M.Sc. BIOINFORMATICS

CHOICE BASED CREDIT SYSTEM

(For the students admitted from the year 2008-09 onwards)

Part	Course Code	Course	Hrs.	Credit	Marks		
					CIA	EA	Total
Semester I							
CORE I	08PBI01	Structural elucidation and interaction among biological molecules	5	5	25	75	100
CORE II	08PBI02	Chemistry of biomolecules and their dynamics	5	5	25	75	100
CORE III	08PBI03	Cell biology	5	5	25	75	100
ELECTIVE	08PBIE01	Relational Database Management Systems	5	4	25	75	100
PRACTICAL	08PBIP01	Lab Course – I	5	4	40	60	100
PRACTICAL	08PBIP02	Lab Course- II	5	4	40	60	100
Semester II							100
CORE IV	08PBI04	Proteomics	5	5	25	75	100
CORE V	08PBI05	Programming for Bioinformatics	5	5	25	75	100
ELECTIVE	08PBIE02	Molecular Biology and Genetic engineering	5	5	25	75	100
VALUE EDU		Human Rights	2	2	25	75	100
PRACTICAL	08PBIP03	Lab Course- III	5	4	40	60	100
PRACTICAL	08PBIP04	Lab Course- IV	5	4	40	60	100
Semester III							
Core VI	08PB106	Genomics and Phylogenetic Analysis	5	5	25	75	100
Core VII	08PB107	Molecular Modelling and Drug Design	5	5	25	75	100
Core VIII	08PB108	Systems Biology and Metabolomics	5	5	25	75	100
Elective	08PBIE03	Digital Image Processing	5	5	25	75	100
Practical	08PBIP05	Lab Course V	5	5	40	60	100
Semester IV							
Core IX	08PB109	Research Methodology	5	5	25	75	100
	08PB110	Project Work		10			200

PROJECT WORK

Dissertation submission: 120

CIA: 30

Viva-voce: 50

Total :200

Total Credits: 92

Total Marks:2100

SEMESTER I

08PBI01: STRUCTURAL ELUCIDATION AND INTERACTION AMONG BIOLOGICAL MOLECULES

UNIT I

Fundamentals of chemical bonding and non bonding interactions: Electrovalent bond, stability of electrovalent bond and compounds, covalent bond – shape of orbitals and hybridization. Molecular geometry, partial ionic character of covalent bonds. Coordination bond, Vander Walls forces, Metallic bond.

UNIT II

Fundamentals of atomic and molecular orbitals: theory of atomic and molecular orbitals, linear combination of atomic orbitals, quantitative treatment of valency bond theory and molecular orbital theory. Resonance structures, σ bond and π bonds.

UNIT III

X-ray crystallography of biomolecules, generation of X-rays and its characteristics properties, atomic scattering factor, structure factor, electron density equation, phase problem, direct methods of overcoming phase problem and determining 3D structures of small molecules-CSD database. X- ray diffraction, Braggs law: unit cell and lattice of crystals. Molecular replacement method, single isomorphous replacement and multiple isomorphous replacement methods, anomalous diffraction methods (single wave length, multiple wavelengths).

UNIT IV

Spectroscopy: spectroscopy of molecules, UV, IR, NMR (elementary treatment). Protein databank (PDB).

UNIT V

Fundamental of stereochemistry: theory of covalent bonds, directional properties of covalent bonds, stereochemistry of proteins and nucleic acids.

Recommended Books

- Albert cotton, 1997. Chemical applications of group theory. John Wiley & sons. NY.
- Ernest Eliel, 1996. Stereochemistry of carbon compounds, Prentice- Hall.
- Spice JE, 1994. Chemical Bonding and structure. Pergamon Press, Oxford.
- Keith Wilson, John Walker, 2005. Principles and Techniques of Biochemistry and Molecular Biology, 6th edition.Cambridge University Press.

08PBI02: CHEMISTRY OF BIOMOLACULES AND THEIR DYNAMICS

UNIT I

Chemical foundations of biology-pH, pK, acids, bases, buffers, weak bonds and covalent bonds. Principles of thermodynamics. Classes of organic acids and their functional groups-atomic and molecular dimensions, space filling and ball & stick model. Amino acids and peptides- classification, chemical reactions and physical properties, sugars classifications and reactions.

UNIT II

Heterocyclic compounds and secondary metabolites in living system- nucleotides, pigments and isoprenoids. Separation techniques of different biomolecules. Lipid- classification, structure and function. Proteins and nucleic acids- classification, separation, purification and criteria of homogeneity, end group analysis, hierarchy in structure.

UNIT III

Polysaccharides- types, structural features, methods for compositional analysis. Analytical techniques in biophysics and biochemistry for small and macromolecules for quantitation.

UNIT IV

Potential energy calculations using semi empirical and quantum chemicals, potential energy function. Electrostatic energy surface generation, methods to predict secondary structures of polymers. Methods to predict three dimensional structure of proteins, nucleic acids- rRNA and DNA using dynamic programming methods.

UNIT V

Molecular mechanism and dynamics of oligopeptides, nucleotides, proteins, drug molecules, pesticides, docking of molecules, knowledge based structure prediction, molecular design. Emerging areas in bioinformatics and biocomputing.

Recommended Books

- Baxevanis, A, Ouellette, FBF.1998. Bioinformatics: A Practical guide to the analysis of genes and proteins. John-Wiley & sons. NY.
- Charles, R, Cautor Paul R, Schinmmel WH, 1980. Biophysical chemistry part I, II and III. Freeman co. SF.
- Lesk AM, 1988. Computational molecular biology, sources and methods for sequence analysis, Oxford University Press, Oxford.
- Setubal, J., Meidanis, J. 1996. Introduction to computational molecular biology, PWS Publishing Co. Boston.
- Wilkins, MR., Williams, KL, Appel, RD., Hochstrasser, DH. 1997. Proteome research: A new frontiers in functional genomics. Springer-Verlag, Berlin.

08PBI03: CELL BIOLOGY

UNIT I

Cell theory- prokaryotic and eukaryotic cells- animal and plant cell. Molecular models of cell wall and cell membrane- structure and function.

UNIT II

Ultrastructure and function of all cell organelles. Mitochondrial and chloroplast genomes. Gene transfer: Vector and vector less modes of gene transfer, plastome transformation. Gene targeting (Ti plasmid, Baculovirus, Adenovirus, SV40, M13 etc.)

UNIT III

Chromosomal architecture, classification, its aberration and banding techniques. Replication, transcription, translation, protein sorting and targeting, chaperones.

UNIT IV

Regulation of gene expression in prokaryotes and eukaryotes, transposons and genetic recombination.

UNIT V

Cell cycle- mitosis, meiosis. Tools to study cell biology, PCR types and application, Cell – cell adhesion, communication, cell matrix adhesion, collagen and non collagen components of extra cellular matrix. Cell death and its regulation.

Recommended Books

- Bruce Alberts , Alexander Johnson , Julian Lewis, Martin Raff , Keith Roberts, Peter Walter, 1994. Molecular Biology of the Cell, Fourth Edition.. Academic Press. New York.
- De Robertis and De Robertis. 2005. 8th Eds. Cell and Molecular Biology. Lippincott Williams & Wilkins
- Lodish, Berk, Baltimore et al. 2000. 6th Eds Molecular Cell Biology. W.H. Freeman & Co.
- Gerald Karp, 2008. Cell and Molecular Biology: Concepts and Experiments, 5th Eds. Wiley
- Geoffrey Cooper, 2000. The Cell: A molecular approach. 2nd Eds. Sinauer Associates Inc.

06PBIE04: RELATIONAL DATABASE MANAGEMENT SYSTEMS

UNIT I

Introduction: purpose of database systems: overall system structure-entity relationship model: entities and entity sets, relationships- mapping constraints- primary keys- ER diagram.

UNIT II

Relational model: structure- formal query languages- relational algebra- relational calculus- commercial query languages.

UNIT III

Relational database: SQL, basic structure, set operations, aggregate functions. Nested subqueries, views, complex queries, modification of the database, join relations, data definition, language embedded SQL, Dynamic SQL.

UNIT IV

Relational database design: pitfalls- normalization using functional dependencies- decomposition-Boyce Codd Normal form-Third normal form- normalization using multi valued dependencies- fourth normal form- normalization using join dependencies, network data model, Hierarchical data model.

UNIT V

Query processing, query optimization, concurrency control, database security and integrity- distributed database. Case study of typical system- ORACLE.

Recommended books

- Hector Garcia-Molina, Jeffrey D. Ullman, Jennider D. Widom, 2002. Database systems-the complete book, Prentice Hall.
- Henry F. Korth and Abraham Silberschatz, 2000. Database systems concepts, Mc Graw Hill International publication.
- Jeffrey D. Ulman, 1998. Principles of database systems, Galgotia Publishers
- Kifer, Michael, Bernstein, Arthur, Lewis, Philp,M. 2000. Database systems: An application oriented approach complete. Addision-Wesley publications.
- Sdate, C.J. 1995. An Introduction to data base systems. 3rd edition, Narosa publishing company.

08PBIP01: LAB COURSE – I

1. Microscopy
2. Staining techniques
3. Stains and staining procedures
4. Instrumental methods for cell biology
5. Microtomy
6. Histochemical techniques
7. Mitosis and Meiosis
8. Cell fractionation method

08PBIP02: LAB COURSE - II

1. ORACLE

   Table creation-simple queries, report creation using column format, built in function of SQL, PL/SQL-student information processing, write a database trigger to implement the concept of master- detailed relationship using PL/SQL Prepare electricity bill.
2. Prediction of protein secondary structure using dynamic programming
3. Prediction of protein 3D structure using dynamic programming
4. Prediction of 3D structure of DNA using dynamic programming
5. Prediction of 3D structure of t-RNA using dynamic programming
6. Determination of Amino acid composition and molecular weight of a protein.
7. Determination of motif and domain of a protein.
8. Signal peptide determination.

SEMESTER II

08PBI04: PROTEOMICS

UNIT I

Chemical foundation of cell: amino acids-peptides and proteins- life cycle of a protein-sequencing of protein-N and C terminal sequencing- proteomics- tools and application of proteomics.

UNIT II

3D structure of protein- overview-protein secondary, tertiary, quaternary structure- protein Denaturation-protein folding- reverse turns- Ramachandran plot- Expasy tools.

UNIT III

Analytical proteomics-analytical protein and protein separation techniques- 1D SDS-PAGE, isoelectric focusing, 2D SDS-PAGE, image analysis of 2D gels-HPLC-protein digestion techniques.

UNIT IV

Protein identification and analysis- Mass spectrometry-tandem mass spectrometry-peptide mass finger printing- SALSA algorithm-protein arrays.

UNIT V

Applications of proteomics: Drug development and toxicology, mining proteomes, protein expression profiling- protein-protein interactions, mapping protein modifications.

Recommended Books

- Daniel C Liebler, 2000. Introduction to Proteomics- tools for the new biology. Humana Press.
- Pennington, SR., Dunn, MJ. 2001. Proteomics- from protein sequence to function. Viva books Pvt. Ltd.
- David, M. 2004. Bioinformatics sequence and genome analysis. Cold spring harbour laboratory Press, NY.

08PBI06: PROGRAMMING FOR BIOINFORMATICS

UNIT I

Programming in C-introduction, Data types, Operators, Expressions, Control flow, structures, input and output, functions, pointers and references, string processing, file handling.

UNIT II

Programming in PERL - introduction, variables and data types, Basic operators and control structures, scalars, arrays, lists, hashes, file manipulation, regular expression, patterns, input and output, references, object oriented programming, CPAN modules and packages.

UNIT III

BioPERL programming- general BioPERL classes, sequence (Bio:: seq class, sequence manipulation) , features and location class, alignments(Align IO), analysis and databases.

UNIT IV

Web programming with PERL script- PERL standard library- sequence analysis with web based object oriented programming in PERL- advanced data manipulation.

UNIT V

Python programming – introduction, data structures, control flow, modules, Basic I/O, exception handling, regular expressions, file manipulation, classes and standard library.

Recommended Books

- Kernigham, BW, Ritchie, DM. 1978. The C Programming language. Prentice Hall Inc.
- Larry Wall, Tom Christiansen and John Orwant, 2000. Programming PERL. O'Reilly publishers.
- Mark Lutz, Laura Lewin, Frank Willison, 2001. Programming Python. O'Reilly publishers.

08PBIE02: MOLECULAR BIOLOGY AND GENETIC ENGINEERING

UNIT I

Introduction to molecular biology and genetics- DNA as genetic material, properties and organization of DNA and RNA. DNA replication- prokaryotic and eukaryotic, inhibitors of DNA replication. Enzymes and accessory proteins involved in DNA replication. DNA damage, repair and recombination.

UNIT II

Prokaryotic and eukaryotic transcription- RNA polymerase, general and specific transcription factors- regulatory elements and mechanisms of transcription regulation, eukaryotic transcriptional promoters and enhancers. Modification in RNA- transcription, splicing, editing, nuclear export of mRNA, termination, 3' end processing, cap formation, polyadenylation and mRNA stability.

UNIT III

Translation: genetic code and its features and amino acyl t-RNA synthatase, prokaryotic and eukaryotic translation- mechanism of initiation, elongation and termination. Regulation of co-translation and post translational modifications of protein. Synthesis of secretory and membrance proteins – import into nucleus, mitochondira, chloroplast and peroxisomes. Receptor mediated endocytosis, Lac and Tryptophan operon.

UNIT IV

Biology of plasmids-discovery, types and structure of F,RTF, Col factors and Ti. Replication and partitioning. Incompatibility and copy number control. Natural and artificial plasmid transfer and their applications. Transposable genetic elements- oncogenes and tumor suppressor genes. Viral and cellular oncogenes. Tumor suppressor genes from humans-structure, function and mechanism of p53 and RB tumor suppressor proteins.

UNIT V

Molecular mapping of genome: genetic and physical maps- physical mapping and map based cloning- choice of mapping population- simple sequence repeats loci- southern and FISH for genome analysis- chromosome microdissection and microcloning- molecular markers in genome analysis. RFLP, RAPD and AFLP analysis- application of RFLP in forensic, disease diagnosis, genetic counsellling, taxonomy and biodiversity.

Recommended Books

- Bruce Alberts , Alexander Johnson , Julian Lewis, Martin Raff , Keith Roberts, Peter Walter. 1994. Molecular Biology of the Cell, Fourth Edition. Academic Press . New York.
- Lodish, Berk, Baltimore et al, 2000. Molecular Cell Biology. 6th Edition. W.H. Freeman & Co.

- Twyman, R.M. 2000. Advanced Molecular Biology. Garland/bios Scientific Publishers.
- Sandy B Primrose. 1991. Molecular Biotechnology. 2nd Edition. Blackwell Scientific Publishers.
- T.A.Brown , 2002. Genomes. 2nd Edition. Wiley-Liss (New York).
- Larry Snyder, Wendy Champness, 2002. Molecular Genetics of Bacteria. 2nd Edition. Amer Society for Microbiology.
- Anthony J.F. Griffiths, Anthony J.F. Griffiths, 2004. An Introduction to Genetic Analysis. 8th Edition.W H Freeman & Co.

08PBIP03: LAB COURSE III

1. Parallel computing and programming PERL
2. PERL programming to convert
    a. The DNA sequence into mRNA
    b. The mRNA sequence into eDNA
    c. The mRNA into amino acid sequence
3. PERL programming to find out
    a. The translated product of the given DNA sequence
    b. The restriction sites in a DNA sequence
    c. The promoter site in a particular DNA sequence
    d. The exon and intron regions within the gene sequence

08PBIP04: LAB COURSE IV

1. Single cell colony isolation- checking for genetic markers
2. Isolation of antibiotic resistants and auxotrophic mutants
3. UV survival curve
4. Isolation of DNA
5. Isolation of Plasmid
6. Extraction of total DNA- plant, animal tissue (Agarose gel electrophoresis)
7. Restriction digestion
8. Blotting techniques
9. PCR amplification
10. Estimation of nucleic acids – DNA and RNA
11. Ligation (Kit)
12. RFLP
13. Protein characterization by coomasie blue and silver staining

SEMESTER III

08PBI06: GENOMICS AND PHYLOGENETIC ANALYSIS

UNIT I

Genomes, transcriptomes and proteomes: Viral genome- bacteriophage and eukaryotic viruses. Prokaryotic genome- chromosome, linear or multipartite genome. Eukaryotic genome - yeast and human. Repetitive DNA sequences- tandem repeats of centromeres, mini satellites and micro satellites, interspersed repeats. Mobile genetic elements -Transposition and DNA transposons.

UNIT II

Restriction mapping, FISH, Sequence tagged site. Sequencing genomes-chain termination, chemical degradation, pyro sequencing. Sequence assembly - shot gun, clone contig methods. Human genome project- mapping phase- sequencing.

UNIT III

Genetic mapping-map repositories: Entrez genome map viewer- GDB, NCBI, OMIM, MGI/MGD Linkage map resources. Gene expression analysis by Micro arrays, Serial analysis of gene expression (SAGE). Applications of structural, functional and metagenomics. Comparitive genomics and databases: PEDANT, COG, NCBI- gene plot, KEGG, MPG

UNIT IV

Molecular phylogenetics: Introduction, analysis and importance. Molecular Clock hypothesis. Methods of phylogenetic analysis-phenetic and cladistic. Phylogenetic trees- methods of determining evolutionary trees-maximum parsimony- distance methods- neighbour joining algorithm, Fitch and Margoliash method, unweighted pair group method with arithmetic mean. Problems in phylogenetic analysis.

UNIT V

Phylogenetic software resources: Parsimony programs, distance matrix methods, computation of distances, maximum likelihood and Bayesian methods, quartets methods, evolutionary parsimony, artificial intelligence and genetic algorithms. Interactive tree manipulation: Bootstrapping and compatibility analysis. Consensus trees, subtrees, supertrees and distance between trees. Tree- based sequence alignment. Gene duplication and genomic analysis.

Recommended Books

- Benjamin Lewin. Genes VIII.2003. Benjamin-Cummings Pub Co.
- Sandy B. Primrose , Richard M. Twyman , Robert W. Old, 2002. Principles of Gene Manipulation and genomics. 7th Edition. Blackwell Science
- Campbell A and Laurie J. Heyer. 2006. Discovering Genomics, Proteomics, and Bioinformatics.. 2nd Edition. Pearson Publishers.
- Desmond S. T. Nicholl. 2002. Introduction to Genetic Engineering.. 2nd Edition. Cambridge University Press
- Richard J. Reece. 2003. Analysis of Genes and Genomes. John Wiley High Education.

08PB107: MOLECULAR MODELLING AND DRUG DESIGN

UNIT I

Macromolecular Structure: Protein - Primary, Secondary, Super secondary, Tertiary and Quaternary structure, SCOP and CATH, Nucleic acid – DNA and RNA, Carbohydrates. Structural validation: PROCHECK (Ramachandran map), analysis of 3D structures, Principles and methods to study protein folding. Macromolecular interactions -Protein – Protein, Protein – Nucleic acids, Protein - carbohydrates.

UNIT II

Chemoinformatics: Chemical structures, Molecular modelling- concepts, history, process of drug discovery. Wiswesser Line Notation (WLN), Representation of Organic Structure Description Arranged Linearly (ROSDAL), Simplified Molecular Input Line Entry Specification (SMILES), SLN, Types of date bases, Representation and searching of chemical structures, Structure and reaction data bases, Applications of chemoinformatics in drug discovery.

UNIT III

Molecular mechanics and dynamics: Introduction- Quantum mechanical simulations- *Ab initio* and semi empirical methods. Force field approach- Energy function and minimization, advantages and limitations. Implication of molecular mechanics and dynamics in drug design.

UNIT IV

Drug Design: Introduction, Drugs/Ligands, Format Conversion, Docking, Searching Methods, Docking Methods (Rigid Body - receptor, Flexible Ligand and Flexible-induced Docking), Scoring Function-Types, Factors affecting Docking Score, Softwares for Docking (DOCK, AUTODOCK, HEX, SLIDE), Virtual Screening, Pitfalls in Docking, Depicting Protein-Ligand Interaction, *De Novo* Design, Lipinski's rules of 5.

UNIT V

Quantitative Structure Activity Relationship (QSAR): Evolution, Types of descriptors - constitutional, topological, charge, quantum chemical, walk and path counts, geometric descriptors- Steps, Statistical methods, Types of QSAR methods-In static contour plot, in electro static contour plots, 3D-QSAR, Pitfalls of molecular field analysis

Recommended Books

1. Andrew, R Leach, 2001. Molecular modeling: Principles and applications Prentice Hall Publications.
2. Shanmughavel, P. 2005. Principles of Bioinformatics, Pointer Publishers, Jaipur, India.
3. Shanmughavel, P. 2006. Trends in Bioinformatics, Pointer Publishers, Jaipur, India.
4. Tamar Schlick 2002. Molecular Modeling and Simulation Springer Publications
5. Rauter, C. Horn, K. 1984. X-ray crystallography and drug design, Elsevier.
6. Leo, Albert, Hockma, D. H., 2005. Exploring QSAR - Hansch, Corwin.
7. Anand Solomon, K. 2008. Molecular Modelling and Drug design, MJP Publishers, Chennai.

08PB108: SYSTEMS BIOLOGY AND METABOLOMICS

UNIT I

Systems biology: Introduction - Integrating networks. Methods of study: Micro array – definition, types of array, micro array analysis: Hierarchical clustering, Self- organizing maps. Applications of micro arrays in system biology.

UNIT II

Metabolism: Basic considerations- Terminology: precursor, substrate, building blocks, metabolites like primary and secondary, macromolecules, catabolism, anabolism, amphibolism and anaplerosis; Biosynthesis of fatty acids; triglycerides; phospholipids; Synthesis of amino acids and *De novo* synthesis of nucleotides

UNIT III

Metabolic Pathways: Gluconeogenesis, Pentose phosphate pathway, Glycogen synthesis and degradation, Fatty acid oxidation and synthesis, Amino acid catabolism, Purine and pyrimidine nucleotide synthesis. Study of metabolic pathways by Public Domain pathways like KEGG, WIT, Biocyc (Ecocyc, Metacyc) and Cazy.

UNIT IV

Enzymes, compounds and reactions databases: LIGAND-Biochemical Compounds and Reactions BRENDA - Comprehensive Enzyme Information System. Mathematical modeling of metabolic pathways-metabolic flux, alternative paths for synthesis of metabolites.

UNIT V

Novel use for database- Use of EST database: Unigene, Gene discovery, Primer design, Restriction mapping, Pharmacophore building, Position specific cloning, SNP database, Target and Epitope identification.

Recommended Books

- D., Voet, Voet, J.G. & Pratt, C. W. 2006. Fundamentals of Biochemistry (2nd edition) John Wiley & Sons.
- D. L. Nelson & M. M. Cox. 2005. Lehninger Principles of Biochemistry (4th edition) by, W. H. Freeman & Co.
- J. M. Berg, J. L. Tymoczko & L. Stryer. 2002. Biochemistry (5th edition) W.H. Freeman & Co.
- G.N. Stephanopoulos, A. A. Aristidou & J. Nielsen. 2006. Metabolic Engineering Academic Press.
- Collado-Vides, J. & Hofestadt, R. Cambridge. 2002. Gene regulation and metabolism: Postgenomic computational approaches., The MIT Press.
- Harrigan, George G. & Goodacre, Royston. 2003. Metabolic profiling: its role in Biomaker discovery and gene function analysis. Kulwer Academic publishers, London.

08PBIE03: DIGITAL IMAGE PROCESSING

UNIT I

Elements of visual perception: Image sampling and quantization, Basic relationship between pixels – Basic geometric transformations-Introduction to Fourier Transform and DFT - Properties of 2D Fourier Transform- FFT - Separable Image Transforms -Walsh - Hadamard – Discrete Cosine Transform, Haar, Slant - Karhunen - Loeve transforms.

UNIT II

Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters: Smoothing, Sharpening filters – Homomorphic filtering.

UNIT III

Model of Image Degradation/restoration process: Noise models -Inverse filtering-Least mean square filtering- Constrained least mean square filtering - Blind image restoration Pseudo inverse- Singular value decomposition.

UNIT IV

Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding- DPCM. Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.

UNIT V

Edge detection – Thresholding - Region Based segmentation – Boundary representation: chair codes- Polygonal approximation - Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors- Texture

Recommended Books

- Rafael C Gonzalez, Richard E Woods. 2003. Digital Image Processing - 2nd Edition, Pearson Education
- William K Pratt, 2001, Digital Image Processing John Wiley.
- Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/colic, 1999, Image Processing Analysis and Machine Vision –, Thompson Learniy.
- Jain, AK 1995. Fundamentals of Digital Image Processing. PHI, New Delhi
- Chanda Dutta Magundar. 2000. Digital Image Processing and Applications, Prentice Hall of India.

08PBIP05 :LAB COURSE V

1. Primary and secondary data base searches
2. Protein finger printing
3. Multiple sequence alignment (Nucleotides, Amino acids)
4. Use of similarity, homology and alignment softwares
5. Phylogenetic tree constructions
6. Analysing codon usage patterns
7. Protein structure prediction
8. Rational probe design and analysis
9. Primer design and analysis
10. DNA fragment contig assembly (GCG, SeqMerge)
11. Restriction mapping and analysis
12. Protein domain and motif prediction
13. Use of web resources cheminformatics studies
14. Molecular modeling softwares and tools-protein docking
15. Protein-protein interaction database
16. Visualization of micro array informatics
17. Homology modelling softwares

SEMESTER IV

08PB109: RESEARCH METHODOLOGY

UNIT I

Research: Definition, types, approaches, significance, research methods, criteria of good research, Literature collection and citation, research design: Basic principles of experimental design. Result analysis and interpretation, Report writing and manuscript preparation.

UNIT II

Statistical analysis of biological data: Mean, median, mode, standard deviation, standard error, correlation & regression, sampling distribution - Student's t test, Chi-Square test. Analysis of experimental results - ANOVA and its interpretation, Duncan's Multiple Range Test.

UNIT III

Bio-instrumentation: Microscopy-Light, Phase Contrast, Fluorescence, Confocal, Scanning and Transmission Electron Microscopy, Atomic Force Microscope, Scanning Tunneling Microscope - principles and applications. Spectroscopy and spectrometry: Fluorescence, UV-Visible spectrophotometer, NMR and ESR Spectroscopy. Mass Spectrometry, GC-MS. Blotting Techniques-Principles and techniques of Southern, Northern and Western blotting techniques and hybridization.

UNIT IV

Algorithms: Protein and Nucleic acid sequence Algorithms: Sequence Databases, Use of the algorithms BLAST, Multiple sequence alignments and Clustering algorithms. Phylogeny: Evolutionary trees; Biological networks: Pathway analysis. Protein structure analysis: Protein structure databases; Protein structure comparison; Fold recognition; 3D-1D Profiles; Threading and Comparative structure modeling.

UNIT V

Computational applications: Introduction to internet – firebox, flock, mozilla, netscape., Clustal W, Wingene, oligo primer analysis, SPDBV, Swiss-prot, PDB, restriction analysis, primer design, data mining methods for sequence analysis, web-based tools for sequence searches, motif analysis and presentation.

Recommended Books

1. Andrews D. Baxevanis and BF. Francis Ouellette, 2001. Bioinformatics-A Practical guide to the Analysis of Genes and Proteins, A John Wiley & Sons Publishers
2. David W.Mount, 2003. Bioinformatics-Sequence and Genome Analysis, CBS Publishers.
3. Ian Korf, Mark Xandell & Joseph Bedell, 2003. BLAST. O'REILLY Publisher.
4. Kothari C.R, 2004. Research Methodology - Methods and Techniques, New Age International (P) Ltd.
5. Gupta S.P, 2008. Statistical Methods. Sultan and Sons Company, New Delhi.