M.Phil., Bioinformatics

Programme Code: SBIN 73

PAPER – I: RESEARCH METHODOLOGY

UNIT-I BIOLOGICAL DATABASES

Biological database - Protein Sequence databases - Nucleotide Sequence databases Other specialized databases – Microarray databases – Genome databases. Sequence retrival – Sequence formats - Classification and clustering of data – Pairwise alignment – Multiple sequence alignment. Data visualization.

UNIT-II GENE EXPRESSION AND MICROARRAY

Genome – Genome information - Gene expression – cDNA – EST. Introduction to Micoarrys - Basic research with DNA microarrays –Tools for microarray analysis – Applications of microarray. Use of array analysis programs – SAM - TIGR programs – MEV.

UNIT-III C PROGRAM

Elements of C Programming - Features – Variables – Constants – Keywords - Data types – Operators – Statements – Loops - Simple programs using Loops - Arrays. – Functions – Pointers - Structures - String manipulations using Pointers and Arrays. Files - Defining & Opening a file, Closing a file, Input / Output operations on files.

UNIT –IV SEQUENCE ANALYSIS

Biological background for sequence analysis. Searching databases for similar to a new sequence. Identification of protein primary sequence from DNA sequence. Construction of phylogenetic tree - Distance and similarity. The evolutionary basis for sequence alignment - Substitution scores - gap penalties.

UNIT –V PROTEOMICS AND GENOMICS

High throughput genome and Protein sequencing, Genome and Proteome assembly; Gene and Protein expression data sets. Algorithms Protein and Nucleic acid sequence Algorithms: BLAST, Multiple sequence alignments and Clustering algorithms. Phylogeny - Evolutionary trees - Pathway analysis.

Reference Books:

1. Jin Xiong, 2006, Essential Bioinformatics, Cambridge University Press UK.
2. N.Gowtham, 2006, Bioinformatics – Databases and algorithms, Alpha Science Intel LTD UK.
3. U.R.Muller and D.V.Nicolau, 2005, Microarray technology and its applications, Springer publications, USA.
4. Kin-N.King, 2008, C-Programming – A modern approach II Edition, W.W. Norton & Company New York.
5. Jason T.L. Wang, Mohammed J. Zaki,Hannu.T.T. Tolvonen and Dennies Shasha, 2005, Data Mining in Bioinofrmatics, Springer-Verleg London limited.
6. David W. Mount, 2004, Bioinformatics- Sequence and Genome analysis, Cold spring harbor laboratory press, USA.
7. Francesco Falciani and Frederics Falciani, 2007, Microarray technology Through application, Taylor & Francis group, UK.

Course II : ADVANCE IN BIOINFORMATICS

Unit 1

Overview of Bioinformatics application, Scope of Bioinformatics Importance of databases - Nucleic acid sequence databases – Genbank, DDBJ - Protein sequence data bases – Swissprot, Uniprot - structure databases – MMDb, PDB - bibliographic databases and virtual library - specialized analysis packages

Unit 2

Sequence analysis of biological data- models for sequence analysis and their biological motivation- methods of alignment - methods for optimal alignments; using gap penalties and scoring matrices - Multiple Sequence Alignment – Tools for MSA - application of Multiple Sequence Alignment.

Unit 3

Gene predictions strategies - protein prediction strategies - molecular visualization. Phylogenetic Prediction, Relationship of phylogenetic analysis to sequence alignment, The concept of evolutionary tree, Maximum parsimony methods, Distance methods, Sequence alignment based on an evolutionary model, Applications of phylogenetic analysis.

Unit 4

Drug Discovery and Pharma Informatics, Discovering a drug - target identification and validation - Identifying the lead compound - optimization of lead compound - chemical libraries.

Unit 5

Perl Programming: Introduction to Perl, Variables and Data types, Arrays and hashes - Control structures, Subroutines, Pattens and regular expressions, working with files - Perl applications for Bioinformatics, BioPerl.

References:

1. S.C. Rastogi & others, Bioinformatics- Concepts, Skills, and Applications, CBS Publishing, 2003.
2. S. Ignacimuthu, S.J., Basic Bioinformatics, Narosa Publishing House, 1995.
3. T K Attwood, D J parry-Smith, Introduction to Bioinformatics, Pearson Education, 1st Edition, 11 Reprint 2005.
4. C S V Murthy, Bioinformatics, Himalaya Publishing House, 1st Edition 2003.
5. Stephen A. Krawetz, David D. Womble, Introduction To Bioinformatics A Theoretical and Practical Approach, Humana Press, 2003.
6. Hooman H. Rashidi, Lukas K. Buehler, Bioinformatics Basics-Applications in Biological Science and Medicine, CRC press, 2005.
7. Bioinformatics, Biocomputing and Perl By: Michael Moorhouse and Paul Berry John Wiley & Sons publications