

OPEN ELECTIVE – FUNDAMENTALS OF BIOINFORMATICS

Contact Hours/ Week	: 4	Credits	: 4
Total Lecture Hours	: 48		

Course Outcomes:

- Ability to use popular bioinformatics tools to generate biologically meaningful results
- Ability to interpret biological results generated by a bioinformatics tool
- Application of some basic models and algorithms
- 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

Unit I 12 Hrs

Introduction to Bioinformatics and Biological Database:

Introduction to bioinformatics, Review of DNA replication, transcription, and translation, Genome organization. Review of molecular biology methods. Introduction to DNA and protein databases, data storage, file formats, information retrieval. Nucleotide and Protein sequence and structure databases (NCBI, EMBL, DDBJ and PDB). Focus on GenBank, UniProt, Entrez and Gene Ontology.

Unit II 12 Hrs

Sequence Alignment and Database Similarity Searching:

Pairwise alignment: Alignment algorithm: Pairwise: Dot matrix method, Dynamic programming Method (For both Local and Global Alignment. i.e. Needleman-Wunch & Smith Waterman), Database Similarity Searching: BLAST. BLAST variants.

Unit III 12 Hrs

Multiple sequence alignment and Phylogenetics: Protein Motif and Domain Prediction: Identification of Motif and Domains in MSA. Gene prediction: Gene prediction in prokaryotes and eukaryotic, Molecular Phylogenetics: Phylogenetics Basics, Terminologies, Gene versus species phylogeny, Forms of tree representation

Unit IV 12 Hrs

Secondary structure prediction, Protein structure building (Homology modelling), Protein Structure Visualization: Rasmol, Pymol, Jmol, CN3D, Swiss PDB viewer, Chimera and Discovery studio visualize, **Applications of Bioinformatics:** Bioinformatics in pharmacy: drug discovery process, structure based and ligand based drug design (CADD). Pharmacokinetics: absorption, distribution, metabolism, excretion and toxicity of drugs. Application of Bioinformatics in OMICS.

REFERENCE BOOKS:

- 1 David W Mount “Bioinformatics sequence and Genome analysis”, Cold Spring Harbor Laboratory Press, 2nd Edition, 2013, 9989332257358
- 2 Jin Xiong Essentials Bioinformatics, Cambridge university press, 3rd Edition, 2006, 9789335657325
- 3 Neil C. Jones and Pavel A. Pevzner An Introduction to Bioinformatics Algorithms, MIT Press, 5th Edition, 2005, 8789432449328
- 4 Steffen Schulze-Kremer Molecular Bioinformatics: Algorithms and Applications, Walter de Gruyter, 4th Edition, 1996, 9789432449327
- 5 Attwood T K, D J Parry-Smith Introduction to Bioinformatics, Pearson Education, 3rd Edition, 2005, 9789332447329