



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Science

Level: Under Graduate

Branch Name: Honors/ Honors With Research (Biotechnology)

Course / Subject Code: BS04001031

Course / Subject Name: Bioinformatics

W.e.f. Academic Year:	2025-26
Semester:	4
Category of the Course:	Core Courses

Prerequisite:

Students should have a foundational understanding of biology, particularly molecular biology, genetics, and cellular biology. Familiarity with DNA, RNA, proteins, and basic genetic principles like Mendelian inheritance, gene expression, and protein synthesis will be essential for understanding bioinformatics concepts.

Rationale:

This course is designed to equip undergraduate students with both theoretical knowledge and practical skills in bioinformatics, enabling them to analyze biological data using computational methods.

Course Scheme :

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

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	Unit 1: Introduction to Bioinformatics: Basic Concepts of Bioinformatics: Definition, scope, and applications of bioinformatics in biology and medicine. Components of Bioinformatics: Databases (GenBank, PDB, etc.), bioinformatics tools, and algorithms. History and Evolution of Bioinformatics: Key milestones and contributors in the field.	10	20
2	Sequence Analysis and Alignment: DNA, RNA, and Protein Sequences: Understanding sequence formats (FASTA, GenBank). Sequence Alignment: Pairwise and multiple sequence alignments (global and local). Algorithms for Sequence Alignment: Needleman-Wunsch, Smith-Waterman, and ClustalW. BLAST (Basic Local Alignment Search Tool): Introduction to BLAST and its applications for sequence comparison.	15	35



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3	Structural Bioinformatics: Protein Structure: Primary, secondary, tertiary, and quaternary structures. Structural Databases: PDB, SCOP, and CATH for protein structures. Molecular Modeling: Introduction to protein structure prediction and modeling. Protein Structure Visualization: Using software like PyMOL or Chimera to visualize 3D structures.	10	25
4	Phylogeny: Molecular clock hypothesis, Molecular Phylogeny, Tree Nomenclature, Phylogenetic Analysis.	5	10
5	Introduction to Omics: Genomics, Proteomics, Transcriptomics and its applications.	5	10

Reference Books:

1. David W. Mount Bioinformatics Sequence and Genome analysis, Cold Spring Harbor Laboratory Press, New York
2. A.D. Baxevanis and B.F.F. Ouellette (Eds). Bioinformatics: a Practical Guide to the Analysis of Genes and Proteins John Wiley and Sons

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
1	Understands the fundamentals of Bioinformatics, perform analysis	UN, RM, AN
2	Building logical step-by-step solutions to solve biological data handling/ analyses problems.	UN, AN
3	Assess the role of bioinformatics in Genome analysis, systems biology and drug discovery.	AN, EL

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

List of Experiments:

1. Biological Database Exploration, and sequence Retrieval
2. Sequence Alignment (pairwise and MSA)
3. Exploration of protein databases
4. Protein structure visualization(pymol/rasmol)
5. Protein structure prediction
6. Construction of phylogenetic tree
