

(BM-307) - Bioinformatics

Course Outline:

Theory:

1. **History and evolution of bioinformatics**
 1. Introduction to databases (Database types, Database formats, DNA databases, European Molecular Biology Laboratory (EMBL))
 2. Genomics
 3. Transcriptomics
 4. Computational proteomics
2. **Pairwise Sequence Alignment**
 1. Evolutionary Basis
 2. Sequence Homology versus Sequence Similarity
 3. Sequence Similarity versus Sequence Identity
3. **Database Similarity Searching**
 1. Unique Requirements of Database Searching
 2. Heuristic Database Searching
 3. Basic Local Alignment Search Tool (BLAST)
 4. FASTA
 5. Comparison of FASTA and BLAST
4. **GenBank and DNA Data base of Japan (DDBJ)**
 1. Protein information Resource (PIR) formats
 2. Protein Sequence (databases, SwissProt, UniProt, UniProtKB/TrEMBL)
 3. Structural databases (Protein Databank (PDB), Structural Classification of Proteins (SCOP) database, Class, Architecture, Topology, Homology (CATH) database)
5. **Introduction to Biomolecules**
 1. Computational Biology : Introduction to Bioinformatics
 2. Protein folding and misfolding
 3. Protein Architecture: Sequence of amino acids
 4. protein interaction.
6. **Structures**
 1. Secondary structure of proteins
 2. Tertiary structure of proteins
 3. Nucleic Acid Structure.
7. **DNAs and RNAs**
 1. Interactions and conformations of DNAs.
 2. Interactions and conformations of RNA.
8. **Computer Simulations of biomolecules**
 1. Classical versus quantum descriptions
 2. Statistical mechanics of biomolecules (e.g., canonical ensemble, ergodicity)
 3. Modeling interaction in protein (Bond-length and bond-angle potentials)
 4. Molecular Dynamics Simulations

Suggested Teaching Methodology:

- Lecturing
- Written Assignments Report Writing

Suggested Assessment:

Theory (100%)

- Sessional (20%)
- Quiz (12%)

- Assignment (8%)
- Midterm (30%)
- Final Term (50%)

Practical Exercises (100%)

- Open-Ended Labs

Text and Reference Books:

1. Introduction to Bioinformatics, Arthur M. Lesk, 4th Edition, Oxford University Press, 2014, ISBN 0198724675, 9780198724674
 2. Bioinformatics and Functional Genomics, Jonathan Pevsner, 2nd Edition, Wiley, 2009, ISBN 0470085851, 9780470085851.
 3. D. Frankel and B. Smit “Understanding Molecular Simulations: From Algorithms to Applications”
 4. T. E. Creighton “Proteins” (2nd edition, W.H. Freeman, and Co., New York)
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