



बिरसा मुंडा ट्रायबल युनिवर्सिटी Birsā Mūṇḁā Ḍāyabala Yūnīvārsīṭī

राजपिपला, जि. नर्मदा Rajpipla, Dist. Narmada

Established by Tribal Development Department, Govt. of Gujarat

School of Science

B.Sc. (Zoology) Programme

Subject Code & Name: BS05SEZOO1 Bioinformatics

Teaching and Evaluation Scheme:

Teaching Scheme				Examination Scheme			
Credits				Component Weightage			
				CCE		SEE	
L	T	P	Total	TH	PWE	TH	PWE
2	-	-	2	50 %	-	50 %	-

Programme Name	B.Sc. Zoology
Semester	V
Course Code	BS05SEZOO1
Course Title	Bioinformatics
Course Content Type (Th./Pr.)	Theory
Course Credit	2
Sessions + Lab. Per Week	2
Total Teaching/Lab. Hours	30 Theory Hours

Learning Objectives

- Concepts: Define the scope of bioinformatics and the legacy of the Human Genome Project.
- Algorithms: Master sequence alignment (Pairwise/MSA), scoring matrices, and phylogeny.
- Data Management: Identify and navigate primary, secondary, and structural databases.
- Pharmacology: Understand the pipeline of drug discovery, SAR/QSAR, and molecular docking.
- Integration: Apply computational tools to solve problems in biotechnology and medicine.

Prerequisites (if any)

- Student should have fundamental knowledge of Molecular Biology: Understanding of the Central Dogma (DNA → RNA → Protein) and Basic Computing: Ability to handle biological data formats (e.g., FASTA) and web-tools.

Learning Outcomes

After completing this course, students will be able to:

- This curriculum integrates computational tools with biological data, enabling learners to master sequence alignment via BLAST and Clustal W while navigating global databases like GenBank and UniProt.
- Through structural analysis and evolutionary mapping, students will use frameworks such as CATH, SCOP, and DALI to categorize proteins and interpret phylogenetic relationships.
- The program emphasizes drug discovery, training learners to predict molecular interactions and design optimized lead compounds with minimal side effects.
- Ultimately, these skills are applied to solve complex challenges across diverse fields, including agriculture, neurobiology, and clinical genomics.





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Detailed Contents		
UNIT	TOPIC/SUB-TOPIC	TEACHING HOURS
I	Fundamentals of Bioinformatics: • Nature and scope of Bioinformatics • Branches of Bioinformatics • Human Genome Project (HGP) • Bioinformatics tools: BLAST and FASTA • Pairwise sequence alignment: Global and Local alignment, • Sequence analysis and Phylogeny – sequence search alignment-pair wise and multiple sequence. Scoring matrices. Introduction to Phylogenetic Trees. Introduction to drug discovery: • Structure based drug design. Docking. Classical SAR / QSAR. • Structure of commonly used drugs in medical field. • New drug design for cancer. • Identification of novel drug design with least side effect.	15
II	Important Biological Databases and Applications of Bioinformatics: • Nucleic acid sequence databases: GenBank, EMBL, DDBJ. • Protein sequence databases: SWISS-PROT, TrEMBL, PIR_PSD. • Genome Databases with special reference to model organisms (Yeast, <i>Drosophila</i>, <i>C. elegans</i>, Rat, Mouse) Human, plants such as <i>Arabidopsis thaliana</i>, Rice, etc. • Derived Databases: Prosite, PRODOM, Pfam, PRINTS. • Composite databases – NRDB, OWL, and Pattern databases. • Other Databases: PDB- Structural database, • Protein structural classification databases: CATH & SCOP. • Metabolic pathway database - KEGG, Secondary structure assignments - DSSP, Comparing 3D structure - DALI. Applications of Bioinformatics in various fields: • Environment, Biotechnology, Molecular Biology, Neurobiology, Agriculture, Drug Designing, Biomedical Genome Medicines, Medical Microbiology.	15





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Text Book(s)

1. Bioinformatics: Methods and Applications by S.C. Rastogi, N. Mendiratta, and P. Rastogi
2. Bioinformatics: Concepts, Skills & Applications by S.C. Rastogi
3. Fundamentals of Bioinformatics by S. Harisha
4. Bioinformatics by C.S.V. Murthy
5. Introduction to Bioinformatics by S. Sundararajan and Balaji

Reference Books

1. Introduction to Bioinformatics by Arthur M. Lesk
2. Bioinformatics: Sequence and Genome Analysis by David W. Mount
3. Bioinformatics: Principles and Applications by Zhumur Ghosh and Bibekanand Mallick
4. Instant notes - Bioinformatics by Westhead, Howard parish and Twyman.
5. Bioinformatics: Methods and Applications Dev Bukhsh Singh and Rajesh Kumar Pathak
6. Bioinformatics: Experiments, Tools, Databases and Algorithms by Orpita Bosu and Simminder Kaur Thukral
7. Bioinformatics: Theory and Practice by N. Ch. S. N. Iyengar

Web Resources

- NCBI (National Center for Biotechnology Information), <https://www.ncbi.nlm.nih.gov>
- EMBL-EBI (European Bioinformatics Institute), <https://www.ebi.ac.uk>
- ExPASy (SIB Bioinformatics Resource Portal), <https://www.expasy.org>
- UniProt (Universal Protein Resource), <https://www.uniprot.org>
- RCSB PDB (Protein Data Bank), <https://www.rcsb.org>
- Ensembl Genome Browser, <https://www.ensembl.org>
- BLAST (Basic Local Alignment Search Tool), <https://blast.ncbi.nlm.nih.gov>

L:: Lecture, **T::** Tutorial , **P::** Practical

CCE:: Continuous and Comprehensive Evaluation

(CCE Theory includes Mid Semester Examination, Assignment, MCQ quizzes, Seminar, Reflective notes, class participation, case analysis and presentation, slip tests (announced/ surprised), attendance etc. or any combination of these)

PWE:: Practical Work Examination

(PWE includes Laboratory practical work, project work, viva simulation exercise work etc.)

SEE:: Semester End Evaluation

