

Devi Ahilya University, Indore, India Institute of Engineering & Technology				IIIYear B.E. (Computer Engg.) (Full Time)			
Subject Code & Name	Instructions Hours per Week			Credits			
CER6E3	L	T	P	L	T	P	Total
Bioinformatics	3	1	2	3	1	1	5
Duration of Theory Paper:3 Hours							

Learning Objectives:

The objective of the course is to introduce students to the rapidly evolving field of bioinformatics. The term "bioinformatics" often means different things to different scientists, and our goal is not to cover all those things. Rather, we will aim to cover in the lectures the most fundamental topics.

Pre requisites: Although there are no strict prerequisites, the course requires some familiarity with molecular biology (what is a gene? a protein?) and some comfort level with probability and statistics (what is standard deviation? a probability distribution?).

COURSE OF CONTENTS

Unit 1:

Introduction - Bioinformatics – Overview and Definitions, Applications, Major Databases in Bioinformatics, Data Management and Analysis, Molecular Biology and Bioinformatics, Central Dogma of Molecular Biology.

Unit 2:

Information Search and Data Retrieval - Introduction, Tools for Web Search, Data Retrieval Tools, Data Mining of Biological Databases.

Genome Analysis and Gene Mapping - Genome Analysis, Genome Mapping, The Sequence Assembly Problem, Genetic Mapping and Linkage Analysis, Physical Maps, Cloning the Entire Genome, Genome Sequencing.

Unit 3:

Alignment of Pairs of Sequences - Biological Motivation of Alignment Problems, Methods of Sequence Alignments, Dynamic programming, global (Needleman-Wunsch) and local (Smith-Waterman) alignments. Using Scoring matrices (PAM and BLOSUM families), Measuring Sequence Detection Efficiency

Tools for Similarity Search and Sequence Alignment - Working with FASTA, BLAST, Filtering and Gapped BLAST, FASTA and BLAST Algorithms Comparison.

Unit 4:

Multiple sequence alignment, Sequence Logos. Phylogenetics, gene prediction,

Gene Expression Microarrays - DNA Microarrays, Clustering Gene Expression Profiles, Data Sources and Tools for Microarray Analysis, Applications of Microarray Technology.

Unit 5:

Protein Classification and Structure Visualization - Overview of Protein Structure, Visualization, Structure based Protein Classification, Protein Structure Databases, Tools, Protein Structure Alignment.

Protein Structure Prediction - Protein Identification and Characterization, Primary Structure analysis and Prediction, Secondary Structure Analysis and Prediction, Motifs, Profiles, Patterns and Fingerprints Search, Methods for Sequence based Protein Prediction.

Learning Outcomes

After completing this course, the students will gain an understanding of the computational challenges (and their solutions) in the analysis of large biological data sets; they will understand how some of the commonly used bioinformatics tools work, how to use these tools effectively, and how to read and evaluate research articles in the field..

RECOMMENDED BOOKS:

- [1] S C Rastogi, N Mndiratta, P Rastogi, Bioinformatics Methods and Applications, Genomics, Proteomics and Drug Discovery, PHI. 2006
- [2] Bryan Bergeron, Bioinformatics Computing, Pearson Education. 2003
- [3] Lesk, A. K., "Introduction to Bioinformatics" 4th Edition, Oxford University Press, 2013
- [4] Dan Gusfield, "Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology" Cambridge University Press, 1997.
- [5] Durbin, R., Eddy, S., Krogh, A., and Mitchison, G., "Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids" Cambridge, UK: Cambridge University Press, 1998.
- [6] Mount, D.W., "Bioinformatics Sequence and Genome Analysis" 2nd Edition, Cold Spring Harbor Laboratory Press, 2004
- [7] Tindall, J., "Beginning Perl for Bioinformatics: An introduction to Perl for Biologists" 1st Edition, O'Reilly Media, 2001
- [8] Baldi, P. and Brunak, S., "Bioinformatics: The Machine Learning Approach" 2nd Edition, MIT Press, 2001.