B.Sc. BIOINFORMATICS

REGULATIONS AND SYLLABI

(Effective from 2011-2012)

Centre for Bioinformatics
SCHOOL OF LIFE SCIENCES
PONDICHERRY UNIVERSITY
PUDUCHERRY
REGULATIONS - B.Sc. BIOINFORMATICS

Aim of the course:

The course of B.Sc. (Bioinformatics) aims to introduce to the students the field of science in which biology, computer science, and information technology merge into a single discipline to analyses biological information using computers and statistical techniques. At the end of the course, the students are expected to have good knowledge in mathematics, statistics and computer science and also will gain knowledge in bioinformatics databases, tools and software in sequence alignment, phylogenetic analysis and protein structure prediction.

Eligibility for admission:

Candidates for the admission to degree of B.Sc. Bioinformatics shall be required to have passed HSc., CBSE / equivalent examination with biology or computer science or mathematics as one of the subjects of study or an examination accepted as equivalent to there and 45% percentage of marks in aggregate, subject to such conditions as may be prescribed there for.

Lateral Entry: Not applicable.

Duration of the course:

The course shall be of three year’s duration spread over six semesters. The maximum duration to complete the course shall be Five years.

Eligibility for admission to examination:

75% of attendance will be required for admission to examination.

Medium:

The medium of instruction shall be English.

Passing Minimum:

Passing eligibility & classification for the award of the degree is as follows:

Passing eligibility:

During the time of course the students have to score minimum 40% of marks in all the subjects including practical.

Classification for the award of the degree:

60-100 - First Class
50-59  - Second class
40-49  - Third Class
### SCHEME OF THE EXAMINATION - B.SC BIOINFORMATICS

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I SEMESTER

MAJOR I: FUNDAMENTALS OF BIOLOGICAL SYSTEMS

UNIT-I  
13 Hours
Introduction to cells: Cell as unit of life- Structure of prokaryotic and eukaryotic cells. Cell organelles (Mitochondria, chloroplasts, ER, Golgi, ribosomes, lysosomes and peroxysomes, nucleus and nucleolus) and their functions. Differences and similarities between plant and animal cells.

UNIT-II  
11 Hours

UNIT-III  
11 Hours
Cell Energetics: Aerobic oxidation and photosynthesis, Utilization of glucose, Role of ATP in energy cycle- Phosphorylation

UNIT-IV  
13 Hours

UNIT-V  
12 Hours
Taxonomic classification of animals. Animal classification – Animal kingdom – Kingdom, phylum, Class, order, family, Genus, species- Importance and application of taxonomic classification.

TEXT BOOKS:

I SEMESTER

MAJOR II: INTRODUCTION TO CHEMISTRY

UNIT – I


UNIT – II


UNIT – III


UNIT – IV

Types of chemical bonds: Ionic bonding – Covalent bonding- Orbital hybridization (Sp\(^3\), Sp\(^2\), Sp\(^1\) only) – Multiple valency – electro negativities and electron affinities – Geometry of simple covalent compounds – coordinate covalent bonds.

UNIT – V

Crystallography: Solids (Crystalline & Amorphous) – Unit cell – Characteristic parameters – Body centered cubic structure (eg. CsCl) – Face centered cubic structure (eg. NaCl)

TEXT BOOKS:

I SEMESTER

ALLIED I: INTRODUCTION TO COMPUTER SCIENCE

UNIT – I  
10 Hours


UNIT – II  
10 Hours

Operating System Concepts: Definition – Architecture – Functions and Services of operating system– Different types of operating system – Single user OS, Multi user OS, Multiprocessing OS, Multitasking OS & Real Time OS. Comparison of Client Server & Peer to peer OS.

UNIT – III  
15 Hours

Number Systems: Non – positional and Positional number system – converting from one number system to another – Fractional numbers. Computer Codes: BCD, EBCDIC, ASCII, Unicode.

UNIT – IV  
13 Hours

Information system and data storage system: Data – Information –Qualities of information –Data processing cycle – Types of data processing – Data processing system, Data storage system: Files - File organization-DBMS Advantage.

UNIT – V  
12 Hours

Network & Internet Technologies : Network – Different types - Internet definition – Brief History - Services – Internet Terminologies ( WWW, web page, website, web browser, Domain name, HTML, HTTP, TCP/IP, URL, search engine) – Web browsers – Uses of Internet.

TEXT BOOKS:


2. Basic Computer Skills made easy, by Sherman, J., 2001 Butterworth-Heinemann Ltd, USA
I SEMESTER

MAJOR PRACTICAL - I

LAB IN BASIC BIOLOGY AND CHEMISTRY

Basic Biology

1. Identification of mitotic stages using Onion root tip.
2. Study of meiotic stage using pollen grains.
3. Isolation of Proteins (Caesin from Milk).
4. Estimation of chlorophyll pigments.
5. Paper chromatography.
6. Thin layer Chromatography.

Chemistry

1. Acidimetry and alkalimetry
   a) Strong acid vs strong base
   b) Weak acid vs strong base
2. Permanganometry
   a) Estimation of ferrous sulphate
   b) Estimation of oxalic acid
3. Iodometry
   a) Estimation of copper
   b) Estimation of potassium dichromate
   c) Estimation of potassium permanganate
5. Preparation of Buffer and pH determination.
I SEMESTER

ALLIED PRACTICAL -I

LAB IN COMPUTER SCIENCE

1. Command line interface – Basic DOS commands – Create and delete directories – View the contents of a directory – Renaming a directory – Changing directory.
4. Word processing, Spreadsheet, Presentation.
5. Searching online databases. Eg. Pubmed.
II SEMESTER

MAJOR III: BIOMOLECULES

UNIT –I 12 Hours

Carbohydrates – Classification, Chemistry and properties, Glycogen metabolism, Glycolysis, Krebs cycle, Gluconeogenesis.

UNIT – II 8 Hours

Proteins – Amino acids, properties, Structure of naturally occurring amino acids, Orders of protein structure.

UNIT – III 15 Hours


UNIT – IV 10 Hours

Amino acid synthesis: From intermediates of citric acid cycle and other major pathways, Purine and Pyrimidine biosynthesis.

UNIT – V 15 Hours


TEXT BOOKS :

II SEMESTER

MAJOR IV: INTRODUCTION TO MATHEMATICS

UNIT – I  18 Hours

Sets – Set Operation – Union Intersection – Complementation – Symmetric Difference – Power sets
Cartesian Product – Relations – Functions – Inverse Functions and composition of functions – Groups
– Types – Simple properties of groups – Cyclic groups and subgroups.

UNIT - II  12 Hours

Elementary Trigonometry: Addition, Subtraction, Sine and Cosine formulas, Concept of Arithmetic
Progression and Geometric Progression -Trigonometry function and acute angle, Radian and degree
measures of angle, solving of right angled triangle.

UNIT – III  20 Hours

Determinants and Matrices- Properties of Determinants, Minors and Cofactors, Multiplication of
Determinants, Adjoint, Reciprocal, Symmetric Determinants, Cramer’s rule, Different types of
matrices, Matrix Operations, Transpose of a matrix, Adjoint of a square matrix, Inverse of a matrix,
Eigen values and eigen vector.

UNIT – IV  20 Hours

Vector Analysis: The concept of a Vector, Vector addition and subtraction, Products of two vectors-
Dot product and Cross product, Products of three vectors- scalar triple product and vector triple
product, Gradient, Divergence and Curl.

UNIT – V  20 Hours

Fourier series: Definition –Fourier formula for 2-periodic functions using sines and cosines –Simple
Fourier series –Fourier motivation –Exponential Fourier series.

TEXT BOOKS :

2. Introduction to Calculus & Analysis, Vol I and II by Richard Courant & Fritz John, 1999,
Springer publisher.
Publishing Co. Ltd, New Delhi.
4. Basic Mathematics by Serge A. Lang, 1988, Springer publisher
Publishers, New Delhi.
6. Schaum’s outline of college mathematics by Philip Schmidt and Frank Ayres, Schaum’s
II SEMESTER

ALLIED II: INTRODUCTION TO PHYSICS

UNIT – I  
11 Hours
Mechanics and General Properties of Matter: Newton’s laws of motion and applications, Velocity and acceleration in Cartesian, polar and cylindrical coordinate systems, uniformly rotating frame, centrifugal and coriolis forces, Motion under a central force, Kepler’s laws, Gravitational Law and field, Conservative and nonconservative forces. Systems of particles Centre of mass, equation of motion of the CM, Conservation of linear and angular momentum, Conservation of energy, variable mass systems. Elastic and inelastic collisions. Rigid body motion, fixed axis rotations, rotation and translation, moments of Inertia and products of Inertia. Principal moments and axes.

UNIT – II  
9 Hours
Elasticity: Stress and strain in solids, Hook’s law, Stress-Strain curves, Properties of fluids.

UNIT – III  
14 Hours

UNIT - IV  
11 Hours
Surface tension: Surface tension and surface energy, Capillary Action, Angle of contact, Wet ability, Relation between surface tension, excess pressure and curvature, surface tension by capillary rise method, Jaeger’s method, quincke’s method, Temperature dependence of surface tension, applications.

UNIT – V  
15 Hours
Sound: Types of waves (Longitudinal and transverse wave), Principles of superposition, Audible, ultrasonic and infrasonic waves, Vibrating systems and source of sound, Beats, the Doppler effect. Thermometry: Principles of thermometry, Concept of temperature and its measurements, Kelvin, Celsius and Fahrenheit, Thermal energy, Platinum resistant thermometer, thermocouple and thermistor as thermometers.

TEXT BOOKS:

II SEMESTER
MAJOR PRACTICAL -II
LABORATORY IN BIOMOLECULES

1. Calculation of Moles, Millimoles, Micromoles and nanomoles.
2. Estimation of Free amino acids.
4. Estimation of blood sugar.
5. Estimation of Glycogen
7. Estimation of Nucleic acid
8. Qualitative tests for Carbohydrate, Protein and Lipid.

II SEMESTER
ALLIED PRACTICAL -II
LABORATORY IN PHYSICS

Typical experiments on

1. Determination of acceleration due to gravity moment of inertia etc – Simple Pendulum
2. Elastic constants determination using different methods – Young’s modulus.
4. Determination of surface tension of water, soap bubble etc - Jet Vibration, Simple Bubble method
5. Determination of Viscosity of a liquid – Viscometer
6. Determination of Velocity of sound in air - Speed of sound.
III SEMESTER

MAJOR V: INTRODUCTION TO BIOLOGICAL DATABASES

UNIT I 15 Hours

Introduction: Aim and branches of Bioinformatics, Application of Bioinformatics, Role of internet and www in bioinformatics. Forms of biological information, Types of Nucleotide Sequence: Genomic DNA, Complementary DNA (cDNA), Recombinant DNA (rDNA), Expressed sequence tags (ESTs), Genomic survey sequences (GSSs).

UNIT II 12 Hours

Organization of Data: Contents and formats of database entries, retrieval of data using text-based search tools – Entrez, SRS, sources of data (e.g. sequencing projects, individual scientists, patent offices etc.), method for deposition of data to databases and tools used (e.g. Webin, sequin), Expasy tools.

UNIT III 12 Hours

Important Biological Databases: Nucleic acid sequence databases: GenBank, EMBL, DDBJ. Protein sequence databases: SWISS-PROT, TrEMBL, PIR_PSD. Genome Databases with special reference to model organisms (Yeast, Drosophila, C. elegans, Rat, Mouse) Human, plants such as Arabidopsis thaliana, Rice, etc.

UNIT IV 11 Hours

Derived Databases: Concept of derived databases, sources of primary data and basic principles of the method for deriving the secondary data for Prosite, PRODOM, Pfam, PRINTS. Composite databases – NRDB, OWL, and Pattern databases.

UNIT V 10 Hours

Other Databases: PDB- Structural database, Protein structural classification databases: CATH & SCOP. Metabolic pathway database - KEGG, Secondary structure assignments - DSSP, Comparing 3D structure - DALI.

TEXT BOOKS :

2. Bioinformatics and Functional Genomics by Pevsner, J., 2003, John Wiley and Sons, New Jersey, USA
III SEMESTER

MAJOR VI: PROGRAMMING IN C

UNIT I  11 Hours

UNIT II  14 Hours

UNIT III  12 Hours
Single dimensional Array: Declaration – Memory representation - Compile and Runtime Initialization – Accessing – String Handling.

UNIT IV  13 Hours
Two dimensional Arrays: Declaration – Memory representation - Compile and Runtime Initialization – Accessing - Matrix manipulation – Sequence manipulation.

UNIT V  10 Hours
Built-in library function – User defined functions – Structure – Union – File handle: Read and Write character from a file

TEXT BOOKS:
III SEMESTER
ALLIED III: BIOSTATISTICS

UNIT – I


UNIT – II

Collection of Data – Primary and Secondary – Types and methods of data collection – Procedure – Merits and Demerits – Classification and tabulation of data – Diagrams and graphs.

UNIT – III


UNIT – IV


UNIT – V


TEXT BOOK:


III SEMESTER
MAJOR PRACTICAL -III
LAB IN C PROGRAMMING

1. Calculate the Body Mass Index of a person. [BMI = Weight in kgs/height in metre$^2$]
   2. Reverse the given number.
   3. Design pattern.
   5. Count the number of A, G, C, T in the given DNA sequence.
   6. Sort the given amino acid names.
   7. Protein Information Systems.
   8. Read the fasta file.
   9. DNA to RNA conversion using text file.

ALLIED PRACTICAL -III
LAB IN BIOSTATISTICS

1. Diagrammatic Representation: Bar Charts, Pie diagrams.
2. Graphical representation of data – Histograms, Frequency polygon.
3. Measures of Central tendency – Arithmetic mean, median, mode.
4. Measure of dispersion
5. Skewness and Kurtosis.
7. Regression – lines of regression
8. Tests of significance based on Student’s t test.

Note: the above mentioned statistical problems were solved using Spreadsheet.
IV SEMESTER

MAJOR VII: MICROBIOLOGY AND IMMUNOLOGY

UNIT – I

Diversity of Microorganisms – Salient features of Bacteria, Virus, Phages, Algae, Fungi and Protozoan. Industrial applications of microorganisms in various fields.

UNIT – II


UNIT – III

Biological control of microorganisms – Antimicrobial agents in therapy – Mode of action and side effects – Mechanism of drug resistance – Symbiotic and Asymbiotic N₂ fixation – Bio fertilizer.

UNIT – IV

Types of Immunity – Lymphoid organs – Lymphocytes – Cell maturation and differentiation – Immune response – Structure and Biological properties of Immunoglobulin.

UNIT – V


TEXTBOOKS:

IV SEMESTER

MAJOR VIII: BIOINFORMATICS ALGORITHM

UNIT – I 10 Hours

Introduction: Algorithm – Definition and concepts. Biological versus computer algorithm. Big notation Types of algorithm (Fast Vs slow, Iterative Vs Recursive)

UNIT – II 10 Hours


UNIT – III 17 Hours


UNIT – IV 10 Hours


UNIT – V 13 Hours

Trees Construction: Distance Based Tree Reconstruction – UPGMA, Neighbor Joining method, Character Based Tree Reconstruction – Maximum parsimony.

TEXT BOOKS:

2. Essential Bioinformatics-Jin Xiong, Cambridge University Press. 2006
IV SEMESTER

ALLIED IV: INTRODUCTION TO DBMS AND INFORMATION TECHNOLOGY

UNIT-I  13 Hours
Introduction: Data abstraction, Data models, Instances & schemes E-R Model: Entity and entity Sets, Relations and relationship sets, E-R diagrams, Data Model: Basic concepts, Hierarchical Data Model: Network, Relational and Object- Oriented Models) – RDBMS: Relational Database Management systems, distributed database processing

UNIT-II  12 Hours
Data definition languages – Data Manipulation language, Data Control language, Data and String Functions, Union and intersect operator, Sub queries, Normal Form, Introduction to PL/SQL, Data types in SQL, Simple PL/SQL programs.

UNIT III  13 Hours
Structured Query Language – Basic Structure, Set Operations, Aggregate Functions, Null Values, Nested Sub queries, Views, Integrity: Domain constraints, Joined Relations, Data-Definition Language

UNIT –IV  10 Hours
Telecommunications: introduction to telecommunications – computer networks – Communication systems – distributed systems

UNIT –V  12 Hours
New technologies in IT; E- Commerce – hypermedia – data warehouses and data marts – data mining – online analytical processing – Geographical information system.

TEXT BOOKS:
2. Computer Networks (3rd Ed.) by Tananbaum A.S., 1999, PHI.
IV SEMESTER

MAJOR PRACTICAL - IV

LABORATORY IN MICROBIOLOGY AND IMMUNOLOGY

Microbiology

1. Preparation of media: Basal, Selective, Differential and Enriched media
3. Isolation of pure culture: Pour plate, spread plate and streak plate.
5. Isolation of microbes from soil, water and air.
6. Preservation of cultures.
8. MBRT for milk analysis
9. MPN test for water analysis.
10. Antibiotic sensitivity test- disc diffusion.

Immunology

1. Preparation of plasma and serum.
2. Blood grouping and Rh typing.
3. Precipitation reaction – single immunodiffusion, double immunodiffusion.

IV SEMESTER

ALLIED PRACTICAL – IV

LAB IN DBMS

1. Creating database, Selecting database, Deleting database, Creating table, Modifying Table,
2. Deleting table
3. Inserting, updating and deleting records
4. Retrieving Records
5. Retrieving specific rows and columns
6. Use of MySQL operators – Arithmetic operators, Comparison
7. Operators, Logical operators
8. Math functions, Aggregate functions
9. String operations
10. Limiting, Sorting and grouping query results
11. Handling null values
12. Renaming or aliasing table and column names
V SEMESTER

MAJOR IX: BIOLOGICAL SEQUENCE ANALYSIS

UNIT – I 10 Hours

Introduction to sequence analysis – why to analyse DNA sequence & Protein sequence. Basic concepts of sequence similarity & identity. Definitions of homology, orthology, paralogy and Analogy. Twilight Zone. Introduction to single letter code of amino acids, symbols used in nucleotides.

UNIT – II 12 Hours


UNIT – III 17 Hours

Multiple alignment – Definition, Consensus. Methods of multiple alignment – Dynamic programming, Progressive, iterative and the tools based on it. Advantages of Multiple alignment. Basic concepts in systematic, taxonomy and phylogeny; molecular evolution; nature of data used in Taxonomy and Phylogeny, Definition and description of phylogenetic trees and various types of trees representation – Phylogram, Cladogram, Dendogram. Evolutionary analysis: Bootstrapping strategies

UNIT – IV 10 Hours

Nucleic acid sequence analysis: Reading frames; Codon Usage analysis; Translational and transcriptional signals; Protein sequence analysis: Compositional analysis; Hydrophobicity profiles; Amphiphilicity detection; Transmembrane prediction methods.

UNIT – V 11 Hours

Sequence patterns and profiles: Basic concept and definition of sequence patterns, motifs and Profiles, various types of pattern representations viz. consensus, regular expression (Prosite type) and sequence profiles; profile-based database searches using PSI-BLAST, analysis and interpretation of profile-based searches.

TEXT BOOKS:


V SEMESTER

MAJOR X: GENETICS AND EVOLUTION

UNIT – I 12Hours


UNIT – II 12Hours


UNIT – III 12Hours


UNIT – IV 12Hours


UNIT – V 12Hours


TEXT BOOKS:

V SEMESTER

MAJOR XI: MOLECULAR BIOLOGY & GENETIC ENGINEERING

UNIT-I 12 Hours
History of Molecular Biology-DNA and RNA as genetic materials-Experiments, Structure of DNA, Chargaff’s rule, different forms of DNA and RNA, secondary structure in single stranded nucleic acids.

UNIT-II 12 Hours
Replication-Semi-conservative process, Transcription and Translation, inhibitors of transcription and translation. Reverse transcription, Genetic code, codon, anticodon.

UNIT III: 12 Hours

UNIT – IV 12 Hours
Gene library in a genomic library, cDNA library, phage lambda verses cosmid for gene libraries, mapping the DNA, restriction mapping – direct mapping, indirect mapping, DNA footprinting, chromosome walking, chromosome jumping.

UNIT – V 12 Hours
DNA sequencing – Maxam and Gilbert chemical method, Sanger and Olson enzymatic chain termination method – the primer, the template, the dideoxynucleotide termination and deoxynucleotides, the polymerases, Shot gun method using computer sequencing.

REFERENCES:

V SEMESTER

MAJOR XII: STRUCTURAL BIOLOGY

UNIT – I 10 Hours
Proteins: Principles of protein structure; anatomy of proteins – Hierarchical organization of protein structure - Primary, Secondary, Super secondary, Tertiary and quaternary structure; Internal coordinates of proteins; Ramachandran plot

UNIT – II 13 Hours
DNA and RNA: DNA and RNA: types of base pairing – Watson-Crick and Hoogstein; types of double helices A,B,Z and their geometrical as well as structural features; structural and geometrical parameters of each and their comparison

UNIT – III 12 Hours
Intermolecular Interactions: Protein-protein interactions, protein –DNA interactions, DNA binding proteins, Types of interactions of DNA with proteins and small molecules. Different forces involved in the interactions.

UNIT – IV 15 Hours
Introduction to X-ray Crystallography - Crystal system, Bragg’s law, diffraction of crystals, crystallization, principles of structure solution, Structure validation. Basics of NMR spectroscopy, coupling constant and chemical shift, NOE, Application of NMR spectroscopy in protein structure determination

UNIT – V 10 Hours
Structure Visualization Tools Knowledge of Programs such as SPDBV, Rasmol, Pymol, Chimera, molmol, chime.

TEXT BOOKS:

V SEMESTER

MAJOR XIII: OPERATING SYSTEMS AND THE NETWORKS

UNIT – I 10 Hours
Introduction to operating systems – MS windows commands – Unix/Linux basic commands – general purpose, file handling; Vi editor, basic commands – Shell programming.

UNIT – II 12 Hours
Reference Model, Network Topologies and Protocols, Types of Networks: Local Area Network (LAN), Wide Area Network (WAN), Metropolitan Area Network (MAN), Network services – OSI architecture

UNIT – III 10 Hours
Wireless communication – Network elements - Introduction to Internet – Internet architecture - resource H/W & S/W requirement of Internet

UNIT – IV 15 Hours
Domain naming system, registering our domain name – URL protocol server port relative URLs overview of web browser- ISDN dialup or leased line connection – internet service providers – internet services protocols concepts – internet client and internet server introduction to TCP/IP FTP SMTP POP3.

UNIT V 13 Hours

TEXTBOOKS:
1. Operating Systems; by Madnick S.E. and Donovan J.J; McGraw –Hill, 2001
V SEMESTER

MAJOR PRACTICAL - V

LAB IN BIOLOGICAL SEQUENCE ANALYSIS

1. Retrieving Protein and DNA Sequences using Entrez at NCBI
2. Retrieving Protein and DNA Sequences using SRS at EBI
3. To retrieve metabolic pathways using KEGG PATHWAY Database
4. Pair wise alignment tools- BLAST & FASTA
5. Multiple Sequence Alignment – CLUSTALW
6. Phylogenetic analysis – PHYLIP/MEGA
7. To retrieve metabolic pathways using Reactome.
8. Web browsing at SwisProt, PIR PSD, UniProtKB
9. Understanding the format of PDB and NDB files.
10. File format conversion tools.

V SEMESTER

MAJOR PRACTICAL - VI

LAB IN BIOTECHNIQUES

1. Quantitative analysis of proteins (Lowry’s method).
2. Isolation of genomic DNA from plant and animal source.
3. Isolation of bacterial plasmids by Agarose gel electrophoresis.
4. SDS PAGE.
5. Study of DNA melting.
7. Study of Restriction digestion.
VI SEMESTER
MAJOR XIV: GENOMICS & PROTEOMICS

UNIT – I

13 Hours

UNIT – II

10 Hours

UNIT – III

13 Hours
Mapping genomes by genetic techniques – Linkage Analysis, Mapping genomes by physical techniques – Restriction mapping, FISH, STS.

UNIT – IV

10 Hours
Introduction to Proteomics – Proteomics Vs Genomics – Classification of Proteomics Proteome projects and their significance – Codon Bias – Motif & Domain – Protein families.

UNIT – V

14 Hours

TEXT BOOKS:

VI SEMESTER

MAJOR XV: PERL PROGRAMMING

UNIT – I 13 Hours

Introduction to Perl: Basic I/O, Lexical VS Global, Scalars/Arrays/Hashes, Interpolation - variable and backslash interpolation, Context - scalar VS list context, Operators - operators, operator, precedence, File/Directory Access - open, opendir, close, < >, $/

UNIT – II 10 Hours

Built-In Functions - push, pop, shift, unshift, keys, values, sort, length, index, reverse, stat Command Line Arguments, Control Structures, Regular Expressions, Pattern Matching.

UNIT – III 15 Hours

Sequences and strings- Representing sequence data, a program to store a DNA sequence, concatenating DNA fragments, transcription: DNA to RNA using the perl, calculating the reverse complement in proteins, files and arrays, reading proteins in files.

UNIT – IV 15 Hours

BIOPERL: Accessing sequence data from local and remote databases, Accessing remote databases (Bio::DB::GenBank, etc), Transforming sequence files (SeqIO) Transforming alignment files (AlignIO) Manipulating sequences, Searching for similar sequences, Running BLAST (using RemoteBlast.pm), Bioperl alphabets, Extended DNA / RNA alphabet, Amino Acid alphabet

UNIT – V 10 Hours

CGI Programming - CGI basics, forms, input types, param(), CGI.pm Module.

TEXT BOOKS:

### V SEMESTER

**MAJOR XVI: MOLECULAR MODELLING**

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### TEXT BOOKS:

VI SEMESTER

MAJOR XVII: BIODIVERSITY

Unit I: 12 Hours

The meanings to Biodiversity: Conceptual framework of Biodiversity - Problems and scales of Biodiversity - Levels and Measures of Biodiversity, Interrelationship between Biodiversity measures, applications and integration of diversity measures - Process and pattern of local and regional biodiversity-Niche assembly theories, unified Neutral theory, Island biogeography model

Unit II: 14 hours

Threats to species diversity: Natural and Human induced threats and vulnerability of species to extinctions- Biodiversity and Rarity, Endemism and Biodiversity- Problem of Genetic diversity loss over time: Genetic drifts, Inbreeding depression- Effective and minimum viable population size, measurements and variations- Review of Risks to Biodiversity extinctions. Extinction vortex.

Unit III: 9 Hours

Global pattern of biodiversity: Diversity in biogeographically region and marine zones - Diversity clines in relation to area, latitude, altitude and deep sea - Theories on biodiversity dispersions

Unit IV: 14 Hours

Effect of human activities: Depletion of resources; Generation of waste; types (agricultural, municipal, industrial); Management of wastes and disposal (emphasis on concepts of reduce, reuse and recycle); Pollution of air, water, soil, noise, and due to radioactive substances; Causes and methods of prevention and control; Eutrophication; Bioremediation; Depletion of forests; Threats to biodiversity.

Unit V: 11 Hours

Sustainable Development: Definition; Threats to sustainable development, green technologies, ecocities, Ecological footprint, National Environmental Policy. Maintaining biodiversity: General measures for conservation and sustainable use – Identification and maintaining –In-situ and Ex-suit conservation –Sustainable use of components of biological diversity –Incentive measures.

Text book:

VI SEMESTER

MAJOR XVIII: WEB PROGRAMMING

UNIT – I  
12 Hours


UNIT – II  
13 Hours

Introduction to DHTML – Introduction to style sheets – setting the default style sheet language – Inline style information – External style sheets – Cascading style sheet.

UNIT – III  
12 Hours

Java Programming - Importance and features of java – Data types – Control statements – Program structure.

UNIT – IV  
10 Hours

Applet Programming – Applet Basics – Applet Life cycle – Fonts and Colors – Simple Graphics

UNIT – V  
13 Hours

Introduction to distributed computing environment (DCE) – DCE components – communication protocols – example of necessary transfer in OSI modules – message passing – desirable features of a good message passing systems.

TEXT BOOKS:

VI SEMESTER
MAJOR PRACTICAL - VII
LAB IN MOLECULAR MODELLING

1. Protein Sequence analysis using Expasy:
   a) Primary
   b) Secondary
   c) Tertiary

2. Homology based comparative protein modeling - Modeller

3. Validation of models.
   a. WHATIF
   b. PROSA
   c. PROCHECK
   d. VERIFY 3D

4. Energy minimization – SPD viewer
VI SEMESTER
MAJOR PRACTICAL - VIII
LAB IN WEB and PERL PROGRAMMING

LAB: WEB PROGRAMMING

1. Usage of simple HTML commands, Graphics and image formats and hyperlinks
2. Use of tables, frames, forms, background graphics and color.
3. Simple Website using HTML
5. Creating a simple java program
6. Simple Applet program

LAB: PERL PROGRAMMING

1. File Handling using Perl.
2. Uses of Regular Expressions
3. Concatenation DNA fragments, Transcribing DNA into RNA
4. Calculating the Reverse complement of a DNA strand
5. Parsing Database sequence and storing in Files - Extract annotation and sequence from GenBank file, Extract sequence chains from PDB file
6. Creating forms using CGI