Mahatma Gandhi University, Kottayam

Curriculum

of

B.Sc. Bioinformatics (UGCBCS) Model III

2016 Admission Onwards

Expert Committee Members

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2. Ms. Shifnamol T.S
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   Department of Bioinformatics,
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   U. C. College, Aluva
4. Mr. Biju Dharmapalan
   Asst. Professor & Head
   Department of Bioscience
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5. Ms. Prisho Mariam Paul
   Lecturer,
   CMS College,
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8. Ms. Sunitha Poulose
   Asst. Professor
   Ilahia College of Arts & Science
   Muvatupuzha

SEMETER	PAPER	TITLE OF SUBJECT	TEACHING HOURS		TOTAL		TOTAL	MAXIMUM MARKS	
	CODE		THEORY	LAB	HOURS	CREDITS	CREDITS	IA	EA
SEM 1		Common Course I	5		25	4	20	20	80
	BI1CRT01	Introduction to Information Technology	5			4		20	80
	BI1CRT02	Biomathematics I	5			4		20	80
	BI1CRT03	Introduction to Cell Biology	3			2		20	80
	BI1CMT01	Fundamentals of Genetics	3			2		20	80
	BI1CRP04	Practical I		4		4		20	80
SEM 2		Common Course II	5			4		20	80
	BI2CRT05	Introduction to Bioinformatics	5		25	4	20	20	80
	BI 2CRT06	Biochemistry	5			4		20	80
	BI 2CMT02	General Microbiology	3			2		20	80
	BI 2CMT03	Basic Instrumentation	3			2		20	80
	BI 2CRP07	Practical II		4		4		20	80
SEM 3	BI 3CRT08	Biomathematics II	5		25	4	20	20	80
	BI 3CRT09	Advanced Biocomputing	5			4		20	80
	BI 3CRT10	Introduction to Programming in C	5			4		20	80
	BI 3CMT04	Biophysics	3			2		20	80
	BI 3CMT05	Immunology	3			2		20	80
	BI 3CRP11	Practical III		4		4		20	80
SEM 4	BI 4CRT12	Structural Bioinformatics	5		25	4	20	20	80
	BI 4CRT13	Biostatistics	5			4		20	80

	BI 4CRT14	Biological Databases	5			4		20	80
	BI 4CMT06	Enzymology	3			2		20	80
	BI 4CMT07	Genetic Engineering	3			2		20	80
	BI 4CRP15	Practical IV		4		4		20	80
SEM 5	BI 5CRT16	Molecular Biology	5		25	4	22	20	80
	BI 5CRT17	Proteomics	5			4		20	80
	BI 5CRT18	Web Programming & Perl	5			4		20	80
	BI 5CMT08	Bioenergetics	3			3		20	80
	BI 5GET01/ BI 5GET02/ BI 5GET03	Generic Elective	3			3		20	80
	BI 5CRP19	Practical V		4		4		20	80
SEM 6	BI 6CRT20	Molecular Modeling & Drug Designing	5		25	4	18	20	80
	BI 6CRT21	Applied Bioinformatics	5			4		20	80
	BI 6CBT01/ BI 6CBT02/ BI 6CBT03	Choice Based Paper	3			3		20	80
	BI 6CRP22	Practical VI		4		4		20	80
	BI 6PR 01	Project		8		3		20	80

Generic Elective

Semester	Paper Code	Paper Name
Fifth	BI 5GET01	Human Health and Nutrition
	BI 5GET02	Genomics & Proteomics
	BI 5GET03	Introduction to Java & web Programming

Choice Based Paper

Semester	Paper Code	Paper Name
Sixth	BI 6CBT01	Algorithms, Data Structure and Compiler
	BI 6CBT02	Database Concepts & PHP
	BI 6CBT03	Genetic Engineering & IPR

SEMESTER 1

BICCT01

Common Course I

Total Credits: 4 **Total Hours : 90**

Common Program, as fixed by the university under the CBCS system

BI1CRT01

INTRODUCTION TO INFORMATION TECHNOLOGY

Total Credits : 4 **Total Hours : 90**

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 **20 hours**

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

Module 2 **24 hours**

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 **24 hours**

Software: System software, Application software, introduction to operating system, programming language, 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 **22 hours**

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.

BI1CRT02

BIOMATHEMATICS I

Total Credits : 4 **Total Hours : 90**

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

Module 1 **20 hours**

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 2 **24 hours**

Matrix: Introduction to Matrices: Matrices- types of matrices, addition and multiplication of matrices, Inverse of matrices.

Module 3 **24 hours**

Theory of Games:

Introduction, Matrix games, problem of game theory, Minimax theorem, Saddle Point, Strategies and Pay off. Theorems of Matrix Games, graphical solutions, Notion of Dominance, Rectangular game as an LP problem.

Module 4 **22 hours**

Differential Calculus:

A quick review of limits of function, rules for finding limits, Derivative of a function, differentiation rules, rate of change, Derivatives of trigonometric functions, chain rule.(problems only)

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)

BI1CRT03

INTRODUCTION TO CELL BIOLOGY

Total Credits : 2 **Total Hours : 54**

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

Module 1 **11 Hours**

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 of plant cells- cell wall, vacuoles and chloroplasts. Animals- epithelia, connective tissue, nervous tissue, muscle, blood, germ cells and sensory cells

Module 2 **10 Hours**

Structure and organization of prokaryotic and eukaryotic cells, differences.

Module 3 **11 hours**

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 4 **12 Hours**

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 5 **10 hours**

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

References:

1.The cell a molecular approach 4th edition-geoffery 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

BI1CMT01

FUNDAMENTALS OF GENETICS

Total Credits : 2 **Total Hours : 54**

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

MODULE 1 **12 hours**

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 2 **12 hours**

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 3 **12 hours**

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 4 **10 hours**

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

MODULE V **10 hours**

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

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:

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

BI1CRP04

PRACTICAL I

Total Credits : 4 **Total Hours : 72**

Aim: To gain hands- on knowledge in basic operations of a GUI Operating System and Standard application softwares 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. Menuging 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 styles 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

BI 2CCT02

COMMON COURSE II

Total Credits : 4 **Total Hours : 90**

Common course, as fixed by the university under the CBCS system.

BI2CRT05

INTRODUCTION TO BIOINFORMATICS

Total Credits : 4 **Total Hours : 90**

Aim

To introduce the basic concepts of Bioinformatics

Module 1 **18 hours**

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

Module 2 **18 hours**

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 **18 hours**

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 **18 hours**

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 **18 hours**

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

References:

Core 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.

BI 2CRT06

BIOCHEMISTRY

Total Credits : 4 **Total Hours : 90**

To understand the basic aspects of biochemistry.

Module 1 **18 hours**

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

Module 2 **20 hours**

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 3 **18 hours**

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 4 **16 hours**

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

Module 5 **18 hours**

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

References:

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.

BI 2CMT02

GENERAL MICROBIOLOGY

Total Credits : 2 **Total Hours : 54**

Module1 **12 hours**

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 **12 hours**

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 **10 hours**

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

Module 4 **10 hours**

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

Module 5 **10 hours**

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.

BI 2CMT03

BASIC INSTRUMENTATION

Total Credits : 2 **Total Hours : 54**

Module 1 **12 hours**

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

Module 2 **10 hours**

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

Module 3 **10 hours**

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

Module 4 **10 hours**

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

Module 5 **12 hours**

Basic applications of Electrophoresis- Principles and Types; Paper, Agarose gel electrophoresis, SDS- PAGE, 2- Dimensional electrophoresis and Isoelectricfocusing.

References:

Core 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. Introduction to Biophysics-Pranab Kumar Banerjee

Additional References:

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

BI 2CRP07

PRACTICAL II

Total Credits : 4 **Total Hours : 72**

I . NCBI,Biological Databases

II. Sequence Database:

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

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, colour 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, NewDelhi

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

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

IMMUNOLOGY

1.Blood grouping

2.Immunodiffusion method (Ouchterlony Double Diffusion test)

3.VDRL Test (Quantitative method)

References:

1. Practical Microbiology-Aneja K R

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

Semester 3

BI 3CRT08

BIOMATHEMATICS II

Total Credits : 4 **Total Hours : 90**

AIM: To introduce various mathematical concepts and techniques

Module 1 **22 hours**

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 2 **24 hours**

Matrix: Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Equivalent matrices, Row Canonical form, Normal form, Elementary matrices only.

Systems of Linear equations: System of non homogeneous, solution using matrices, Cramer's rule, system of homogeneous equations

Module 3 **22 hours**

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

Module 4 **22 hours**

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. Thomas Calculus
2. David W. Lewis - Matrix Theory (Allied)
3. Shanti Narayan , P .K . Mittal :Integral Calculus (S. Chand & Company)
4. Shanthi Narayanan & P.K. Mittal, A Text Book of Matrices, S. Chand
5. Narsingh Deo – Graph Theory with Applications to Engineering and Computer Science
6. A text book of graph theory R. Balakrishnan, K. Ranganathan
7. Graph theory Reinhard Diestel.

BI3CRT09

ADVANCED BIOCOMPUTING

Total Credits : 4 **Total Hours : 90**

AIM: To introduce the fundamentals of advanced bio computing.

Module 1 **22 hours**

Micro arrays- Basic concepts- concept of gene expression- comparative genomics, Making macro arrays- Spotted Micro arrays- Insitu synthesised 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 2 **24 hours**

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 3 **22 hours**

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 4 **22 hours**

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:

1. M.S Waterman: Mathematical methods for DNA sequences: CRS press, Inc, BocaRaton, Florida, 1989
2. D Fasman: Prediction of protein structure and the principles of protein confirmation, Plenum press, Newyork, 1989.
3. L.A.Segel: Modeling Dynamic Phenomenain Molecular and Cellular Biology: Cambridge Univesity press, Cambidge, 1984.

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

BI 3CRT10

INTRODUCTION TO PROGRAMMING IN C

Total Credits : 4 **Total Hours : 90**

Aim: To develop programming skills

Module 1 **22hours**

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 2 **23 hours**

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

Module3 **23 hours**

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

Module 4 **22 hours**

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:

1. Programming in ANSI C,E Balaguruswamy*(3rd Edition)TATA McGraw Hill
2. Additional references:
3. Scham's Outline Of theory and Problems of Programming with C,Byron S Gottfried,TATA McGraw Hill
4. The C programming, Brain W Kernighan and Dennis Ritchie(2nd Edition),Printice Hall of India.

BI 3CMT04

BIOPHYSICS

Total Credits : 2 **Total Hours : 54**

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

Module 1 **14 hours**

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 2 **14 hours**

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 3 **13 hours**

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 4 **13 hours**

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.

References:

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

BI 3CMT05

IMMUNOLOGY

Total Credits : 2 **Total Hours : 54**

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

Module 1 **13 hours**

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

Module 2 **13 hours**

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 3 **14 hours**

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 4 **14 hours**

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 References:

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

BI 3CRP11

PRACTICAL III

Total Credits : 4 **Total Hours : 72**

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

1. Programming in C language.

Experiments on Bioinformatics

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

Semester 4

BI 4CRT12

STRUCTURAL BIOINFORMATICS

Total Credits : 4 **Total Hours : 90**

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

Module 1 **18 hours**

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 2 **18 hours**

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 3 **18 hours**

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 4 **18 hours**

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

Module 5 **18 hours**

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- Baxevanis AD and Quellette BFF, John Wiley and 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.

BI 4CRT13

BIOSTATISTICS

Total Credits : 4 **Total Hours : 90**

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

Module 1 **24 hours**

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 2 **22 hours**

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 3 **22 hours**

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 4 **22 hours**

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

BI 4CRT14

BIOLOGICAL DATABASES

Total Credits : 4 **Total Hours : 90**

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

Module 1 **22 hours**

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 2 **24 hours**

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

Module 3 **22 hours**

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

Module 4 **22 hours**

Biological databases: sequence databases, structural databases.

References:

Core references:

1. Bioinformatics methods and protocols-Misner s. et. al
2. Database systems concepts - Hanery Korth and Abraham Silberchatz
3. Introduction to Database Systems - C J Date
4. Introduction to database systems - J M Martin

BI 4CMT06

ENZYMOLOGY

Total Credits : 2 **Total Hours : 54**

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

Module 1 **10 hours**

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

Module 2 **12 hours**

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 3 **12 hours**

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 4 **10 hours**

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 5 **10 hours**

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:

1. Enzymes - Trevor palmer
2. Fundamentals of enzymology - Nicolas C price
3. Lehniger principles of biochemistry
4. Enzyme technology -Ashok pandey
5. Enzymology-Devasena

BI 4CMT07

GENETIC ENGINEERING

Total Credits: 2 **Total Hours : 54**

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

Module 1 **14 hours**

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 2 **15 hours**

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 3 **15 hours**

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 4 **10 hours**

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

References:

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

BI 4CRP15

PRACTICAL IV

Total Credits : 4 **Total Hours : 72**

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

BI 5CRT16

MOLECULAR BIOLOGY

Total Credits : 4 **Total Hours : 90**

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

Module 1 **23 hours**

DNA as the vehicle of inheritance- Experimental evidence -Griffith, McLeod, McCarty and Avery,HerscheyChase 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 2 **24 hours**

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 3 **20 hours**

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

Module 4 **23 hours**

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.

References:

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

BI 5CRT17

PROTEOMICS

Total Credits : 4 **Total Hours : 90**

Aim: To explore major techniques in Proteomics

Module 1 **10 hours**

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

Module 2 **22 hours**

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 3 **20 hours**

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

Module 4 **18 hours**

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

Module 5 **20 hours**

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:

1. Liebler; introduction to proteomics:Tols for the New Biology, Humans Press,2001
2. Proteomics: from protein sequence to function; S.Penington, M.J. Dum Bios scientific pub.ltd 2001
3. Mount david, W;bioinformatics sequence and genomic analysis, cold spring harbor laboratories press, CsH NEW YORK
4. Ian M Rosenberg: Protein analysis and purification (massachusettsBoston)

BI 5CRT18

WEB PROGRAMMING AND PERL

Total Credits : 4 **Total Hours : 90**

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

Module 1 **18 hours**

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

Module 2 **18 hours**

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

Module 3 **15 hours**

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

Module 4 **15 hours**

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

Module 5 **24 hours**

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

References:

Core reference

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

BI 5CMT08

BIOENERGETICS

Total Credits : 3 **Total Hours : 54**

AIM: To explore basic metabolic events taking place inside the body.

Module 1 **12 hours**

Carbohydrate Metabolism : Aerobic and anaerobic Glycolysis. and its regulation, Gluconeogenesis and its regulation.TCA cycle, amphibolic & anaplerotic reactions.Glyoxylate cycle .Electron Transport chain, Oxidative phosphorylation & production of ATP, balance sheet of glucose oxidation. Pentose phosphate pathway (HMP shunt) & its regulation.

Module 2 **12 hours**

Lipid metabolism:Outline study of β oxidation ,ATP yield in β oxidation.Brief study of α oxidation and ω oxidation of fattyacids.Oxidation of unsaturated and odd chain fatty acids.Biosynthesis of fatty acids. Metabolism of ketone bodies.

Module 3 **10 hours**

Aminoacid metabolism: Transamination and oxidative deamination.Urea cycle.Outline of metabolic breakdown of glucogenic,ketogenic and glucoketogenic aminoacids.

Module 4 **10 hours**

Nucleic acid metabolism:Biosynthesis of purine and pyramidine nucleotides denovo and salvage pathway (no structure required).

Module 5 **10 hours**

Photosynthesis:Light reaction and dark reaction.Photorespiration,C4 pathway,Crassulacean Acid Metabolism.Factors affecting photosynthesis.

References:

1. Biochemistry-Leninger, A.L,Kalyni publishers
2. Biochemistry –voet D and Voet J G John wiley
3. Biochemistry- Strayer L
4. Harper's illustrated biochemistry
5. Biochemistry-J.L Jain
6. Plant physiology-J.L Jain

BI 5GET01

Generic Elective 1: Human Health and Nutrition

Total Credits : 3 **Total Hours : 54**

Objectives: To provide the students with an in-depth study on different aspects of Human health and nutrition

Module 1 **14 hours**

Basic concept of food, nutrition and health: Concepts of nutrition, classification, protein, fat, carbohydrate, fiber, and vitamin, mineral and trace elements. Nutritional profile principal foods- Cereals, pulses, vegetables, fruits, nuts, oil seeds, animal foods, milk and milk products, egg, fish, meat, drinks and spices. Nutritional requirements- concepts, energy, Energy requirements protein quality, fat carbohydrate Balanced diet- for different ages, sex, occupation etc Functions of food, Components of food- nutrients, their functions and sources. Food groups and the concept of balanced diet Nutritional status indicators, Nutritional needs during the life cycle (infancy to old age) including physiological conditions like pregnancy and lactation. Socio-Economic Aspects of Nutrition, Health status in India, & Kerala, Nutrigenomics and customized nutrition, Functional foods: food safety and quality.

Module 2 **10 hours**

Nutritional Programmes

National programmes related to nutrition, Vitamin A deficiency programme, National iodine deficiency disorders (IDD) programme, Mid-Day meal programme, Integrated child development scheme (ICDS), National and International agencies working towards food/nutrition: NIPCCD, CARE, FAO, NIN, CFTRI (Central food technology & research institute) etc. Assessment of nutritional status.

Module 3 **10 hours**

Food additives- colors, preservatives, Food adulteration, Household level food preservation and storage, Food labeling.

Module 4 **10 hours**

Food Processing: (i) Methods of cooking, (ii) Healthy cooking practices, (iii) Food hygiene: Potable water- sources and methods of purification, Food and Water born infections.

Module 5 **10 hours**

Major nutritional deficiency diseases- Protein Energy Malnutrition, Vitamin A deficiency, Iron deficiency anemia, Iodine deficiency disorders, their causes, symptoms, treatment, prevention and government programmes, if any. Life style related diseases- hypertension, diabetes mellitus, and obesity- their causes and prevention through dietary/lifestyle modifications. Social health problems- smoking, alcoholism, drug dependence and Aquired Immuno Deficiency Syndrome (AIDS), Diseases related to mineral deficiency, e.g. osteomalacia and anemia. Obesity and malnutrition including protein-energy malnutrition, Lifestyle diseases including circulation and coronary heart diseases, Diabetes and inherited metabolic diseases, Food allergy. Diseases related to nutrition in the developing countries versus the industrialized world.

References:

1. Food Additives Characteristics Detection & Estimation **by** Mahindru S N (2000) **Publisher:** Tata Mcgraw Hill Publishing Co Ltd **ISBN:** 0074637355 **ISBN-13:** 9780074637357, 978-0074637357
2. Potable Water **by** S.N. Mahindru (2004) **Publisher:** Aph Publishing Corporation **ISBN:**
3. 8176487252, ISBN**-13:** 9788176487252, 978-8176487252
4. Food: the Chemistry Of Its Components 4th/ed **by** T. P. Coultate (2002) **Publisher:** Royal Society Of Chemistry **ISBN:**0854046151 **ISBN-13:** 9780854046157, 978-0854046157
5. Food Hygiene **by** Kavita Ed Marwaha (2007) **Publisher:** Daya Publishing House ISBN**:** 8189729721 **ISBN-13:** 9788189729721, 978-8189729721
6. Principles Of Human Nutrition **by** Martin Eastwood (2003) **Publisher:** Atlantic Publishers & Distributors **ISBN:** 1405120290 **ISBN-13:** 9781405120296, 978-1405120296
7. Health, Nutrition And Diseases by Chatterjee, G. (2000) **Publisher:** Rajat Publication **ISBN:** 8187317566 **ISBN-13:** 9788187317562, 978-8187317562

8. Nutrition And Dietetics **by** Shubhangini A Joshi (2007) **Publisher:** Tata Mgraw Hill **ISBN:**0070472920 **ISBN-13:** 9780070472921, 978-0070472921
9. A Handbook Of Foods And Nutrition **by:** F.C. Blank (2007) **Publisher:** Agrobios (India) (ISBN: 8177541633 **ISBN-13:** 9788177541632, 978-8177541632
10. Chemical Analysis Of Foods And Food Products, **by** M B Jacobs (1999) **Publisher:** Cbs ISBN**:** 8123906439 **ISBN-13:** 9788123906430, 978-8123906430
11. Nutrition Research: Current Scenario And Future Trends **by** Krishnaswamy **Publisher:** Oxford & Ibh Publishing Co. Pvt Ltd **ISBN:** 8120413245 **ISBN-13:** 9788120413245, 978-8120413245

BI 5GET02
Generic Elective 2: Genomics & Proteomics

Total Credits : 3 **Total Hours : 54**

Module 1 **10 hours**

Concepts of genomics

History of genomics; genome projects of model organisms; human genome structure and comparative genomics. Genomic elements, SNPs and genome-wide association studies.

Module 2 **10 hours**

Principle of and output from Sanger's dideoxy method versus NGS; shotgun sequencing method and library preparations, comparative study of standard NGS methods.

Module 3 **12 hours**

Overview of metagenomics principles, microbial and ecological aspects underlying metagenomic experiments, applications and limitations of metagenomics, differences between metagenomics and single-cell genomics.

Module 4 **10 hours**

Proteomics

Interatomic forces and protein structure; covalent interaction, hydrogen bonds, hydrophobic and hydrophilic interaction, charge/dipole interaction, Vander Waals forces, steric interaction. Primary structure; 20 amino acids as structural Modules, peptide bonds, proteins as polypeptides.

Module 5 **12 hours**

Secondary structure; Alpha helices, Beta sheets and turns, Backbone flexibility- Φ and ψ- Properties of amino acids-Hydrophobicity, EIIP, Molecular weight, α and β propensities

Types of RNAs and the respective roles in cells. Transcriptome and techniques used for Transcriptomics

References:

1. Liebler; introduction to proteomics:Tols for the New Biology, Humans Press,2001
2. Proteomics: from protein sequence to function; S.Penington, M.J. Dum Bios scientific pub.ltd 2001
3. Biotechnology - B.D. Singh
4. Principles of gene manipulation – old R W Primross
5. From gene to clones – Winnaker E L
6. Text book of biotechnology – P.K Gupta

BI 5GET03

Generic Elective 3: INTRODUCTION TO JAVA & WEB PROGRAMMING

Total Credits : 3 **Total Hours : 54**

Module 1 **10 hours**

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

Module 2 **10 hours**

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

Module 3 **12 hours**

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

Module 4 **12 hours**

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

Module 5 **10 hours**

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:

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

BI 5CRP22

PRACTICAL V

Total Credits : 4 **Total Hours : 72**

AIM: To develop programming skills in Perl and Bioinformatics softwares

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

BI 6CRT20

MOLECULAR MODELLING AND DRUG DESIGNING

Total Credits : 4 **Total Hours : 90**

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

Module 1 **22 hours**

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. Emperical representation of molecular energy, Uses of force field, Molecular mechanics .

Module 2 **24 hours**

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 **22 hours**

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 **22 hours**

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

BI 6CRT22

APPLIED BIOINFORMATICS

Total Credits : 4 **Total Hours : 90**

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

Module 1 **18 hours**

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 2 **18 hours**

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 3 **18 hours**

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 4 **18 hours**

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

Module 5 **18 hours**

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

BI 6CBT01

Choice Based Paper 1

ALGORITHMS,DATA STRUCTURE AND COMPILER

Total Credits : 3 **Total Hours : 54**

Aim:To Develop Computer Algorithms Using Different Data Structures.

Module 1 **13 hours**

Different types of data structures,complexity of algorithms,big O notations.

Arrays-bubble sort,linear search,binary search.

Module 2 **14 hours**

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

Module 3 **14 hours**

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 4 **13 hours**

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

References:

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

BI 6CBT02

Choice Based Paper 2

DATABASE CONCEPTS &PHP

Total Credits : 3 **Total Hours : 54**

Module 1 **10 hours**

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 2 **10 hours**

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 3 **12 hours**

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 4 **12 hours**

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

Module 5 **10 hours**

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.

BI 6CBT03

Choice Based Paper 3

GENETIC ENGINEERING & IPR

Total Credits : 3 **Total Hours : 54**

Module 1 **12 hours**

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: **12 hours**

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 **10 hours**

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 **10 hours**

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 **10 hours**

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
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BI 6CRP22

PRACTICAL VI

Total Credits : 4 **Total Hours : 72**

AIM: To model a molecule and drug.

1. Homology modeling-SWISS-MODEL-An automated knowledge –based protein modeling server
2. To design drug using drug designing software-HEX
3. Structure prediction tools-GOR and SOPMA

MODEL QUESTION PAPERS

B.SC. DEGREE (UGCBCS) EXAMINATION, 2016
First Semester
INTRODUCTION TO INFORMATION TECHNOLOGY

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

1. What is a computer virus?
2. Differentiate between Hardware and Software.
3. Which communication media is used in very short distance networks?
4. A LAN is classified by their configuration. What are they?
5. Define computer.
6. What is the difference between bit and byte?
7. What is the use of output device?
8. What is VDU? Give examples.
9. Classify the following devices.
   Plotter, Microphone, LCD, Barcode Reader, MICR, Thermal printer, Joysticks, CRT Monitor
10. What is an IP address?
11. Explain :(a) Repeater; (b) Router.
12. Expand SRAM.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Explain the various functions of control unit.
14. What are the disadvantages of bus topology?
15. Explain mother board.
16. What is meant by mainframe computer?
17. What are different types of ROMs?
18. What are the different types of access in secondary memory?
19. Explain different types of Expansion slots.
20. Explain virus.
21. Is it possible to connect all the computers to a network? Justify your answer.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Discuss the elements of URL with suitable examples.
23. Explain various I/O ports.
24. What are the system components of computer?
25. Briefly explain third generation of computers.
26. What are the two main classification of software?

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. With neat diagram describe briefly functions of each components of a digital computer.
28. Write notes on various output devices.
29. Briefly explain different types of computer memory.
30. Explain different generations of computers.

(2 x 10 = 20)

B.Sc. DEGREE (UGCBCS) EXAMINATION.

First semester

BIOMATHEMATICS-I
(For B.Sc. Bioinformatics)

Time: Three Hours Maximum: 80 Marks

Part A (Answer any 9 questions each carries 2 mark)

1. What is scalar matrix?
2. If a matrix has 24 elements, what are the possible dimensions it can have? What if it has 13 elements?
3. What is constant function?
4. What is the range of $f(x) = \frac{3}{2} - x^2$?
5. Let A= {1}, B= ϕ, C = {1, 2} and D =ϕ. Then what is A ∪ B ∩ C ∪ D.
6. What are the properties of matrix multiplication?
7. What is saddle point?
8. State the Minimax theorem.
9. What is the chain rule in differential calculus?
10. Find the derivative of $1/x^4$.
11. What is De-Morgan's law? State with an example?
12. What is absolute value of a function?

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Write the cofactors of the elements of the second row and evaluate them $\begin{vmatrix} 1 & 4 & 3 \\ -4 & 3 & 6 \\ 2 & -7 & 9 \end{vmatrix}$.
14.
15. If any two rows of a determined are identical, then its value is zero. Prove?
16. If A =$\begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$, B=$\begin{bmatrix} 0 & 3 & 7 \\ 1 & 8 & 9 \end{bmatrix}$, C=$\begin{bmatrix} 3 & 7 & 1 \\ 2 & 6 & 1 \\ 1 & 4 & 0 \end{bmatrix}$, find (AB) C = A (BC).
17. What is a function? Give two examples.
18. Write the power set of (3,-1).
19. The following is the pay off matrix. What is the value of the game? Who will be the winner of the game? Why?

	Y	
X	1	2
	2	-1

20. Find i) $\lim_{x\to 2}(x^2+1)(x^3+1)$ ii) $\lim_{x\to 1}\frac{2x^3-5x^2+7x+1}{3x^2+5x+2}$

21 What is the difference between relation and function? Illustrate with an example.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Find the inverse of a matrix A by Gauss-Jordan elimination A = $\begin{bmatrix}2 & 1 & 1\\ 1 & 2 & 2\\ 1 & 1 & 2\end{bmatrix}$.

23. Show that the function $f(x) = \frac{2x}{x-1}$ is one-one and onto.

Where $A = \{x \in R/\ x \neq 1\}$ and $B = \{y \in R/\ y \neq 2\}$. Find log if $g(x) = {}^{1}/_{x}, x \neq 0$.

24. Differentiate i) $y = \sin(2x) + cos^2(x)$ ii) $f(x) = \frac{\sin(3x)}{4+5\cos(2x)}$

25. If A = $\begin{bmatrix}2 & 1\\ 5 & 3\end{bmatrix}$, B = $\begin{bmatrix}1 & 2\\ -3 & 4\end{bmatrix}$ verify that (i) $(A+B)^1 = A^1 + B^1$; (ii) $(AB)^1 = B^1A^1$.

26. Solve the following 2 × 3 game graphically.

	B_1	B_2	B_3
A_1	2	-3	4
A_2	-1	1	-3

(3×6=18)

Part D (Answer any 2 questions each carries 10 mark)

27. (a) Write a short note about Two-Persons Zero-Sum game. Write the method of solving Two Persons Zero-Sum game.

(b) Write a short note about Principle of dominance.

(c) Solve the following games using dominance rule?

	1	2	3	4
1	3	2	4	0
2	3	4	2	4
3	4	2	4	0
4	0	4	8	4

28. Two companies A and B are computing for the same product. The different strategies are given in the pay off matrix. Use linear programming to determine the best strategies for both players.

	Player B		
Player A	2	-2	3
	-3	5	-1

29. (i) Solve the equation $\begin{vmatrix} 3x-8 & 3 & 3 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix} = 0.$

(ii) Find the inverse of A = $\begin{bmatrix} -1 & 1 & 0 \\ 2 & 1 & 3 \\ 4 & 1 & 8 \end{bmatrix}$.

(iii) Solve the following system of equation:-

$x - y + 3z = 6$

$x - 3y + 3z = -4$

$5x + 3y + 3z = 10.$

30. (a) Let f be the exponential function and let g be the logarithmic function. Find the values of :

i) $(f+g)(1)$ ii) $(f.g)(1)$

iii) $(2f)(1)$ iv) $(5g)(1)$

v) $(f \circ g)$ vi) $(g \circ f)(1)$.

(2×10=20)

B.Sc. Degree (UGCBCS) Model Examination
First semester
INTRODUCTION TO CELL BIOLOGY
(For B.Sc. Bioinformatics)

Time: 3 Hours Total Marks: 80

PART I

Part A (Answer any 9 questions each carries 2 mark)

Define the following terms

1. Cell
2. Uniport
3. Xylem and phloem
4. Germ cell
5. MPF
6. Cyclosome
7. Epidermis
8. Ribosomes
9. Plant vacuoles
10. F0 F1 complex.
11. sensory cells
12. unit membrane hypothesis

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Explain the role of connective tissue in animals.
14. Draw and label the structure of chloroplast.
15. What is the role of blood cell?
16. What are the postulates of cell theory?
17. Describe the functions of lysosomes.
18. Give notes on functions of membrane proteins.
19. Write the functions of plasma membrane.
20. Write notes on functions of golgi complex
21. Write notes on nucleosomes.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Differentiate between prokaryotic and eukaryotic cell.
23. What are chromosomes?Give notes on any two types.

24. Describe Sodium potassium pump.
25. Give a note on the size and shape of cells.
26. Differentiate between animal and plant cell.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain the various stages of cell cycle.
28. Explain the structure and functions of mitochondria..
29. Describe elaborately on cell division.
30. Explain the structural components of a cell

(2 x 10 = 20)

B.Sc. DEGREE (UGCBCS) EXAMINATION

First Semester

FUNDAMENTALS OF GENETICS

(For B.Sc. Bioinformatics)

Time: 3Hrs. **Total Marks: 80**

Part A (Answer any 9 questions each carries 2 mark)

1. What is heredity?
2. Define test cross.
3. Define phenotype.
4. What is pedigree analysis?
5. Give an example of X - linked inheritance.
6. What is Down's syndrome?
7. What is polyploidy?
8. What is gene mutation?
9. What is a chromosome?
10. What is hemophilia?
11. What is co- dominance?
12. What are lethal genes?

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Differentiate between dominance and recessive.
14. What are mutagens'?
15. Define multiple alleles with examples?
16. What is epistatis?
17. Write any three significance of crossing over.
18. What is spontaneous mutation?
19. Write about genetic mapping.
20. What is physical mapping
21. Give a note on non allelic interaction?

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Briefly explain multiple factors with example.
23. Give a note on chromosomal mutation?
24. Explain the concept of linkage.
25. Describe the inheritance of hemophilia.
26. Describe color blindness?

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain chromosome theory of inheritance and its importance?
28. Write an essay on Mendel's law of inheritance with suitable examples?
29. Differentiate between complete linkage and incomplete linkage with example?
30. Explain genetic map of chromosome?

(2 x 10 = 20)

B. Sc. DEGREE (UGCBCS) MODEL EXAMINATION, MARCH 2016

Second Semester

B. Sc Bioinformatics

INTRODUCTION TO BIOINFORMATICS

Time : Three Hours Maximum Marks :80

Part A (Answer any 9 questions each carries 2 mark)

1. What is EBI .

2. What is FASTA.

3. Name two Structural Databases.

4. Define NCBI.

5. What is Genetic Algorithms.

6. What is INSDC.

7. Define Clustal W .

8. What is BLAST.

9. General Overview of Genbank.

10. Define MSA.

11. Explain RCSB.

12 . Explain Locus Linker & ORF Finder. (9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Describe Drug discovery process.

14. Briefly Describe Human Genome Project.

15. Describe Multiple Sequence alignment with examples .

16. Differences in nature and scope of biology and computer science .

17. Define CADD.

18. Define Bioinformatics Tools.

19. Describe Biological motivation in computing Neural Network.

20. Explain Robotics.

21. Briefly describe PIR-PSD. (6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Explain Protein databases.

23. What are the difference between Databases and Biological Databases ?

24. Explain Swiss -Prot.

25. Describe Pharmacogenomics & Chemiinformatics.

26. Discuss nature & scope of Bioinformatics.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Which are the Sequence Visualization and Structure visualization Tools in Bioinformatics? Explain about it.

28. Discuss tools for the similarity search and sequence alignment ? Explain about the output?

29. Explain Molecular Phylogenetics ? Explain the software for Phylogenetic analysis.

30. What is Biological databases ? What are the function of Biological Databases ? Explain Different types of Biological Databases and its Examples ?

(2 x 10 = 20)

B.Sc. Degree (UGCBCS) Model Examination
Second semester
BIOCHEMISTRY
(For B.Sc. Bioinformatics)

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

Define the following terms

1. Enantiomers
2. Invert sugar
3. Amylose
4. Epimers
5. Saponification value
6. Peptide bond
7. Mutarotation
8. Micelle
9. Ribose sugar
10. Rancidity of fats
11. Give two essential fatty acids
12. What is lactose intolerance.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Explain the properties of saturated and unsaturated fattyacids
14. What are glycosaminoglycans?
15. Give notes on protein folding.
16. Differentiate between reducing sugar and nonreducing sugar.
17. What is Reichert-Meissel number.
18. Explain the biological significance of fats.
19. What are heteroplysaccharides? Give two examples.
20. What are the general properties of fats.
21. How does the protein can be classified based on composition.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Differentiate between essential and non essential aminoacids.
23. Give notes on the structure of tRNA
24. What are the forces stabilizing the protein structure?

25. Write the importance of maltose and lactose.
26. Explain the deficiency diseases of water soluble vitamins.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain the classification of lipids.
28. Explain the Watson Crick Model of DNA
29. Explain the properties and functions of fat soluble vitamins.
30. Explain the different levels of protein structure.

(2x10=20)

B.SC. DEGREE (UGCBCS) MODEL EXAMINATION
Second Semester
GENERAL MICROBIOLOGY
(For B.Sc. Bioinformatics)

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

1. What is Staining?
2. Inclusion bodies?
3. Define Halophiles.
4. What are the viral enzymes?
5. Osmotic pressure?
6. Define microscopy?
7. Purpose of L shaped rod in the laboratory?
8. Define fastidious microorganism?.
9. Properties of virus?
10. What is a chemostat?
11. Negative staining?
12. Explain the growth curve?

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. What is synchronous growth?
14. Write a brief note on bacterial cell wall?
15. Write about icosahedral symmetry?.
16. Write about flagella and its motility.
17. Explain briefly the theory of spontaneous generation?
18. What are bacteriophages with diagram?
19. Influence of oxygen availability in growth?
20. Functions and types of flagella?
21. Give an account on specimen preparation?

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Structure and properties of viruses?
23. What is gram staining ?
24. Write about continuous culture and batch culture?

25. Explain briefly the viral genome?
26. Explain the Koch postulates?.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. What is culture methods and explain the culture techniques?.
28. Explain growth curve? Write about the factors influencing the growth curve?
29. Write about lytic and lysogenic cycles of bacteriophages?
30. Explain the prokaryotic cell structure and function?

(2X10=20)

B.Sc. DEGREE (UGCBCS) EXAMINATION, MARCH 2016

SECOND SEMESTER

(B.Sc. Bioinformatics)

BASIC INSTRUMENTATION

Time: Three Hours **Total Marks: 80**

Part A (Answer any 9 questions each carries 2 mark)

1. What is microscopy?
2. What is Resolving power.
3. What is monochromator.
4. Explain Partition coefficient.
5. Explain Diffraction.
6. Explain PAGE.
7. Explain HPLC.
8. Explain NMR.
9. Explain Relative centrifugal force.
10. What is paper chromatography?
11. What are th3 sources of UV- Visible spectroscopy?
12. Write about properties of light.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. What are the factors affecting electrophoresis.
14. What is dark field microscopy?
15. High speed centrifuge.
16. What is affinity chromatography?
17. What is numerical aperture.
18. What is isoelectric focusing?
19. What is spectroscopy?
20. Differentiate between single beam and double beam IR spectroscopy.
21. Discuss about ion exchange chromatography.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Differentiate between SEM and TEM.
23. Explain Beer- Lambert's law.

24. Write about application of Analytical ultra centrifuge.
25. Explain about principle, types and applications of electrophoresis.
26. Explain Optical microscopy. (3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain about types of centrifuges.
28. Give an account on NMR and ESR spectra.
29. Explain about paper chromatography and HPLC.
30. Write note on PAGE and SDS- PAGE and its applications.

(2×10=20)

B.Sc. DEGREE (UGCBCS) EXAMINATION 2016

Third semester

BIOMATHEMATICS-II
(For B.Sc. Bioinformatics)

Time: Three Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

1. Basic logic operators.
2. Differentiate walks and paths.
3. Define path matrix.
4. What is the height of the tree?
5. How a binary tree differ from tree?
6. What is cyclic and acyclic graph?
7. Define singular matrix.
8. Rank of a matrix.
9. State the Fundamental Theorem of calculus.
10. Write the application of graphs.
11. Define sub graph with examples.
12. Define adjacency matrix with example

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. What are the conditions that should be satisfied by a tree?
14. Prove, In every graph, the number of nodes with odd degree is even.
15. Draw the truth table for exclusive NOR gate and give the Boolean notation.
16. What is spanning tree? Give atleast 3 properties.
17. Explain circuits with example.
18. Find the adjoint of the matrix

$$\begin{bmatrix} 2 & 3 & 1 \\ 1 & 2 & 3 \\ 3 & 1 & 2 \end{bmatrix}$$

19. Show that adj (A^T) = $(\text{adj } A)^T$.
20. Explain different logical operations with truth table.
21. Integrate $x^3 \log x$. (6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Write a brief note about conditional, bi conditional, converse, inverse and contra positive statements.
23. a) Write a brief note about row canonical method.
    a) By reducing to the echelon forms, find the rank of the following matrices:

    i) $\begin{bmatrix} 1 & 6 & -18 \\ -4 & 0 & 5 \\ -3 & 6 & -13 \end{bmatrix}$ ii) $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 3 & 4 & 1 & 2 \\ 4 & 3 & 1 & 2 \end{bmatrix}$.

24. What is meant by equivalence and implication? Give detailed explanation.
25. Integrate $\int \sqrt{3+2x}\, dx$.
26. Find $\frac{dy}{dx}$ when $x^3 + y^3 = 3axy$.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Evaluate $\int \frac{2x+3}{x^2+5x+7} dx$.
28. Test for consistency and then find the solution.
    $2x + 2y - z = 3$
    $3x - y + 2z = 1$
    $2x - 2y + 3z = 2$
    $x - y + z = -1$
29. Solve the following simultaneous equations using Crammer's rule.
    $5x - 6y + 4z = 15$
    $7x + 4y - 3z = 19$
    $2x + y + 6z = 46.$
30. Explain Spanning tress, Minimum spanning trees.

(2 x 10 = 20)

B.Sc. DEGREE (UGCBCS) MODEL EXAMINATION

Third Semester

ADVANCED COMPUTING

(For B.Sc. Bioinformatics)

Time: Three Hours **Total Marks: 80**

Part A (Answer any 9 questions each carries 2 mark)

1. Define FASTA.
2. What is LCR.
3. What is Hybridisation..
4. Which are the sequence alignment tools..
5. Define UPGMA.
6. Write down the examples of Distance based methods.
7. Explain BLAST.
8. Name the Multiple alignment tools.
9. What is Masking.
10. Define BLOSUM.
11. Write a note on Bootstrapping.
12. Explain Inkjet array synthesis.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Explain Global alignment and Local alignment.
14. Define Regular expression.
15. What is Dynamic Programming..
16. Explain different types of Phylogenetic methods .
17. What are the advantages and disadvantages of Microarray?
18. Explain the difference between the weighted and unweighted parsimony.
19. Write about HSP.
20. Explain Multiple Sequence alignment.
21. Describe motif?

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Describe Jukes-Cantor and Kimura Distance Model . .
23. What are the difference between heuristic and exhaustive algorithms?..
24. Define patterns and profiles.
25. What are the different steps used to Design of oligonucleotides .
26. Define Needleman – Wunsch algorithm ..

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain about scoring matrices?Write about the examples of scoring matrices?
28. Write down the Drug Discovery in bioinformatics with examples.
29. Discuss tree construction method used in phylogenetic analysis **?**
30. Define Microarray ? What are the different techniques used in Micro array? What are the concept & advantages of Micro array?

(2 x 10 = 20)

B.Sc. DEGREE (UGCBCS) MODEL EXAMINATION

Third Semester

INTRODUCTION TO PROGRAMMING IN C

Time :3 Hrs Maximum Marks :80

Part A (Answer any 9 questions each carries 2 mark)

1. Define algorithm?
2. What is a function?
3. What do you mean by type casting?
4. Differentiate between getchar() and getch()?
5. What is the different between postfix and prefix increment?
6. What is the value of k after execution?

```
Int x=10,y=15
K=(x<y) ? (y+x) : (y-x);
```

7. What is union?
8. Differentiate gets() and puts()?
9. What is an array?
10. What is a pointer?
11. Explain conditional operator?
12. Differentiate array and structure?

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Explain the various data types available in c?
14. Write an algorithm to find the largest among three numbers?
15. Write a program to find the average of n numbers?
16. What is the difference between call by value and call by reference?
17. Write a program to find the factorial of a number?
18. Explain the for loop with examples?
19. Differentiate actual and formal parameters?
20. Explain about enum identifier?
21. Differentiate continue and break statements?

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Explain different string handling functions in c?
23. Explain about the elements of user defined functions?
24. Explain about the IF statement ant its classifications?
25. Explain about the storage class in c?
26. Differentiate between switch and else if ladder.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain about c tokens?
28. Explain the classification of the functions?
29. Explain different loop statements in c?
30. Explain about decision making statements with example?

(2 x 10 = 20)

B.Sc. DEGREE(UGCBCS) EXAMINATION, MARCH 2016
THIRD SEMESTER
B.Sc. BIOINFORMATICS
BIOPHYSICS

Time: Three Hours **Total Marks: 80**

Part A (Answer any 9 questions each carries 2 mark)

1. Define PH.
2. Define buffer.
3. What are colloids?
4. What is osmosis?
5. Define absorption.
6. Define Emulsion.
7. Explain Molarity.
8. Explain Diffusion.
9. Define Entropy.
10. Explain Dialysis.
11. Write notes on GM counter.
12. What are the factors influencing surface tension.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Write the method of dialysis.
14. Differentiate between absorption and adsorption..
15. Differentiate between order and molecularity of chemical kinetics.
16. Give notes on properties of solution.
17. Explain the first law of thermodynamics.
18. What is active transport?
19. Write a note on PH meter.
20. What is radioactive decay?

21What is osmotic pressure?

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

21. Explain the technique of liquid scintillation counter?Write its applications.
22. Explain autoradiography and its applications.
23. Write about the applications of radioisotope in science.
24. Write a note on X- ray crystallography.
25. Give an accounting on separation techniques in colloids.
26. Derive Donnan equilibrium.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain the laws of thermodynamics
28. Write an essay on colloids?
29. Explain about the instruments used for the measurement of radioactivity.
30. Explain diffusion in detail.

(2 x 10 = 20)

B.Sc. Degree (UGCBCS) Model Examination

Third semester

IMMUNOLOGY

(For B.Sc. Bioinformatics)

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

1. What is allograft?
2. NK cell.
3. What is an important function of IgE.
4. What is Innate immunity
5. ELISA.
6. Write the function of Bone marrow?
7. Explain AIDS.
8. What is hypersensitivity?
9. What is isotype?
10. What is precipitation reaction?
11. What are the sources of infection?
12. Explain about Haptens.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Draw and label the structure of IgM .
14. Differentiate between allotype and idiotype.
15. Write about dendritic cell.
16. What is hemolytic disease of new born?
17. What is MHC complex?
18. What is T- dependent and T -independent antigen
19. What is complement system?
20. Write about types of transplantation.
21. What are lymphocyte cells?

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Explain briefly cell mediated immune response.
23. What are immunoglobulins?

24. Discuss about type II and type III hypersensitivity.
25. Discuss about ABO blood group system.
26. What is monoclonal antibody?

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain the complement system and its activation Pathways.
28. What are immunoglobulin? Explain the structure of an immunoglobulin and different types.
29. What are vaccines? Explain their different types and applications.
30. Write a note on the different cells involved in immune response.

(2 x 10 = 20)

B.SC. DEGREE (UGCBCS) EXAMINATION, 2016
Fourth Semester

STRUCTURAL BIOINFORMATICS
(For B.Sc. Bioinformatics)

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

1. Explain Nucleosides.
2. What are the Components of DNA and RNA.
3. Define amino acids.
4. Explain Peptide bond.
5. Explain N-and C-terminals.
6. Define Pentose sugar.
7. Difference between purines and pyrimidine.
8. Draw the structure of guanine.
9. Define Ionic bond.
10. Describe Van der Waal force in protein.
11. Explain Fuctions of nucleotides.
12. Explain alpha helix with diagram showing CO and NH group.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Explain Exceptional case of Gycine and Proline in Ramachandran plot.
14. Explain Inter and intra chain H bond.
15. Expplain Chargaff rule.
16. Describe the importance of energy in the content of protein-ligant interactions.
17. Describe the Stucture of ocytocin.explain the type of bond.
18. Explain Collagen triple helix.
19. Explain Difference between hemoglobin and myglobin.
20. Explain Motifs and patterns.
21. Explain Differences between double stranded and single stranded DNA.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Explain Ramachandran plot with diagram.
23. Explain Protein tertiary structure.
24. Explain Variants of double helical DNA.

25. Explain Chou Fasman and GOR methods for protein structure prediction.
26. Draw cloverleaf model of tRNA.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Protein secondary structure with examples and diagram.
28. Homology Modeling of protein structures.
29. Watson-crick model double helical structure of DNA.
30. Protein – DNA interactions and types of interactions of DNA with protein.

(2 x 10 = 20)

B.Sc. DEGREE (UGCBCS) MODEL EXAMINATION.

Fourth Semester

Core Course 12- BIOSTATISTICS

(For B.Sc. Bioinformatics)

Time: Three Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

1. Define Biostatistics?
2. What is cumulative frequency curve?
3. Explain the term sample space?
4. State the principle of least square.
5. Write the multiplication theorem in Probability.
6. Which diagram best represent continuous variables?
7. What divides the series of observation into hundred equal parts?
8. Define linear regression?
9. Define random experiment?
10. Define variance.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

11. State any two merits at diagrammatic representation.
12. Explain in brief qualitative data.
13. Write about methods of primary data collection.
14. Explain the term curve fitting.
15. What do you mean by mutually exclusive events?
16. Explain the term "rank correlation".
17. Write the working rules to prepare a frequency table?
18. Define the term "mean" and "median".
19. Write one merit and demerit of geometric mean.
20. Differentiate absolute and relative measures of dispersion.
21. Explain the term "attributes" and "variables".

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Write down the limitations of Biostatistics.
23. What are the characteristics of a good average?
24. Find Arithmetic Mean:

Mid value:	18	25	32	39	46	53	60
Frequency:	10	15	32	42	26	20	9

25. From the following data of values of x and y, find the regression equation of y on x.

x:	2	3	4	5	6
y:	3	5	4	8	9

26. Find SD from the following data:

X:	0-10	10-20	20-30	30-40	40-50	50-60
F:	8	12	18	13	15	9

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Write an essay on "Statistics in the field of Biological science".
28. State and explain various types of Bar diagram.
29. Calculate regression line of X on Y and Y on X from the following data and obtain the values of 'X' if 'Y' is 15.

X:	1	2	3	4	5	6
Y:	4	5	6	7	8	9

30. Three judges ranked the ten beauty contestants and the results are as follows:-

Serial number of the contestant…	1	2	3	4	5	6	7	8	9	10
Rank given by Judge A …	9	3	7	5	1	6	2	4	10	8
Rank given by Judge B …	9	1	10	4	3	8	5	2	7	6
Rank given by Judge C …	6	3	8	7	2	4	1	5	9	10

Use the correlation coefficient to discuss which pair of judges has nearest approach to common test of beauty.

(2 x 10 = 20)

B.SC. DEGREE (UGCBCS) MODEL EXAMINATION
Fourth semester
DATABASE AND THEIR MANAGEMENT

Time:3 hr Total Marks:80

Part A (Answer any 9 questions each carries 2 mark)

1. Define database.
2. What you mean by relational database management system?
3. What you mean by normalization?
4. Define first normal form.
5. Define Swissprot.
6. What is MMDB?
7. What you mean by biological database?
8. Define EMBL.
9. What you mean by Genbank?
10. Define NCBI.
11. Difference between biological database and database.
12. Write a short note on SQL?

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Define first normal form with example.
14. What are the advantages and disadvantages of normalization?
15. Define network model. What are its advantages and disadvantages?
16. What is the importance of biological database?
17. What are the objectives of normalization?
18. Define entity relationship with example.
19. What are the differences between primary and secondary database?
20. What is importance of sequence database?
21. Describe DNA Databank of Japan.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Define second normal form with example.
23. Explain the different operators used in relational algebra with examples.
24. Illustrate the architecture of database systems.
25. Difference between network model and relational model.

26. Write a short note on PDB.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Define structural databases. What are its different categories?
28. Explain normalization and its different forms.
29. Write a note on biological database.
30. Explain in detail about ER Model and Relational Model.

(2 x 10 = 20)

B.SC. DEGREE (UGCBCS) MODEL EXAMINATION
Fourth semester
ENZYMOLOGY
(For B.Sc. Bioinformatics)

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

Define the following terms

1. Ribozymes
2. Turn over number
3. Activation energy
4. Holoenzyme
5. Binding energy
6. Transition state
7. Allosteric enzyme
8. FMN
9. Kcat
10. Abzymes
11. Why are enzymes called biological catalyst?
12. What is order of reaction ?Explain with types.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Define IU and Katal.
14. Describe the four most striking properties of enzymes.
15. What is a rate limiting step in a reaction?
16. What are coenzymes? Explain with 2 example.
17. Explain the importance of Km and Vmax.
18. Describe Lineweaver -Burk equation.
19. What is feedback inhibition?Give an example.
20. What are the differences between metal activated enzymes and metalloenzymes?
21. What are isoenzymes?Give one example

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. How are km and Vmax estimated from plots of kinetic data.
23. Describe the MM plot and LB plot for competitive competition
24. Explain lock and key and induced fit model.

25. Explain Michaelis-Menten equation.
26. Explain the role of pyruvate dehydrogenase complex as a multienzyme complex.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain the nomenclature and classification of enzymes.
28. Discuss the medical applications of enzymes.
29. Describe elaborately different types of enzyme inhibition.
30. What are enzymes? Explain the mechanism of enzyme action.

(2 x 10 = 20)

B.Sc. DEGREE(UGCBCS) EXAMINATION, MARCH 2016
FOURTH SEMESTER
B.Sc. BIOINFORMATICS
GENETIC ENGINEERING

Time: Three Hours **Total Marks: 80**

Part A (Answer any 9 questions each carries 2 mark)

1. Write an introduction to genetic engineering.
2. Define hybridoma.
3. Define restriction enzyme.
4. Define recognition sequence.
5. Define probe.
6. Function of ligase.
7. Define cosmid.
8. Write note on c DNA.
9. Define phagemid.
10. Define phasmid.
11. What are the two types of probe labeling?
12. What are the tools of genetic engineering?

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Write short note on site directed mutagenesis.
14. Describe micro injection with diagram.
15. What are the applications of PCR?
16. What are the steps in gene cloning?
17. What are recombinant vaccines?
18. What are the two life cycles in bacteriophage?
19. What are the advantages of phage vector?
20. What do you mean by lac Z α complementation?
21. Write about application in genetic engineering.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Explain the types of PCR.
23. Write notes on Lambda vector in details..
24. Draw and explain cosmid.
25. Explain southern blotting.
26. What are the c DNA cloning techniques?

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Write an essay on monoclonal antibodies.
28. Explain blotting techniques in detail.
29. Describe Sanger's method of sequencing.
30. Give an account on site directed mutagenesis and its methods.

(2 x 10 = 20)

B.Sc. Degree (UGCBCS) Model Examination
Fifth semester
MOLECULAR BIOLOGY
(For B.Sc. Bioinformatics)

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

Define the following terms

1. Gene
2. Telomere
3. Repetitive DNA
4. Okazaki fragments
5. Pseudogenes
6. IS
7. Intron
8. Helicase
9. Replisome
10. F0 F1 complex.
11. What is satellite DNA? What does it signify?
12. What is C value paradox?

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Write notes on tarnsposones and its types.
14. What is klenow fragment and explain its role?
15. What are the postulates of cell theory?
16. What is unit membrane hypothesis?
17. Describe the functions of lysosomes.
18. Give notes on functions of membrane proteins.
19. Write the functions of plasma membrane.
20. Write notes on functions of Golgi complex
21. Give note on nervous tissue.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Describe two classical experiments which demonstrated that DNA is the genetic material.
23. Explain genetic code.
24. Give a note on types and functions of RNA.
25. Explain prokaryotic transcription in detail.

26. Write short note on post -transcriptional modification

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain the mechanism of DNA replication in *E coli*.
28. Explain operon concept and trp operon.
29. Explain different type of DNA repair mechanism.
30. Write an essay on post- translational modifications.

(2 x 10 = 20)

B.SC. DEGREE (UGCBCS) MODEL EXAMINATION
Fifth Semester
PROTEOMICS
(For B.Sc. Bioinformatics)

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

1. Define amino acids.
2. Amide bond and peptide bond.
3. Write down the full form of PIR,RCSB.
4. Write a short Note on NMR.
5. Name of the phosphate modifications of proteins.
6. Name of NCBI biomedical literature citations and abstracts database.
7. Parallel and antiparellell beta sheets?
8. What are structural proteins?
9. Define SCOPE.
10. Primary structure of proteins.
11. Short note on different levels of protein structure.
12. Explain proteogenomics.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. What is the protein separation technique?
14. What is metabolic labeling?
15. Describe one protein extraction method.
16. What is HPLC?
17. Explain MALDI TOF instrumentation..
18. Protein identification tools.
19. What is LC-MS?
20. Explain x-ray crystallography technique.
21. Explain mapping of protein.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Explain secondary structure of protein with diagram.
23. What is immunoprecipitation?
24. Explain the significance of ramachandran plot.
25. Explain NMR spectroscopy.
26. Short note on homology modeling.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain the role of proteomics in drug discovery.
28. Explain protein structure prediction methods.
29. Applications of proteomics.
30. Explain Comparative proteomics methods and application.

(2 x 10 = 20)

B.Sc. DEGREE (UGCBCS) MODEL EXAMINATION

Fifth Semester

WEB PROGRAMMING AND PERL

(For B.Sc. Bioinformatics)

Time: Three Hours **Total Marks: 80**

Part A (Answer any 9 questions each carries 2 mark)

1. Define Scripting Language.
2. What is HTML tag? Give *three* examples.
3. Define Bio-PERL.
4. Explain UNTIL statement in PERL.
5. Define XML.
6. Write down the tags for ordered and unordered list *in HTML*
7. List data types available in Java Script.
8. Name the attributes of frame tag.
9. What is Dialogue Box in Java Script?Give an example.
10. Define Arrays in PERL.
11. What is Decision - Making?
12. Define PERL and give any *two* perl editor.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Write a note on Web Programming Languages.
14. Write the HTML tags for adding text and images.
15. Write a note on operators and expressions in Java Script.
16. What are the advantages and disadvantages of PERL?
17. What is internet? Explain its components?
18. Explain FOR and FOREACH statements in PERL.
19. Write about open and close functions in PERL.
20. Explain how to place a text in Browser in Java Script.
21. Describe DHTML?

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Explain formatting characters (Escape sequences) in PERL.
23. Explain push,pop,unshift functions in PERL.
24. Define PERL SCRIPT and Explain.
25. Explain the Structure of HTML.
26. Explain about Tables and Linking tags in HTML with an example.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Define and Explain:
    (i) Conditional statement.
    (ii) Looping statement in Java Script.
28. Write down the HTML tags to Display *Amino Acid* and *Nucleic Acid* in aTable.
29. Write HTML Tags and Explain the following:
    (i) Text formatting.
    (ii) Frames
    (iii) Forms.
30. Explain the string functions for the following:-
    (a) Concatenation.
    (b) Reverse a string.
    (c) To find the length of a string.
    (d) To convert upper case and lower case.
    (e) Splitting a string.
    (f) Joining a string.
    (g) Finding substring

(2 x 10 = 20)

B.SC. DEGREE (UGCBCS) MODEL EXAMINATION

Fifth semester

BIOENERGETICS

(For B.Sc. Bioinformatics)

Time: 3 Hours **Total Marks: 80**

Part A (Answer any 9 questions each carries 2 mark)

Define the following terms

1. ω oxidation
2. Link reaction
3. Anaplerotic reaction
4. Fermentation
5. Malonyl CoA
6. Photosystem
7. Carnitine
8. Acyl carrier protein
9. ATP Synthase
10. PLP
11. ketone bodies.
12. CAM pathway

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Define urea cycle
14. What is F0-F1 complex?
15. Explain the regulatory enzymes in glycolysis
16. What is glyoxylate cycle?
17. Explain malate aspartate shuttle.
18. What is transamination and deamination?
19. Discuss the metabolism of phenyl alanine and tyrosine.
20. Explain non cyclic photophosphorylation.
21. Draw the structure of chlorophyll.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Calculate the ATP yield in β oxidation
23. What are the factors affecting photosynthesis?
24. Differentiate between respiration and photorespiration
25. Give notes on fatty acid synthase.

26. Explain the amphibolic nature of TCA cycle.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain the ETC and oxidative phosphorylation.
28. What is calvin cycle?
29. Explain metabolic breakdown of glucogenic and ketogenic aminoacids.
30. Explain the biosynthesis of purine nucleotides.

(2 x 10 = 20)

B.Sc. DEGREE (UGCBCS) EXAMINATION

Fifth Semester

HUMAN HEALTH AND NUTRITION

Time: 3Hrs. **Total Marks: 80**

Part A (Answer any 9 questions each carries 2 mark)

1. Define health?
2. What are national deficiency disorder programmes?
3. Write a note on vitamin A?
4. Full form of CFTRI and ICDS.
5. Define braising?
6. Define food labelling?
7. What is potable water.
8. Name the social health problems?
9. What is undernutrition?
10. Define food allergy?
11. Write about the concept of nutrition?
12. Define malnutrition?

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Concept of balanced diet?
14. What are the nutrition status indicators ?
15. What is food hygiene and sanitation?
16. Give note on Iodine defiency disorders?
17. Brief note on life style related diseases?
18. Nutritional concept of carbohydrate?
19. Discuss about health status in India?
20. What is food safety and quality?
21. Socio-economic aspects of Nutrition.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Explain concept of food adulteration?
23. Give away household level of food preservative measures?
24. Explain nutrigenomics and customized nutrition?
25. What are the food and water born infections.
26. What are nutritional requirements of the body.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain the nutritional profile principal foods?

28. Explain the concept of nutrition and their classification?
29. Explain food additives- colors, preservatives and food adulteration?
30. Explain the major nutritional deficiency diseases- causes ,symptoms,treatment and prevention?

(2*10=20)

B.SC. DEGREE (UGCBCS) EXAMINATION, 2016
Fifth Semester
GENOMICS & PROTEOMICS

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

Explain the following terms:

1. Genome
2. SNP
3. Sequencing
4. NGS
5. metagenomics
6. single cell genomics
7. polypeptides
8. hydrophobic interactions
9. propensities
10. Transcriptomics
11. Alpha Helix
12. microbial genomics

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Explain the history of genomics.
14. Explain SNPs and role of SNP in genome
15. Explain Sangers method sequencing.
16. What is meant library preparation in sequencing?
17. Explain in detail single cell genomic experiments?
18. Explain covalent ineractions
19. Explain steric interactions
20. Explain EIIP
21. Explain the role of Hydrophobicity in protein structure.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Discuss comparative genomics.
23. Explain short gun sequencing.
24. Explain metagenomics principles.
25. Explain the structure of peptide bonds.
26. Explain backbone flexibility.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain genome project of different organisms.
28. Explain different sequencing methods.
29. Explain the protein structures in details.
30. Explain different Transcriptomics techniques

(2 x 10 = 20)

B.Sc. Degree (UGCBS) Model Examination

Fifth semester

INTRODUCTION TO JAVA & WEB PROGRAMMING

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

31. Define encapsulation
32. What is JVM?
33. Explain the difference between break and continue statement in Java
34. What do you mean by a "stream" in Java?
35. Explain JDBC Driver
36. What is Object oriented programming?
37. How connection object is created in JDBC?
38. Difference between an alert box and a confirmation box in Javascript
39. How a Java array is constructed?
40. What is Bytecode in Java
41. Explain the features of Javascript
42. What is "extends" keyword in Java?

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

43. Explain the use of Java package with example
44. What is polymorphism?
45. Explain Bitwise operators in Java
46. What are the steps for building a JDBC application?
47. Why and how the concept of interface is used in Jav?a
48. Explain the text formatting tags in HTML
49. Explain the life cycle of a Java applet
50. Explain String Handling in JAVA
21 Explain server side scripting (6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22 Create a Java applet to print a message in the browser
23 Explain the data types in Java
24 Difference between an interface and an abstract class
25 Explain the syntax and working of for loop in Java with example

26 Create a web page using table in HTML

(3 x 6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27 Explain multilevel inheritance in java with example

28 Describe the concepts in generic method

29 Explain exception handling in Java

30 How a form validation is carried out in Javascript (2 x 10=20)

B. Sc. BIOINFORMATICS (UGCBCS) DEGREE EXAMINATION

(For B.Sc. Bioinformatics)

Sixth semester

MOLECULAR MODELING AND DRUG DESIGNING

Time: 3 Hrs **Maximum Marks :80**

Part A (Answer any 9 questions each carries 2 mark)

1. What are the two major types of Drug design?
2. Name two Molecular Modeling softwares?
3. Name two Molecular Visualisation tool?
4. Expand the term DFT
5. Define ADME
6. Expand Metabolites.
7. Describe Force Field.
8. What do you meant by Energy Minimisation.
9. Define Blast ?
10. Explain dynamic programming?
11. What is Cartesian coordinates and Internal Cordinates
12. What is Born oppenheimer approximation

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Discuss the stages in Drug discovery
14. Describe Internal energy
15. What is Molecular graphics
16. Define local and Global minima
17. Describe Auto docking tools
18. Define surfaces with diagrams.
19. What are the units of Length and Energy .
20. Explain RASMOL?
21. What is biological data base?

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Describe Molecular modeling Softwares.
23. Describe the structural based drug design.
24. Discuss Drug-Receptor Interaction.
25. Describe abintio method.
26. What are the limitations of secondary structure prediction.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Define Homology Modeling? Discuss the main steps in Homology based Modeling?

28. Explain a) Molecular Mechanics b) Molecular dynamics
29. What is QSAR? How does it help to predict activity for new Compounds ? What are the applications of QSAR ?
30. What are the basic concepts of molecular modeling and its implications?

(2 x 10 = 20)

B.SC. DEGREE (UGCBCS) EXAMINATION, 2016
Sixth Semester

APPLIED BIOINFORMATICS
(For B.Sc. Bioinformatics)

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

1. What is Trips agreement ?
2. Types of IPR.
3. Define Tradesecret.
4. Geographical indications.
5. What is domain names?
6. Gene and genome.
7. Genotype and phenotype.
8. Define gene therapy.
9. Vectors.
10. Restriction endonuclease.
11. Explain patents in IPR.
12. Briefly describe trademarks.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Technical report writing.
14. What is DNA computing? Explain Directed Hamiltonian Path problem.
15. Explain Software copyright and infringement.
16. What is research? Type of research.
17. Explain cultural anthropology.
18. What is bioinformatics and lifeform patenting
19. Applicaions of genetic engneering.
20. Mendel law of inheritance.
21. Explain biosensors and its applications.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Differentiate Biocomputer and Biochips.
23. Explain the techniques involved in advanced internet searching.
24. What is anthropolgy?Types of anthropology?
25. Explain the structure of a professional dissertation.
26. Write a short note on agriculture and challenges.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Over view of Pharmaceutical indrustry in india.
28. Applications of bioinformatics in biodiversity.
29. Explains genetic engineering.
30. Describe Future aspects of biotechnology.

(2 x 10 = 20)

B.SC. DEGREE (UGCBCS) EXAMINATION
Sixth Semester
ALGORITHMS, DATA STRUCTURES AND COMPILER

Time:3 hrs Total Marks:80

Part A (Answer any 9 questions each carries 2 mark)

1. What is a compiler?
2. Define stack.
3. Define linked list.
4. Define algorithm.
5. Define array.
6. What is the use of interpreter?
7. Different operation on data structure.
8. Define time complexity and space complexity of an algorithm.
9. Define queue.
10. Define omega notation.
11. What is binary tree?
12. Define linear arrays with example.

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Explain the asymptotic notations for complexity of algorithms.
14. Representation of linear arrays in memory.
15. Write an algorithm for traversing on linear arrays?
16. Find the complexity of linear search algorithm?
17. Arrays representation of stack.
18. Define lexical analyzer.
19. Different methods for traversing binary trees.
20. Define binary search tree.
21. Difference between stack and queue.

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Define finite automata with example.
23. Different phases of compilation.
24. Explain different data structures.
25. Write the Algorithm for stack operations.
26. Write the basic operations in queue with algorithm (3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain with algorithm and examples
    a) Depth first search
    b) Breadth first search
28. Transforming infix expression into postfix expression using an algorithm and example.
29. Explain Quick sort with algorithm and example.
30. Explain multistage graph with algorithm and example.

(2 x 10 = 20)

B.SC. DEGREE (UGCBCS) MODEL EXAMINATION
Sixth semester
DATABASE CONCEPTS &PHP

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

Explain the following

1. DML
2. Primary Key
3. Attributes
4. Group by clause
5. IN operator in SQL
6. aggregate functions
7. PL/SQL
8. Exceptions
9. PHP
10. PHP Strings
11. MySQL
12. Database connection

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Explain Three views of DATA
14. Explain Data Independence
15. Explain String functions in SQL
16. Explain with example pattern matching in SQL
17. Explain conditional statements in PL/SQL
18. Explain Iterative statements in PL/SQL with example.
19. Discuss the use of arrays in PHP
20. Explain create table commands using PHP
21. Explain Loop statements using PHP

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Explain the advantages of databases.
23. Describe basic SQL queries with examples.
24. Explain the advantages of PL/SQL

25. Explain data types and basic syntax of PHP.
26. Explain how to connect to MySQL database using PHP with program code.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain Normalizations in database .
28. Explain SQL queries & subquery creation in SQL
29. Explain with example concepts of Trigger in PL/SQL
30. Explain with example and code PHP form handling.

B.SC. DEGREE (UGCBCS) EXAMINATION, 2016
Sixth Semester
Genetic engineering & IPR

Time: 3 Hours Total Marks: 80

Part A (Answer any 9 questions each carries 2 mark)

Explain the following terms:

1. Gene transfer
2. PEG
3. electrophoresis
4. Ligases
5. PCR
6. DNA cloning
7. Plasmids
8. Linkers
9. ELISA
10. microassays
11. Royalty
12. Patent

(9 x 2 = 18)

Part B (Answer any 6 questions each carries 4 mark)

13. Explain the Milestones in Genetic Engineering .
14. Explain different gene transfer techniques
15. Explain the role of Restriction endonucleases
16. Explain the ways of amplifying DNA.
17. Explain Gene cloning techniques
18. Explain the use of cDNA.
19. What are hybridization assays
20. Explain antibody production
21. What is a Patent document?

(6 x 4 = 24)

Part C (Answer any 3 questions each carries 6 mark)

22. Explain the Preparation of total cellular DNA

23. Explain joining and modifying of DNA.
24. Explain Cloning mRNA enrichment.
25. Explain ELISA techniques.
26. Explain need for IPR.

(3 x6 = 18)

Part D (Answer any 2 questions each carries 10 mark)

27. Explain different methods of gene transfer techniques in plants and animals
28. Explain PCR techniques and its application.
29. Explain Nucleic acid microarray arrays and its applications
30. Explain different Intellectual property rights and patent law

(2 x 10 = 20)