>Total</b>	<b>45</b>	

## Reference Books:

1. Molecular Biology of the cell by Albert et al. 4th Edition, Garland Science, Taylor & Francis Group. 2002.
2. Cell Biology by C.B. Powar. Himalaya Publishing House, Mumbai. 2004.
3. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by P.S. Verma and V.K. Agarwal. S.Chand & Company Ltd. Ram Nagar, New Delhi. 2007

## List of Experiments: (Minimum 6 experiments need to be performed)

1. Nucleus staining visualization in Bright Field Microscope
2. Mitosis and Meiosis: Observation through Prepared Slides
3. Cell staining and counting: Haemocytometer
4. Nucleus staining and visualization in Fluorescent microscope
5. Cell fractionation using density gradient



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6. Bacterial cell wall staining
7. Microscopic visualization of prokaryotic and eukaryotic cells (Plant & animal cells)
8. MTT assay
9. Effect of hyper, hypo and isotonic solvent on cell morphology
10. Mitosis in onion root tip

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