Mahatma Gandhi University, Kottayam

Curriculum

of

B Sc Bioinformatics (CBCSS)

SEM	PAPER CODE	TITLE OF SUBJECT	TEACHING HRs THEORY	LAB	TOTAL HRS	CREDITS	TOTAL CREDITS
SEM 1	BI 1A 01	English I	5		25	4	20
	BI 1B 01	Introduction to information technology	5			4	
	BI 1B 02	Research Methodology	5			4	
	BI 1C 01	Introduction to Cell Biology	3			2	
	BI 1C 02	Fundamentals of genetics	3			2	
	BI 1B 03	Practical I		4		4	
SEM 2	BI 2A 02	English II	5			4	
	BI 2B 04	Introduction to Bioinformatics	5		25	4	20
	BI 2B 05	Biochemistry	4			3	
	BI 2C 03	General Microbiology	3			2	
	BI 2C 04	Biomathematics	4			3	
	BI 2B 06	Practical II		4		4	
SEM 3	BI 3B O7	Advanced Biocomputing	5		25	4	20
	BI 3B 08	Introduction to programming in C	5			4	
	BI 3B 09	Basic Instrumentation	4			3	

	BI 3C 05	Biophysics	4			3	
	BI 3C 06	Immunology & Immunotechnology	3			2	
	BI 3B 10	Practical III		4		4	
SEM 4	BI 4B 11	Structural Bioinformatics	5		25	4	20
	BI 4B 12	Biostatistics	5			4	
	BI 4B 13	Databases and their management	5			4	
	BI 4C 07	Enzymology	3			2	
	BI 4C 08	Genetic Engineering	3			2	
	BI 4B 14	Practical 4		4		4	
SEM 5	BI 5B 15	Molecular Biology	5		25	4	22
	BI 5B 16	Proteomics	4			3	
	BI 5B 17	Web Programming & Perl	4			4	
	BI 5C 09	Environmental studies & human rights	4			4	
	BI 5D 01	Open Course: Basic Bioinformatics Concepts & Biological Databases	4			3	
	BI 5B 18	Practical 5		4		4	

SEM 6	BI 6B 19	Molecular Modelling & Drug designing	6		25	4	18
	BI 6B 20	Applied Bioinformatics	5			4	
	BI 6E 01	Choice Based Paper	3			3	
	BI 6B 21	Practical 6		5		4	
	BI 6B 22	Project & Viva		6		3	

SEMESTER 1

ENGLISH I

As fixed by the university under the CBCS system

INTRODUCTION TO INFORMATION TECHNOLOGY

AIM: To create overall generic awareness about scope of the field of IT and to impart basic personal computing skills to; to expose students to algorithmic thinking and problems solving impart moderate skills in programming

Module 1

Information Technology: historic evolution of computers, classification of computers, micro computer,mini computer, main frames, super computers, personal computers, desktop, laptops, Palmtop, tablet PC, hardware & software.

Module 2

Hardware CPU, memory, input device, output device, memory Modules, RAM;ROM-different types: Flash memory, Auxiliary storage, Magnetic device, optical device, floppy device, hard disk, CD ,DVD, input devices-keyboard mouse, scanner, joystick, optical readers, bar code reader, output device: display device, size, and resolution, CRT, LCD, Printers: Dot-matrix, inkjet, plotters, sound cards & speakers.

Module 3

Software: System software, Application software, introduction to operating system, programming language,

Application softwares,compiler,interpreter,assembler,linker,databases;different types of operating systems; single user, multitasking, time sharing ,multi user, booting, POST, generic features of word processors, spreadsheets and presentation software, computer viruses and protection.

Module 4

Computer networks- requirements for a network server, work station hub/switch, network interface card ;internet -brief history, www, websites, url, browsers, search engines, internet connections-isp, dialup, cable modem, WLL, DSL, Leased line , EMAIL, Email software features(send,receive,filter,attach,forward,copy,blindcopy)internet security and privacy.

References

Core Reference

1. Alexis lean & Mathews lean, Computers today,leon vikas.

Additional References

1. Computer Fundamentals By P K Sinha & Priti Sinha Fourth Edition.
2. Greg Perry, SAMS teach yourself open office.org.
3. Alexis & Mathews Leon, Fundamentals of information technology.

RESEARCH METHODOLOGY

OBJECTIVES

- To understand the significance of research methods in Biological research.

Module I

Introduction to Research Methodology

Introduction to Research- Definition, Objectives and Characteristics of research, Types of Research- Basic, Applied and Action research, Exploratory and Descriptive, Ex-post facto research

Module II

Defining the Research Problems

Identification of Research Problem Sources of research problem, Criteria for the selection of research problem. Research design, Rationale, Statement of problem, Setting objectives. Definition of concepts Hypothesis - Meaning and importance, types of hypotheses.

Module IV

Research Methods and Tools

Methods of Collecting Primary Data - Questionnaire, preparation of schedules, interview method, case study method, experimentation method and sources of secondary data. Editing and Coding the Data Organization of Data - Classification - meaning and objectives, types of classification.

Representation of

Methods - Survey, observation, interview, experimental, clinical methods. Tools Questionnaire, Schedule (for interview and observation) Rating Scales, Attitude Scales. Reliability and validity.

Module IV

Data collection and presentation:

Introduction to Biostatistics: Variable and attribute; Population vs. sample; Census vs sample survey; Arrangement of data; Frequency distribution. Graphical presentation of data: Line diagram; Bar diagram; Pie chart; Histogram

Module V

Scientific writing.

Basics in Scientific Grammar. Importance of abbreviations and acronyms. Types of scientific publications-magazines, journals, reviews, news letters, Structure of Scientific paper. Various reference styles.

References

- Bandarkar, P.L. and Wilkinson T.S. (2000): Methodology and Techniques of Social Research, Himalaya Publishing House, Mumbai.
- Batnagar, G.L. (1990): Research Methods and Measurements in Behavioral and Social Sciences, Agri. Cole Publishing Academy, New Delhi.
- Mukherjee, R. (1989): The Quality of Life: Valuation in Social Research, Sage Publications, New Delhi.
- Biju Dharmapalan (2012). Scientific Research Methodology. Narosa Publications, New Delhi
- Kothari, C.R. (2000) Research Methodology- Methods and Techniques, 2nd edition, New age International (P) Ltd. Publishers, New Delhi,
- Gupta, S.F., (2002). Statistical Methods, Sultana Chand and Sons, 3l Revises Edition,

INTRODUCTION TO CELL BIOLOGY

Aim: To study the basic levels of cell and its functions

MODULE I

Module I: Definition of Cell, Cell theory, Diversity of cell size and shape. Overview of cell specialization – Plants – epidermis, vascular tissue and cortex. Special properties pf plant cells- cell wall, vacuoles and chloroplasts. Animals- epithelia, connective tissue, nervous tissue, muscle, blood, germ cells and sensory cells

MODULE II

Structure and organization of prokaryotic and eukaryotic cells, differences.

MODULE III

Plasma membrane-Structure and functions. Structure and Function of Cell organelles- Endoplasmic reticulum, nucleus, mitochondria, chloroplast, lysosomes, Golgi apparatus, cytoskeleton-microtubules, intermediate and microfilaments, ribosomes. Membrane proteins and their functions.

MODULE IV

Transport across membranes, Types of membrane transports- active and passive Transport, Passive transport- Simple and facilitated diffusion, transporters- Uniporters , antiport and symport. Active transport- Na+ K+Pump, Ca pump.

MODULE V

Cell cycle-phases, Cell Division-Mitosis and Meiosis and Cell death. Chromosome-Structure and types.

REFERENCE

1.The cell a molecular approach 4th edition-Geoffrey m. cooper Robert E. Hausman

2.Cell and Molecular Biology-Gerald Karp 7th edition

Additional References

3.Cell Biology-Rastogi

4.Cell Biology and Genetics-P K Gupta

FUNDAMENTALS OF GENETICS

Aim: To introduce the fundamentals of genetics and give information of genes and their inheritance.

MODULE 1

Introduction to Genetics – Genetic terminology (trait, gene, locus, allele, diploid, haploid, phenotype, genotype, homozygous, heterzygous, dominant and recessive) Hereditary and Variation. Mendel experiments in garden pea and laws of hereditary.

MODULE II

Gene interaction- Allelic interactions (complete, incomplete dominance and codominance). Non-allelic interactions (complementary and supplementary gene interaction, Epistasis, Duplicate genes, Polymeric genes, Lethal genes, poly genes and Pleiotropism). Multiple alleles (Coat color in rabbit, ABO blood group system in man)

MODULE III

Mutations: Chromosomal Mutations-Changes in number (Euploidy and aneuploidy) and changes in structure (Deletion, Duplication, Inversion and Translocation). Gene mutations: Induced versus Spontaneous mutations. Mutagens (Physical and chemical). Molecular basis of gene mutations in relation to UV light.

MODULE IV

Linkage- Types (complete and incomplete linkage with example) linkage groups. Crossing over-Mechanism, Types and significance. Genetic map of chromosomes.

MODULE V

Sex linked inheritance – X- linked (color blindness in humans, hemophilia) Y- linked and X-Y linked inheritance. Cytoplasmic inheritance and maternal effects (shell coiling in limnea). Chromosome theory of inheritance.

REFERENCES

Core References

1. Peter J. Russell, iGenetics: A Molecular approach (2nd edition), Pearson education, Inc.
2. Peter Snustad &Simmons, Principles of Genetics (8th edition), John WILEY & Sons, Inc.

Additional References

1. Monroe w. stickberger, Genetics (3rd edition), Prentice- Hall of India Pvt. -Ltd.

PRACTICAL I

Aim: To gain hands- on knowledge in basic operations of a GUI Operating System and Standard application software and utilities

OBJECTIVES:

After the completion of this course, the student should be able to:

- Create, Save, Copy, Delete, Organize various types of files and manage the desk top in general
- Use a standard word processing package exploiting popular features
- Use a standard spread- sheet processing package exploiting popular features
- Use popular utilities on a PC such as file compressor, CD writer, Media Player etc
- Browse the internet and search for required information successfully

SYLLABUS

1. Lab Sessions to Practice the following features (depending on availability) on a selected GUI Operating System: Mouse Practice, Starting, Login, Shutdown, Exploring Directories, Resizing, Moving, Minimizing, closing of software, windows, familiarization with file icons, Launching Applications, Deleting, Renaming tiles. Managing Directories, searching for files, Using Accessories.
2. Lab Sessions to practice the following features (depending on availability) on a selected word processor: General: Menus, Shortcut menus, Toolbars, customizing toolbars, creating and opening documents, saving documents, renaming documents, working on multiple documents, close a document, Working with Text: Typing and inserting text, selecting text, deleting text, undo, formatting toolbar, formal painter, formatting paragraphs: paragraph attributes, moving copying and pasting text. The clipboard, columns, drop caps; Styles: Apply a style, apply a style from the style dialog box, create a new style from a model, creating a simple style from the style dialog box, modify or rename a style, delete a style; Lists: Bulleted and numbered lists, Nested lists, Formatting lists tables insert table button, draw a table, inserting rows and columns, Moving and resizing a table.

Semester 2

ENGLISH II

As fixed by the university under the CBCS system

INTRODUCTION TO BIOINFORMATICS

Aim

To introduce the basic concepts of Bioinformatics

Module 1 : Bioinformatics , Nature and scope of Bioinformatics, Branches of Bioinformatics , Human Genome Project (HGP) , Bioinformatics Industry, Differences in nature and scope of Biology and computer science, Biological motivation in computing neural network , Genetic Algorithms , Robotics etc.

Module 2 : , Sequence alignment , Bioinformatics tools - BLAST and FASTA, Pairwise sequence alignment :- Global and Local alignment, Multiple Sequence alignment (MSA):- Progressive and Iterative Methods , Eg:- Clustal W , Clustal X & Mult alin.

Module 3 : Biological Databases in Bioinformatics :- Sequence databases and Structure databases , General overview of NCBI , Genbank , DDBJ , EMBL , SWISS PROT , PROSITE , RCSB - PDB , PIR - PSD.

Module 4 : Sequence visualization and Structure Visualization tools :- General Overview of Map viewer , ORF Finder , Locus link , Swiss PDB Viewer , Webmol , Rasmol ,Chime, MOLMOL ,Cn3D, MolScript, Phymol.

Module 5 :, Computational Genomics , Computational Proteomics , Drug discovery, Molecular Phylogenetics and Molecular Evolution:-Terminology , Bio-datamining , Pharmaco genomics & Chemiinformatics.

REFERENCES

Coe References

1. Dan E Krane and Michael L Raymer, fundamental concepts of bioinformatics ,pearson Education(low priced Edition)
2. Claverie & Notredame, Bioinfomatics- A Beginners Guide, Wiley-Dreamtech India Pvt LTD, 2003

Additional References

1. Pevnezer, Bioinformatics and functional genomics, John Wiley
2. Lesk, Introduction to Bioinformatics, Oxford University Press, Indian Edition,2003
3. Jin Xiong , Essential Bioinformatics-Cambridge University Press, Printed and bound in India by Replika Press Pvt.Ltd.

BIOCHEMISTRY

To understand the basic aspects of biochemistry.

MODULE I

Carbohydrates- Introduction, classification, monosaccharide-structure, stereo isomers and structural isomers, and mutarotation. Oligosaccharides-Disaccharides -structure and importance of sucrose, lactose, maltose, cellobiose. Polysaccharides-structure and importance of homopolysaccharides and heteropolysaccharides.

MODULE III

Lipids: Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids. Triacylglycerols: nomenclature, chemical properties and characterization of fats - hydrolysis, saponification value, acid value, rancidity of fats, Reichert-Meissel number. Biological significance of fats. Glycerophospholipids (lecithins, lysolecithins, cephalins. phosphatidyl serine, phosphatidyl inositol, plasmalogens), sphingomyelins, glycolipids -cerebrosides, gangliosides.

MODULE IV

Aminoacids -General properties, peptide bond, essential and non-essential amino acids. Protein chemistry: Classification, different levels of protein structure, forces stabilizing protein structure, and protein folding.

MODULE V

Nucleic acids: Introduction, chemistry of nucleic acids, double helical structure and properties of DNA, RNA –types, structure and functions.

MODULE V

Vitamins: Introduction ,properties, functions and deficiency diseases of fat soluble and water soluble Vitamins.

CORE REFERENCES

1.Lehninger’s Principles of Biochemistry (2000) by Nelson, David l. and Cox, M.M. Macmillan/ worth,.NY

2.Fundamentals Of Biochemistry (1999) by Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY
3.Biochemistry 3rd (1994) by lubert stryer, W H freeman and co, Sanfrancisco.
4.Text book of biochemistry (1997) 4th edition Thomas M devlin, A John Wiley, Inc publication, New York

ADDITIONAL REFERENCES

5.Textbook of Biochemistry-J L Jain.

GENERAL MICROBIOLOGY

Module1

Discovery of Microorganisms, Theory of spontaneous generation, Koch's Postulates, The role of microorganism in disease. The future of microbiology. Preparation & staining of specimens, simple staining and differential staining, Microscopy & specimen preparation.

Module 2

Prokaryotic cell structure & function ,cell membrane and cytoplasmic matrix, Nucleotide,cell wall, components external to cell wall and bacterial endospore. Chemotaxis . An overview of eukaryotic cell structure and function.

Module 3

Microbial nutrition,Nutrient requirements and growth factors, Nutritional types of microorganisms . Culture media and culture techniques.

Module 4

Microbial growth, The growth curve, continuous culture of microorganisms, Influence of environmental factors of growth, microbial growth in natural environment.

Module 5

Viruses ,properties & structure of viruses, Helical capsids, Icosahedral capsids, Viral enzymes and enzymes, Viral genome, Bacteriophages, structure and properties, Lytic and Lysogenic cycles.

REFERENCES

1.Microbiology:Pelczar M J
2.Microbiology:Presscott L M,Harley J P and Klein D A
3.Textbook of Micrbiology-Ananthanarayan
4. General microbiology - Powar & Daginawala

5. Textbook of Microbiology-R C Dubey.

BIOMATHEMATICS

Aim: To introduce some of the mathematical concepts and techniques that has applications Bioinformatics

Module I

Set: Introduction to sets- Set operations- Union, intersection- complementation- symmetric difference- Power sets (simple problems). Cartesian product- Relations- functions, types of functions (definition and examples only)

Module II

Matrix: Introduction to Matrices: Matrices- types of matrices, addiction and multiplication of matrices. Inverse of matrices. Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Equivalent matrices

Module III

Mathematical logic- Propositional calculus, Basic logic operations- conjunction, disjunction, negation. Conditional and bi conditional, converse, inverse and contrapositive statements. Tautologies, , contradiction, equivalence and implications.

Module IV

Integral Calculus: A quick review of indefinite integral as anti derivative. The Definite integral. The fundamental theorem of Calculus

Module V

Graph theory: Definition, terminology, Paths and Circuits, Representation of Graphs, Path Matrix, Adjacency matrix, Adjacency matrix.

Exterior paths and circuits, Hamiltonian paths and Circuits, Spanning tress, Minimum spanning trees.

References:

1. Discrete Mathematics Rajendra Akerkar, Rupali Akerkar, Pearson Education
2. Shanti Narayan : Differential Calculus (S Chand)
3. David W. Lewis - Matrix Theory (Allied)
4. Operation Research by Kanti Swarup, P. K. Gupta and Man Mohan - (Sultan Chand and Sons)
5. K.V.Mital & C.Mohan :Optimization Methods in Operations Research and System Analysis (New Age International Private Limited)

6. J.K.Sharma :Operations Research Theory and Applications (Macmillan)
7. David W. Lewis - Matrix Theory (Allied)
8. Shanti Narayan , P .K . Mittal :Integral Calculus (S. Chand & Company)
9. Shanthi Narayanan & P.K. Mittal, A Text Book of Matrices, S. Chand
10. Narsingh Deo – Graph Theory with Applications to Engineering and Computer Science
11. A text book of graph theory R. Balakrishnan, K. Ranganathan
12. Graph theory Reinhard Diestel.

PRACTICAL II

1. Protein Sequence Database

a. SWISSPROT

b. PROSITE

c. PIR

2. Nucleotide Sequence Database

a. DDBJ

b. EMBL

c. GENBANK

III. Structural Database

a. PDB

b. MMDB

IV. Bioinformatics Tools

a. BLAST

b. CLUSTAL W

I.MICROBIOLOGY

1. Study the parts and usage of a Compound Microscope
2. Sterilization Techniques – Moist heat and dry heat methods
3. Study of cultural colony characters- Size, shape, color etc.
4. Staining-Principles and techniques

i) Simple staining

ii) Grams staining

iii) Negative staining

iv) Motility test

REFERENCES

1.Practical Microbiology R.C Dubey, D.K Maheshwari, S Chand and Company,New Delhi.

2. Microbiology Laboratory Manual - Cappuccino, Sherman, Pearson Education

II BIOCHEMISTRY

I. Colorimetry and Spectrophotometry techniques

i)Verification of Beer Lamberts law.

2.Estimation of protein –(Lowry's and Biuret method), DNA(DPA method), and carbohydrates (Anthrone method)

3. Separation of plant pigments (thin layer chromatography) and amino acids (paper chromatography)

4. Centrifugation Technique- Isolation of crude cytoplasmic fraction from a biological tissue sample

REFERENCES

1.Practical Biochemisry-Plummer

2. Experimental Biochemistry: A Student Companion, Beedu Sasidhar Rao & Vijay Deshpande (ed), I.K International Pvt. LTD, New Delhi

III IMMUNOLOGY

1.Blood grouping

2.Immunodiffusion method (Ouchterlony Double Diffusion test)

3.VDRL Test (Quantitative method)

RFERENCES

1.Practical Microbiology-Aneja K R

2.Practical Microbiology R.C Dubey, D.K Maheshwari, S Chand and Company,New Delhi.

Semester 3

ADVANCED BIOCOMPUTING

AIM: To introduce the fundamentals of advanced bio computing.

Module I

Micro arrays- Basic concepts- concept of gene expression- comparative genomics, Making macro arrays- Spotted Micro arrays- Insitu synthesized Oligo nucleotide arrays- Affymatrix Technology- Inkjet array synthesis- Using Microarrays- Sample preparation and labeling- Hybridization – Washing- Image Acquisition, Computer design of Oligo nucleotide probes.

Module II

Alignment Algorithms: Dot matrix, Dynamic programming:- Needleman & Wunch algorithm, Smith and Waterman algorithms, Word method. Scoring matrices: Basic concept of a scoring matrix, matrices for nucleic acid and protein sequences, PAM and BLOSUM series, principles based on which these matrices are derived.

Module III

PROSITE Database. Sequence patterns and profiles: Basic concepts and patterns of sequence, motifs and pattern representation viz. Consensus, regular expression (prosite type) and profiles.

Module IV

Molecular Phylogenetics: Construction of phylogenetic trees: - Distance Based Methods:- Clustering and Optimality based Methods,Character Based methods:- maximal parsimony and maximum likelihood.

References:

Core References

M.S Waterman: Mathematical methods for DNA sequences: CRS press, Inc, BocaRaton, Florida, 1989

D Fasman: Prediction of protein structure and the principles of protein confirmation, Plenum press, Newyork, 1989.

L.A.Segel: Modelling Dynamic Phenomenain Molecular and Cellular Biology: Cambridge Univesity press, Cambidge, 1984.

Jin Xiong , Essential Bioinformatics-Cambridge University Press,Printed and bound in India by Replika Press Pvt.Ltd.

INTRODUCTION TO PROGRAMMING IN C

Aim:To develop programming skills

Module I

Concept of algorithm, flowchart, program, introduction to C ,programming, keywords ,identifiers, constants, variables, data types. Operators and expressions, arithmetic, relational ,logical, assignment, increment ,decrement ,bitwise ,conditional and special operators.

Module II

Input and output operations ,Decision making and branching-IF statement ,different forms of IF statement ,SWITCH statement ,ternary operator ,GOTO statement ,Decision making and looping-WHILE,DO-WHILE,FOR,BREAK and CONTINUE statements.

ModuleIII

Arrays-one dimensional array ,two-dimensional array, Character arrays and strings ,string handling functions ,storage classes ,simple programs ,structures and union ,defining and declaring structure, accessing structure members, structure initialization, pointers-declaring and initializing a pointer variable

Module IV

User defined functions-definition of a function, function call, function declaration, return value, Category of functions-functions with no argument and no return value, argument with return value, no argument but return value, Recursion.

References:

Core references:

- Programming in ANSI C,E Balaguruswamy*(3rd Edition)TATA McGraw Hill

Additional references:

- Scham's Outline Of theory and Problems of Programming with C,Byron S Gottfried,TATA McGraw Hill
- The C programming, Brain W Kernighan and Dennis Ritchie(2nd Edition),Printice Hall Of India.

BASIC INSTRUMENTATION

Module 1: Microscopy: Principles – resolving power, numerical aperture, limit of resolution, magnification power. Types - Light, Fluorescence, Phase contrast and Electron microscopy (TEM and SEM).

Module 2: Spectroscopy: Beer- Lamberts law. Types- UV-Visible, Infrared, fluorescence NMR and ESR.

Module 3: Chromatography: General principle and applications. Types- Paper, Thin layer, Ion exchange, Affinity, Gas and HPLC .

Module 4: Centrifugation - Principle and application. Types-Low speed, High speed, and Ultracentrifuge (preparatory and analytical ultracentrifuge) .

Module 5: Basic applications of Electrophoresis- Principles and Types; Paper, Agarose gel electrophoresis, SDS- PAGE, 2- Dimensional electrophoresis and Isoelectric focusing.

REFERENCES

Coe References

1. Biophysical chemistry, Upadhyay A, Upadhyay K, and Nirmala Nath, First edition, Himalaya Publishing Company Mumbai.
2. Textbook of Biophysics-R N Roy
3. Intrduction to Biophysics-Pranab Kumar Banerjee

Additional References

1. Biophysics-Principles and techniques-M A Subramanian
2. Principles of biochemistry- A L Lehninger.

BIOPHYSICS

Aim: To introduce the fundamentals of biophysics and biological importance of various physical and chemical phenomenons

MODULE I

Laws of thermodynamics, Basic concept of enthalpy,entropy and free energy .chemical kinetics – rate, order, molecularity of reactions and energy of activation. Chemical kinetics-Order and Molecularity. Buffers-acidic and basic buffers. p H –meter and scale. Interaction of acids with base.

MODULE II

Properties of solution-Types of solution, characteristics of true solution.Concentration Modules;Normality, Molarity, and Molality. Colloids- types, properties and its separation techniques. Donnan equilibrium. Adsorption and Absorption. Emulsions.

MODULE III

Dynamics of biomolecules: Diffusion, Laws of diffusion, Active transport, Facilitated diffusion, Osmosis, Osmotic pressure, Osmoregulation, Viscosity and biological importance, Surface tension, Factors influencing surface tension. Dialysis.

MODULE IV

Radioactivity-Types and Modules.Types of radiation. Radioactive decay.Applications of Radioisotope in science.Detection and measurement of radioactivity.-Ionisation counter, G M counter and Liquid scintillation counter. Applicatons in Biology-. X-ray crystallography and Auto radiography.

Refere **REFERENCES**

Core references

4. Introduction of Biophysics-Pranab Kumar Banerjee
5. Principles Physical chemistry, puri B R , Sharma L R, and Madan S P, visal publishing company, Jhlandhar.
6. Biophysical chemistry, Upadhyay A, Upadhyay K, and Nirmala Nath, First edition, Himalaya Publishing Company Mumbai.

Additional References

1.Biophysics- Volkensteion M V

2.Principles of biochemistry- A L Lehninger.

3. Biophysics-Upadhay

IMMUNOLOGY AND IMMUNOTECHNOLOGY.

Aim: To introduce the fundamentals of immunology and the mechanisms by which the body protects itself from infections and the scope of immunology.

MODULE I

Introduction to immModuley. Infection, Source of infection, Methods of transmission.Types of immModuley- innate and adaptive immModuley.Immune system- Cells and organs of immune system.

MODULE II

Antigens, immunogenicity and antigenicity, factors affecting antigenicity. Haptens:- their applications. Epitopes. Antibodies- types , structure and functions of antibodies. Monoclonal antibodies .MHC complex. Humoral and cell mediated immModuley.

MODULE III

Immunological reactions and common techniques used: Complement system- activation and functions. Antigen- Antibody reactions(Precipitation, Agglutination, CFT, Immunofluorescence, RIA and ELISA). Hyper sensitivity reactions:-types and examples. Auto immModuley – Mechanisms of autoimmModuley, Autoimmune diseases:-organ specific and systematic auto immune diseases.

MODULE IV

Immunohematology- ABO and Rh blood group system, Immunology of blood transfusion,, Hemolytic disease of new born .Vaccines, types and their applications. Fundamental concepts of transplantation immunology and AIDS.

REFRENCES:

CORE REFRENCES

1. Kuby immunology, sixth edition Thomas J Kinddt et al,W H Feeman and Company New York.
2. Textbook of Microbiology-Ananthanarayan

ADDITIONAL REFERENCES

1. Immunology, sixth edition Garland science publishing , new York , www.galandscience.com
2. Immunology, seventh edition, Roitt I et al Elsevier limited,www.elsevierhealth.com

Practical III

AIM: To gain hands -on knowledge in programming and bioinformatics tools.

1. Programming in C language.

Experiments on Bioinformatics

2. To perform global alignment and local alignment using EMBOSS.
3. To perform sequence alignment using Dotlet.
4. To perform phylogenetic analysis using Phylip software.

Semester 4

STRUCTURAL BIOINFORMATICS

Aim: To introduce the structure of Biomolecules and their interactions.

Module I

Structure of proteins: Principles and Anatomy of proteins; Hierarchial organization of protein structure- Primary, Secondary, Supersecondary, Tertary, Quarternary structure, internal co-ordinates of Proteins- Theory, Derivation and significance of Ramachandran Plot.

Module II

Structure of Nucleic Acids: DNA and RNA; Base pairing- Watson crick and Hoogestein; Types of double helices A,B,Z and their geometrical as well as structural features; Types of RNA and geometrical parameters of each and their composition.

Module III

Molecular Interactions: Protein-Protein interaction, Structural Analysis of domain interactions, Protein-DNA interactions, Types of interaction s of DNA with proteins and small molecules.

Module IV

Protein structure prediction: Principles of protein structure prediction, Secondary structure prediction- Chou Fasman and GOR method. Homology Modelling- concepts, basic principles and protocol

Module V

Molecular modelling tool- SPDBV, Structure visualization tools such as Rasmol, Cn3D, VMD, MOLMOL, Chime. Basic concepts in structural bioinformatics.

References

1. Introduction to bioinformatics-attwood and parrysmith, pearson education.
2. Bioinformatics-A Beginner's guide by gena-michel claverie,john wiley&sons.
3. Structural bioinformatics by Philip.e.bourne and helge weissing, wiley.
4. Bioinformatics- BaxevanisAD and Quellette BFF,John Wiley ans sons Inc.
5. Introduction to protein structure by Brandel C and Tooze J.
6. Structure and mechanism in protein science-Fresh W H freeman and co.

BIOSTATISTICS

AIM:- To introduce statistical concepts and techniques which have applications in bioinformatics.

MODULE I. Introduction to biostatistics

Biostatistics- Brief history, definition, scope, aim and application of biostatistics. Role of biostatistics in modern research. Definitions of data, population and sample, attributes and variables, parameters and statistics, accuracy and precision.

Collection of biometric data:-Primary and secondary data. Methods of collection and editing of primary data. Designing of a questionnaire and schedule. Reliability and validity of data. Census and sampling-advantages, disadvantages. Random Sampling- simple random sampling, stratified sampling, systematic sampling, cluster sampling and multistage sampling.

Non random sampling-Convenience, purposive and quota sampling.

MODULE II- Classification, Tabulation and Presentation of biometric data

Classification of data:-Methods of classification of data- geographical classification, chronological classification, qualitative classification and quantitative classification. Tabulation of data. Frequency distributions-class interval, tally marks, frequency. Types of frequency distribution- Raw data, discrete and continuous. Working rules to prepare a frequency table.

Graphic presentation of data: - Histogram, frequency polygon, frequency curve, and cumulative frequency curves

Diagrammatic presentation of data:- Bar diagrams, Pie diagram, Pictograms, Stem and leaf displays.

MODULE III- Measures of central tendency and dispersion

Measures of central tendency- Mathematical averages-Arithmetic mean, Geometric mean and Harmonic mean-simple arithmetic mean and weighted arithmetic mean .Positional averages-median, mode (simple problems). Relationship between arithmetic mean, median and mode. Partition values: quartiles, deciles and percentiles

Measures of dispersion-Absolute and relative measures of dispersion. Range, quartile deviation, mean deviation, and standard deviation. Variance and coefficient of variation (simple problems only).

MODULE IV Correlation, Regression and Probability

Correlation and Regression: - Bivariate data, scatter diagram, curve fitting, principle of least squares, fitting of straight lines .Linear regression, regression lines, coefficients of regression. Karl Pearson's correlation coefficient.

Probability:- Random experiment, sample space and events. Mutually exclusive events, exhaustive events and equally likely events. Definition of probability –classical, frequency and axiomatic definitions. Addition theorem (up to 3 events) conditional probability and independence of events. Multiplication theorem.

REFERENCES

1. Fundamentals of biostatistics; Veer Bala Rastogi; Ane' students edition; Ane books private limited.
2. Textbook of biostatistics-vol 1-A.K Sharma, discovery publishing
3. Textbook of biostatistics-vol 2-A.K Sharma, discovery publishing

DATABASES AND THEIR MANAGEMENT

Aim: to introduce the basic concepts involved in maintenance of biological databases

Module I

Overview of database management-Advantages of database systems, architecture of database systems, Levels of abstraction, data models-Hierarchical network and relational models,Enitity relationships.

Module II

Relational data models, relational algebra, SQL and commercial RDBMS-ORACLE, Views, Triggers,cursors,exceptions.

Module III

Data independencies and Normalization-First normal form, second normal form, third normal form,Boyce-Codd normal form, security and integrity constraints.

Module IV

Biological databases: sequence databases, structural databases.

References

Core references

- Bioinformatics methods and protocols-Misner setal

- Database systems concepts Hanery Korth and Abraham Silberchatz
- Introduction to Database systems C J Date
- Introduction to database systems J M Martin

ENZYMOLOGY

AIM To study the structural characteristics of enzymes; their functional properties and their role in control of metabolism and application of enzymes.

MODULE I:

Introduction to enzymes: Holoenzyme, apoenzyme, and prosthetic group. History of Enzymology (Contributions of Louis Pasteur and J B Sumner) .General properties of enzymes. .

MODULE II:

Enzyme Commission system of classification and nomenclature of enzymes. Models for monosubstrate reaction (lock and key model and induced fit model) and models for bisubstrate reaction (Random sequential ,ordered sequential and Ping-pong model). Features of active site. Ribozymes, Abzymes. Coenzymes and their functions - NAD, $NADP^+$, FAD, FMN, lipoic acid, TPP, pyridoxal phosphate and biotin.

MODULE III:

Enzyme kinetics- Mechanism of Enzyme action (Transition state and activation energy).Order of reaction, Factors affecting the velocity of enzyme catalyzed reaction- enzyme concentration, temperature, pH, substrate concentration, inhibitors and activators (explanation with graphical representation). Definition of IU, katals, enzyme turnover number and specific activity. Introduction to Michaelis -Menten equation and LB plot (only formulae and significance of each term). Enzyme inhibition: Reversible and irreversible . Reversible- competitive, noncompetitive and uncompetitive inhibition- explanation of inhibition types with double reciprocal plot and examples of each type of enzyme inhibition.

MODULE IV

Enzyme regulation - covalently modulated enzymes with examples of adenylation and phosphorylation and allosteric regulation- example Aspartate trascarbamoylase, Isoenzymes- Lactate dehydrogenase and creatine phosphokinase, Zymogen form of enzyme and zymogen activation, Multienzyme complexes and their role in regulation of metabolic pathways.

MODULE V

Application of enzymes: Industrial uses of enzymes: production of glucose from starch, cellulose and dextrans, use of lactase in diary industry, production of glucose fructose syrup from sucrose, use of proteases in food, leather and detergent industry. Diagnostic and therapeutic enzymes (brief study of name of enzyme and role in diagnosis and therapy).

REFERENCES

- Enzymes - Trevor palmer
- Fundamentals of enzymology - Nicolas C price
- Lehniger principles of biochemistry
- Enzyme technology -Ashok pandey
- Enzymology-Devasena

GENETIC ENGINEERING

AIM: To study relevant aspects of cloning techniques and application of Biotechnology.

MODULE I

Introduction to genetic engineering, Gene cloning and its steps. Tools for genetic engineering a) DNA Manipulative-Restriction enzymes and DNA ligase b) Gene cloning vectors-plasmids, Bacteriophage and cosmids,recognition sequence of restriction enzymes.

MODULE II

Techniques involved in gene manipulation, Polymerase chain reaction (PCR)- types and its applications, Site directed mutagenesis (SDM) nucleic acid sequencing-Sanger's method, Blotting techniques-Southern, Western and Northern blot. Probe and its construction.

MODULE III

Gene transfer techniques in animals- Agrobacterium mediated and chemical methods. Gene transfer techniques in plants-particle gun delivery, Electorporation and microinjection. Gene libraries-Genomics DNA and C DNA Cloning techniques .

MODULE IV

Applicatons of Genetic Engineering-Gene therapy, Recominant vaccines, Monoclonal antibodies.

REFERENCES

- Biotechnology - B.D. Singh
- Principles of gene manipulation – old R W Primross
- From gene to clones – Winnaker E L
- Text book of biotechnology – P.K Gupta

PRACTICAL IV

AIM: To perform analysis of protein.

Experiments on Bioinformatics

1. To retrieve data from sequence database and structural databases.
2. To perform primary structure analysis of protein using Protparam
3. To perform secondary structure analysis using GOR OR SOPMA
4. To perform tertiary structure analysis of protein using Swisspdb(automated method)
5. Use visualization tools like Rasmol, pymol
6. Download protein and DNA from PDB and display using above programs and analyze the structural features
7. To use NCBI tools, EBI tools, Expasy tools

Semester 5

MOLECULAR BIOLOGY

AIM:To give an exposure to students about DNA at molecular level

MODULE I

DNA as the vehicle of inheritance- Experimental evidence -Griffith, McLeod, McCarty and Avery,HersheyChase experiments. Definition of Gene,organization of genes and non-coding DNA in prokaryotes and Eukaryotes - unique, moderately repetitive and highly repetitive DNA sequence, Satellite DNA.Cot value.

MODULE II

DNA replication in prokaryotes, mode of replication, Semiconservative modes of replication. An overview of replication-, replication forks, semi discontinuous replication, Okazaki fragments, RNA primers.Enzymes of replication- DNA polymerases I, II, III, Topoisomerases, Helicases, DNA binding proteins and ligases.

MODULE III

Repair of DNA - types of damages,repair by direct reversal of damage, excision repair, recombination repair, SOS repair.

MODULE IV

Transcription in prokaryotes, RNA polymerase, types and functions of RNA. polymerases in eukaryotes.Post transcriptional modification. Genetic code, translation in prokaryotes, Post-translational modifications. Gene organization, Operon concept and introduction to gene regulation mechanisms.-lac,trp and ara. Transposons.

REFERENCE

CORE REFERENCE

1.Molecular biology of gene; James D . WATSON et .al; dorling kindersley pvt.Ltd;2006

2.Genes VIII Benjamin Lewin

3.Molecular Biology-David Friefelder

ADDITIONAL REFERENCE

4.Textbook of Molecular Biology-Verma and Agarwal

PROTEOMICS

Aim: To explore major techniques in Proteomics

Module I

Introduction to Proteomics- What is Proteomics. One genome many proteome, Overview of proteomics tools. Structural proteomics- four levels of protein structure.

Module II

Analytical proteomics-Protein extraction methods from biological samples, Protein separation techniques-ID and 2D SDS PAGE, HPLC, IEF and Capillary electrophoresis, Protein digestion techniques- Proteases and Cleavage reagents.

Module III

Protein and Peptide analysis using Mass spectrometers – MALDI TOF and ESI Tandem MS instruments, Protein identification – Peptide mass fingerprinting (Algorithm and Software tools)

Module IV

Peptide sequence analysis by tandom mass spectrometry. SALSA algorithm. Protein structural analysis-X ray crystallography and NMR spectroscopy

Module V

Applications of Proteomics: Proteomining, Expression profiling, Comparative proteomics with 2D gel, Comparative proteomics with LCMS and isotope tagging, Identifying protein-protein interactions and protein complexes, Immunoprecipitation, mapping protein modifications.

References

Liebler; introduction to proteomics:Tols for the New Biology, Humans Press,2001

Proteomics: from protein sequence to function; S.Penington, M.J. Dum Bios scientific pub.ltd 2001

Mount david, W;bioinformatics sequence and genomic analysis, cold spring harbor laboratories press, CsH NEW YORK

Ian M Rosenberg: Protein analysis and purification (massachusettsBoston)

WEB PROGRAMMING AND PERL

Aim: To explore the usage of web page designing and Perl

Module I

Introduction to internet, www, servers and browsers. Introduction to web programming languages-HTML, DHTML, XML,JAVASCRIPT etc..

Module II

Introduction to HTML-structures of HTML.Text formatting, Lists-ordered and unorderedlists.Adding graphics to HTML documents,Tables, Linking documents,Frames,Forms.

Module III

Introduction to Javascript-Dta types,literals,operators and expressions,Placing text in browser

Module IV

Javascript programming constructs-conditional checking using if,switch,Loops-for,while,do while loops,Dialogue boxes,Functions in javascript.

Module V

PERL-Introduction , perl strings,scalar variables,arrays,hashes.Operators and decision makinf in PERL-if,while,until,for loop,foreach loop,string handling functions,regular expressions.

Reference:

Core reference

- **HTML,DHTML,JAVASCRIPT<PERL CGI(REVISED EDITION) IVAN BAYROOS**
- **Perl-5 Hermann**
- **Perl programming for Bio Informatics and Biologists. D Cristis Jamisen**

CORE MODULE SYLLABUS FOR ENVIRONMENTAL STUDIES & HUMAN RIGHTS

FOR UNDER GRADUATE COURSES OF ALL BRANCHES

OF HIGHER EDUCATION

Vision

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Conference on Environment and Development held in Rio de Janerio in 1992 and World Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues..

India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution have been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future.

In spite of the deteriorating status of the environment, study of environment have so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India.

The syllabus of environmental studies includes five modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The second two modules are strictly related with the core subject and fifth module is for human rights.

Objectives

- Environmental Education encourages students to research, investigate how and why things happen, and make their own decisions about complex environmental issues by developing and enhancing critical and creative thinking skills. It helps to foster a new generation of informed consumers, workers, as well as policy or decision makers.
- Environmental Education helps students to understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future. It encourages character building, and develop positive attitudes and values.

- To develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment and helps to protect the nature and natural resources.
- To help the students in acquiring the basic knowledge about environment and the social norms that provide unity with environmental characteristics and create positive attitude about the environment.

SYLLABUS

4 credits **72 hrs**

Module I

Unit 1 : Multidisciplinary nature of environmental studies

Definition, scope and importance (**2 hrs**)

Need for public awareness.

Unit 2 : Natural Resources :

Renewable and non-renewable resources : Natural resources and associated problems.

a) **Forest resources** : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) **Water resources** : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) **Mineral resources** : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) **Food resources** : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) **Energy resources**: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.

f) **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

- Role of individual in conservation of natural resources.
- Equitable use of resources for sustainable life styles. (**10 hrs**)

Unit 3: Ecosystems

- Concept of an ecosystem

- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem (**6 hrs**)

Module II

Unit 1: Biodiversity and its conservation

- Introduction
- Biogeograhical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- India as a mega-diversity nation
- Hot-sports of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India (**8 hrs**)

Unit 2: Environmental Pollution

Definition

Causes, effects and control measures of: -

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides. (**8 hrs**)

Unit 3: Social Issues and the Environment

- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns, Case studies
- Environmental ethics: Issues and possible solutions

- Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents and holocaust, Case studies
- Consumerism and waste products
- Environment Protection Act
- Air (Prevention and Control of Pollution) Act
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness (**10 hrs**)

Module – III

Unit 1- Human Rights– An Introduction to Human Rights, Meaning, concept and development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Unit-2 Human Rights and United Nations – contributions, main human rights related organs - UNESCO,UNICEF, WHO, ILO, Declarations for women and children, Universal

Declaration of Human Rights.

Human Rights in India – Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit-3 Environment and Human Rights - Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of

New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal,

Protection of Environment

- **Conservation of natural resources and human rights**: Reports, Case studies and policy formulation. Conservation issues of western ghats- mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc. **(8 Hrs)**

Module -IV

Bioethics

- Ethical theory and principles
- History of research ethics
- Contemporary issues in research ethics
- Balancing the benefits and harms of participation in research
- Ethical issues in study design
- Informed consent in research

- Institutional Review Boards
- Selection of research participants
- Ethical issues in vaccine research **(10 hrs)**

Module -V

Introduction to Intellectual Property

- Types of IP: Patents
- Trademarks
- Copyright & Related Rights
- Protection of New GMOs;
- International framework for the protection of IP
- Indian Patent Act 1970
- IPR and copyrights,
- Importance of protecting scientific discoveries,
- Qualification for a Patent
- Indian & International Patent laws
- IPR and WTO regime - GATT and TRIPS
- Patenting gene.
- Issues and case studies. **(10 hrs)**

Internal: Field study

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc
- Study of simple ecosystem-pond, river, hill slopes, etc

(Field work Equal to 5 lecture hours)

REFERENCES

1. Bharucha Erach, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013 (TB)
2. Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)
3. Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001 Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)
4. Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)
5. Down to Earth, Centre for Science and Environment (Ref)
6. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)

7. Jadhav.H & Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
8. Mekinney, M.L & Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
9. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
10. Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
11. Rao.M.N & Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)
12. Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)
13. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
14. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)
15. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (Ref)
16. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)
17. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref)
18. (M) Magazine (R) Reference (TB) Textbook

Human Rights

1. Amartya Sen, The Idea Justice, New Delhi: Penguin Books, 2009.
2. Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla: Indian Institute of Advanced Studies, 1998)
3. Law Relating to Human Rights, Asia Law House,2001.
4. Shireesh Pal Singh, Human Rights Education in 21st Century, Discovery Publishing House Pvt.Ltd, New Delhi,
5. S.K.Khanna, Children And The Human Rights, Common Wealth Publishers,1998. 2011.

6. Sudhir Kapoor, Human Rights in 21st Century,Mangal Deep Publications, Jaipur,2001.
7. United Nations Development Programme, Human Development Report 2004: Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press, 2004.
8. P. Narayanan, Intellectual Property Laws, Eastern Law House.200
9. Meenu Paul, Intellectual Property Laws, Allahabad Law Agency.20
10. Intellectual Property Law containing Acts and Rules, Universal Law Publication Company.

Open Course

Basic Bioinformatics Concepts & Biological Databases

Objectives: To provide the students with an understanding Basic Bioinformatics Concepts

Module I :

Introduction to Bioinformatics , Nature and scope of Bioinformatics, Branches of Bioinformatics ,Genomics ,Transcriptomics , Proteomics – HGP

Other Genome Projects

Module II :

Introduction to sequence Alignment – Pairwise alignment tools – BLAST, FASTA ; MSA- Clustal, Multalin

Scoring Matrices – PAM, BLOSUM

Module III:

Biological Data File Formats:- FASTA Format, Genbank Format, PDB Format

Sequence Visualization Softwares – Rasmol, SPDBV, MOLMOL

Gene finding Software – ORF Finer, Mapviewer

Module IV:

Biological Databases- Primary Databases

Nucleotide : General overview of NCBI , Genbank , DDBJ , EMBL

Protein : Swiss prot, trEMBL,PIR – UNIPROT

Secondary Databases

Structural Database – PDB

Module V:

Molecular Phylogeny: - Introduction, Phylogenetic Methods & Types of Trees ; Phylip introduction, PAUP Introduction

Introduction to Computer Aided Drug Discovery, Introduction to Molecular Modelling;

References

1. Dan E Krane and Michael L Raymer, fundamental concepts of bioinformatics, pearson Education
2. Lesk, Introduction to Bioinformatics, Oxford University Press, Indian Edition,2003
3. David W Mount, Bioinformatics: Sequence and Genome Analysis

PRACTICAL V

AIM: To develop programming skills in Perl and Bioinformatics software

1. Programming in Perl language

Bioinformatics softwares

2. Domain/Motif databases- Blocks, PRINTS, PFAM
3. Using Expasy tools to identify various parameters
4. Post translational modification prediction:-chloro P, lipo P
5. Primary structure analysis :-Protparam,Compute PI/MW
6. Secondary structure analysis:-GOR, SOPMA

Semester 6

MOLECULAR MODELLING AND DRUG DESIGNING

AIM: to introduce the basic concepts and techniques involved in molecular modeling and drug design.

MODULE 1

Introduction to the concept of molecular modeling:- Application of molecular graphics, Molecular structure and Internal energy, , Energy minimization of small molecules, Local and Global energy minima. Empherical representation of molecular energy, Uses of force field, Molecular mechanics .

MODULE 2

Macro molecular modeling, Homology modeling, secondary structure prediction, basic principles of ab initio structure prediction. The techniques of molecular dynamics and monte carlo simulation analysis, ab initio,DFT.

MODULE 3

Design of Drugs, Absorption, Distribution, Metabolism and Excretion of drugs (ADME or ADME-Tox), Drug targets: Receptors, Enzymes, Structural proteins and Nucleic acids as the drug targets.

MODULE 4

Drug- Receptor Interaction, Enzyme Inhibition Strategies, Design of ligands for known macromolecular targets sites, Classical SAR and QSAR studies and their implications to the 3D modeler, Pharmacophore Identification and Novel Drug Design, , Structure Based Drug Design and Computer Aided Drug Design.

REFERENCES

1. STRUCTURAL BIOINFORMATICS by Philip E bourne and helge weissing, wiley
2. BIOINFORMATICS – methods and applications, rastogi S c mendiratta, N nad rastogi P, prentice- hall of india pvt,ltd, new delhi
3. EVOLUTIONARY COMPUTATIONS IN BIOINFORMATICS- forgel and cornr, Morgan Kafman publishers
4. INTRODUCTION TO PROTEIN STRUCTURES by Brandel C. and Tooze J.
5. STRUCTURE AND MECHANISM IN PROTEIN SCIENCE – Fresht W H freeman and co

6. PROTEIN FOLDING – Creighton T E9ed0 W H freeman W H freemn and co.
7. BASIC PHARMACOLOGY- Cox F, butterworths.

APPLIED BIOINFORMATICS

Aim: To introduce various applications of Bioinformatics and to create awareness about various issues of relevance to a professional Bioinformatician.

MODULE I

Bioinformatics objectives: Organizing the data, Analytical approaches of the data, Interpretation and application of data. Research methodology- Technical report writing, software documentation, web searching techniques

MODULE II

Introduction to IPR: Copyrights and Patents applied to software and life forms, Introduction to Bio-ethics, Indian Biotech policies and laws, Survey of Biotech.

MODULE III

IT knowledge in life sciences: Role of computers in biological research, File transfer protocol (FTP), Web tools and biological database. Biocomputers, DNA computing, Biochips, Biosensors, Bioelectronics and E-cell

MODULE IV

Applications of Bioinformatics in Biodiversity, Gene therapy, Genetic engineering, Human genetics, Agriculture, Anthropology etc

MODULE V

Bioinformatics and Biotechnology activities in India: Biotech market in India, Indian Biotech industries, Convergence of Biotech and infotech, Indian IT companies involved in Bioinformatics initiatives, Bioinformatics and Pharmaceutical industries in India and Worldwide, Clinical research organizations, Job opportModuleies of Bioinformatics and corresponding skill profiles.

REFERENCES

1. M. govindarajan , s natarajan, v.s senthil kumar,e engineering ethics, PHI Indian copyright act and Indian patent acts.
2. Richard Stallman,free software: a perspective .,prajasakthi book house,Hyderabad
3. Shailendra nigam, total quality management ,excel books
4. James s bownman, et.al .the professional edge, PHI
5. S K Agarwal, bioelectronics, APH publishing corporation New Delhi
6. Martin amos, theoretical and experimental DNA computation , springer

7. Martin amos, cellular computing, oxford university press

Choice Based Paper 1
ALGORITHMS,DATA STRUCTURE AND COMPILER

Aim:To Develop Computer Algorithms Using Different Data Structures.

Module I. Different types of data structures,complexity of algorithms,big O notations.
Arrays-bubble sort,linear search,binary search.

Module II. Stacks and queues-organization and operation on stacks-conversion between infix,suffix and prefix representation,quick sort,heap sort,merge sort.

Module III. Design and analysis technique-divide and conquer,dynamic programming,greedy algorithms,tree graph algorithms-breadth first search,depth first search, minimal spanning tree algorithms,shortest path.

Module IV. Concept of compiler and interpreter,different phases of compilation,lexical analyzer concept.

Reference:

1.Fundamental Of Computer Algoritms By Horowitz Ellis.
2.Introduction Of Algorithms By Coremen,Charker E Leiserson.
3.Fundamentals Of Data Structures By Horowitz Ellis And Sartaj Sajni.
4.Principles Of Compiler Design By Aho & Ulman.
5.Computer Algorithms Introduction To Design & Analysis By Saara Baase,Allen Van Gelder.
6.Data Structures And Algorithms By Alfred V Aho,John E Hopcroft,Jeffrey D Ullman

Choice Based Paper II

DATABASE CONCEPTS

Module I

Database Concepts - Advantages; Applications; Three Level Architecture: Physical, Logical, View level; Data Independence; Data Models; Database Languages: DDL, DML, DCL; Attributes; Constraints; Keys; Normalization; SQL-

Module II

Basic SQL queries; Built-in functions: individual numeric functions, aggregate functions, string functions; Set operators: union, intersect, minus; Clauses: Group by, Having, Where; Boolean

Operators:AND, OR, NOT; Pattern Matching-LIKE statement and wildcard characters(%, _); BETWEEN operator, IN operator; Subqueries.

Module III

PL/SQL- Introduction; Advantages; PL/SQL block; PL/SQL character set, Variables, Data types, Constants; Conditional Statements, Iterative Statements; Cursor; Trigger; Functions; Procedures; Exceptions

Module IV

PHP-MySql: Introduction; Basic Syntax; Operators; Variables; Constants; Data types; PHP strings; Conditional statements; Loop statements; Arrays;

Module V

PHP form handling; Connecting to MYSQL; Creating and Selecting a database; creating tables; MySql Insert, Delete, Update and Select data

References:

1. Silberschatz, Korth, Sudarshan: Database System Concepts - Fifth edition; McGrawHill
2. Benjamin Rosenzweig, Elena Silvestrova Rakhimov: Oracle PL/SQL by example – Fourth edition; Pearson
3. Dr. P. S. Deshpande: SQL & PL/SQL for Oracle 11g - Black Book
4. Steve Suehring, Tim Converse, and Joyee Park: PHP6 and MySQL Bible
5. Julie C. Meloni: PHP, MySQL and Apache - All in One- Fifth edition; Pearson
6. Gibas C. Jembecl P: Dereloping Bioninformatics computer skills.

Choice Based Paper III

GENETIC ENGINEERING & IPR

MODULE 1

Scope of Recombinant DNA Technology, Milestones in Genetic Engineering Isolation, purification, and quantification of DNA and RNA Preparation of total cellular DNA from animal & plant, preparation of plasmid DNA ,separation and quantization of DNA by Gel electrophoresis. Methods of gene transfer techniques in plants and animals (Agrobacterium mediated, electrophoration and particle gun, liposome, PEG).

MODULE 2:

Cutting, joining and modifying and amplifying DNA , Restriction endonucleases, Ligases, Alkaline phosphatase, polymerases. Double digest modification of restriction

fragment ends. Other ways of joining DNA. Amplification of DNA-PCR and cell based DNA cloning, importance of cloning, PCR : Basic features,.

MODULE 3

Gene Cloning Vectors Plasmids, bacteriophages, phagemids, cosmids, Artificial chromosomes. Nucleic acid microarray arrays. cDNA Synthesis and Cloning mRNA enrichment, reverse transcription, DNA primers, Linkers.

MODULE 4

Nucleic acid hybridization: Principles and applications, preparation of probes, principles of nucleic acid hybridization, nucleic acid hybridization assays and microassays. Tools for analyzing gene expression ELISA, protein gel electrophoresis, antibody production.

MODULE 5

Introduction and the need for intellectual property right (IPR). Patent document, Searching a patent Drafting of a patent Filing of a patent, Environmental impacts - Ethical issues - ethical committees - Commercialisation – Copy right – royalty - Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights, Rights of Trademarks, Types of Trademarks, signs used in Trade marks, Geographical indications

Ethical Issues of Genetic Engineering.

REFERENCES:

1. Molecular Cell Biology-Lodish , Berk, 5th Edn. Freeman 2003
2. Molecular Biology of the Cell, 5th edn, Alberts 2008, Grandland science
3. Cells-Levin, 1st Ed. Jones & Bartlett Publisher 2006
4. The cell – A molecular Approach 4th Edu. Geoffrey M. Cooper, Rober E. Hausman
5. Genes IX - Lewin B. 2004, Prentice Hall
6. Biochemistry – Voet D. Voet J. G. 3rd Edn., Johnwiley & Sons inc. 2004
7. Cell & Molecular & William & Wilkins 2006
8. DNA repair mutagenesis: Friedberg E. C. ASM press 1995.
9. Enzymology primer for Recombinant DNA technology Eun HM, Elservier, 1996.
10. Glick, B.R. and Pasternak, J.J. (1994) Molecular Biotechnology, ASM Press.
11. John G. Webster. (2004) Bioinstrumentation. Univ. of Wisconsin, John Wiley & Sons, Inc.

12. Sambrook, J. and Ruseell, D.W. (2001) Molecular Cloning – A Laboratory Manual (3rd edn., Vol. 1,2,3) Cold Spring Laboratory Press, New York.
13. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006

Choice Based Paper IV

Introduction to Java & web Programming

Module I

Features of Java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance.

Module II

Packages and Interfaces –Exception Handling – Input/Output String Handling. Generic methods.

Module III

Java applets- Life cycle of an applet – Adding images to an applet – Adding sound to an applet. Passing parameters to an applet.

Module IV

JDBC Overview – JDBC implementation – Connection class – Statements - Catching Database Results, handling database Queries

Module V

Web page Designing using HTML, Scripting basics-Client side and server side scripting. Java Script-Object, names, literals, operators and expressions- statements and features- events- windows- documents- frames- data types- built-in functions- Browser object model- Verifying forms.

References

- Java The Complete Reference , Herbert Schildt 7th Edition. Tata McGraw-Hill Edition
- Java 6 by Rogers Cadenhead, Laura Lemay, Pearson education
- Java Programming – A Practical Approach – C Xavier, Tata McGraw-Hill Edition
- K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000
- Javascript A Beginners Guide, 3rd Edition – John Pollock - Tata McGraw-Hill Edition

PRACTICAL VI

AIM: To model a molecule and drug.

1. Homology modeling-SWISS-MODEL-An automated knowledge –based proteideling server
2. To design drug using drug designing software-HEX

   Structure prediction tools-GOR and SOPMA