

Course Code	Course Name	Credits
26BY106	BIOINFORMATICS AND ARTIFICIAL INTELLIGENCE IN BIOLOGICAL DATA ANALYSIS	04

Course Objectives

- Explain the scope, significance, and applications of bioinformatics in biological sciences.
- Retrieve and analyze biological information from major bioinformatics databases.
- Perform sequence comparison and alignment using standard bioinformatics tools.
- Describe the applications of artificial intelligence and bioinformatics in genomics, crop improvement, plant disease detection, and drug discovery.

Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Identify biological databases and retrieve nucleotide and protein sequence data.
- Explain sequence alignment techniques and substitution matrices used in bioinformatics.
- Use bioinformatics tools such as BLAST and ClustalW for sequence analysis.
- Explain the role of artificial intelligence in biological data analysis and plant research.

Unit 1 - Introduction to Bioinformatics (12 Hrs.)

Scope and significance of bioinformatics in biological sciences. Types of biological data and biological data formats (FASTA, PDB). Biological data mining and analysis. Introduction to bioinformatics tools used for biological data analysis.

Unit 2 – Biological Databases (12 Hrs.)

Online biological databases and data organization. NCBI resources. Nucleic acid sequence databases – GenBank, EMBL and DDBJ. Protein sequence databases – SWISS-PROT and UniProt. Structural databases – Protein Data Bank (PDB).

Unit 3 - Biological Databases (12 Hrs.)

Online biological databases and data organization. NCBI resources. Nucleic acid sequence databases – GenBank, EMBL and DDBJ. Protein sequence databases – SWISS-PROT and UniProt. Structural databases – Protein Data Bank (PDB).

Unit 4 – Multiple Sequence Alignment and Phylogenetic Analysis (12 Hrs.)

Multiple sequence alignment using tools such as ClustalW. Phylogenetic analysis and evolutionary relationships using software tools such as MEGA.

Unit 5 – Artificial Intelligence in Bioinformatics (12 Hrs.)

Introduction to artificial intelligence and machine learning in biological sciences. AI applications in genomics and proteomics. AI-based gene prediction and protein structure prediction. Applications of bioinformatics and AI in crop improvement, plant disease detection, drug discovery, and precision agriculture.

Reference Books:

1. Lesk, A. M. (2019). *Introduction to Bioinformatics*, 5th Edition. Oxford University Press.
2. Mount, D. W. (2017). *Bioinformatics: Sequence and Genome Analysis*, 2nd Edition. Cold Spring Harbor Laboratory Press.
3. Baxevanis, A. D., & Ouellette, B. F. F. (2020). *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*. Wiley.
4. Pevsner, J. (2015). *Bioinformatics and Functional Genomics*, 3rd Edition. Wiley-Blackwell.
5. Xiong, J. (2021). *Essential Bioinformatics*. Cambridge University Press.
6. Zou, J. et al. (2019). *A Primer on Deep Learning in Genomics*. Nature Genetics.