

**Paper No- 17**  
**SEMESTER - VI**  
**BIOINFORMATICS**

**THEORY**

**MARKS: 100**

**Unit 1 Introduction to Computer Fundamentals** **No. of lectures: 6**

- 1.1 RDBMS - Definition of relational database
- 1.2 Mode of data transfer (FTP, SFTP, SCP), advantage of encrypted data transfer

*(Chapters 14, 16 & 18, Foundations of Computing by Pradeep and Preeti Sinha, BPB Publications, 2007, Pages: 251-277, 305-308, 358-365)*

**Unit 2 Introduction to Bioinformatics and Biological Databases** **No. of lectures: 10**

- 2.1 Biological databases - nucleic acid, genome, protein sequence and structure, gene expression databases, Database of metabolic pathways
- 2.2 Mode of data storage - File formats - FASTA, Genbank and Uniprot
- 2.3 Data submission & retrieval from NCBI, EMBL, DDBJ, Uniprot, PDB

*(Chapters 1 & 3, Introduction to Bioinformatics by Lesk MA, 3<sup>rd</sup> Ed., Oxford Publication, 2008, Pages: 1-21, 148-162, 186-237)*

**Unit 3 Sequence Alignments, Phylogeny and Phylogenetic trees** **No. of lectures: 12**

- 3.1 Local and Global Sequence alignment, pairwise and multiple sequence alignment.
- 3.2 Scoring an alignment, scoring matrices, PAM & BLOSUM series of matrices
- 3.3 Types of phylogenetic trees
- 3.4 Different approaches of phylogenetic tree construction - UPGMA, Neighbour joining, Maximum Parsimony, Maximum likelihood

*(Chapter 5, Introduction to Bioinformatics, 3<sup>rd</sup> Ed., by Lesk MA, Oxford Publications, 2008, Pages: 243- 298)*

**Unit 4 Genome organization and analysis** **No. of lectures: 8**

- 4.1 Diversity of Genomes: Viral, prokaryotic & eukaryotic genomes
- 4.2 Genome, transcriptome, proteome
- 4.3 Major features of completed genomes: *E.coli*, *S.cerevisiae*, *Arabidopsis*

*(Chapter 2, Introduction to Bioinformatics, by Lesk MA 3<sup>rd</sup> Ed., Oxford Publications, 2008, Pages: 69- 132)*

**Unit 5 Protein Structure Predictions** **No. of lectures: 12**

- 5.1 Hierarchy of protein structure - primary, secondary and tertiary structures, modeling
- 5.2 Structural Classes, Motifs, Folds and Domains
- 5.3 Protein structure prediction in presence and absence of structure template
- 5.4 Energy minimizations and evaluation by Ramachandran plot

*(Chapter 5, Introduction to Bioinformatics, 3<sup>rd</sup> Ed. by Lesk MA, Oxford Publications, 2008, Pages: 327- 380)*

## **PRACTICALS**

**MARKS: 50**

1. Introduction to different operating systems - UNIX, LINUX and Windows
2. Introduction to bioinformatics databases (any three): NCBI/PDB/DDBJ, Uniprot, PDB
3. Sequence retrieval using BLAST
4. Sequence alignment & phylogenetic analysis using clustalW & phylip
5. Picking out a given gene from genomes using Genscan or other softwares (promoter region identification, repeat in genome, ORF prediction). Gene finding tools (Glimmer, GENSCAN), Primer designing, Genscan/Genetool
6. Protein structure prediction: primary structure analysis, secondary structure prediction using psi-pred, homology modeling using Swissmodel. Molecular visualization using jmol, Protein structure model evaluation (PROCHECK)
7. Prediction of different features of a functional gene

## **SUGGESTED READING**

1. Saxena Sanjay (2003) A First Course in Computers, Vikas Publishing House
2. Pradeep and Sinha Preeti (2007) Foundations of Computing, 4<sup>th</sup> ed., BPB Publications
3. Lesk M.A.(2008) Introduction to Bioinformatics . Oxford Publication, 3<sup>rd</sup> International Student Edition
4. Rastogi S.C., Mendiratta N. and Rastogi P. (2007) Bioinformatics: methods and applications, genomics, proteomics and drug discovery, 2<sup>nd</sup> ed. Prentice Hall India Publication
5. Primrose and Twyman (2003) Principles of Genome Analysis & Genomics. Blackwell

## **ONLINE READING MATERIAL**

1. [www.freebookcentre.net/Biology/Bioinformatics-Books.html](http://www.freebookcentre.net/Biology/Bioinformatics-Books.html)
2. [www.roseindia.net/bioinformatics](http://www.roseindia.net/bioinformatics)