M.Sc. BIOINFORMATICS

PROGRAM STRUCTURE AND SYLLABUS
2019-20 ADMISSIONS ONWARDS

(UNDER MAHATMA GANDHI UNIVERSITY PGCSS REGULATIONS 2019)

MAHATMA GANDHI UNIVERSITY

2019

EXPERT COMMITTEE IN BIOTECHNOLOGY (PG)

Chairperson:

Dr. Indu C Nair,

Assistant Professor in Biotechnology

Department of Biotechnology

SAS SNDP Yogam College, Konni

Members:

1. Dr Nisha Raj S

Assistant Professor

Department of Biotechnology

SAS SNDP Yogam College, Konni

2.Dr. Umesh BT

Assistant Professor in Biotechnology

Department of Biotechnology

MES College, Marampally

3. Dr Ally C Antony

Assistant Professor of Biotechnology

Department of Biotechnology

MES College, Marampally

4. Dr Sona A

Assistant Professor in Biochemistry

Department of Biotechnology

SAS SNDP Yogam College, Konni

5.Smt. Reenamol . S

Assistant Professor in Biotechnology

Department of Biotechnology

6. Sri. Roshan K V Ramesh

Assistant Professor in Biotechnology

Department of Biotechnology

5. Mr Shyam Mohan

Assistant Professor of Bioinformatics

Department of Bioinformatics

UC College, Aluva

6. Mr Stephan James

Assistant Professor of bioinformatics

Department of Biosciences

MACFAST, Thiruvalla.

Table of Contents

M.Sc. BIOINFORMATICS

(Mahatma Gandhi University Regulations PGCSS2019 from 2019-20 AcademicYear)

1. **Aim of the Program**

   To enable the students to apply the principles of biotechnology for the development of Science and society.

2. **Eligibility for Admission**

   Any student who has bachelor's degree in Biochemistry, Biophysics, Biotechnology, Plant Biotechnology, Bioinformatics, Botany, Zoology/Plant Biology/Chemistry/Computer Science, Computer Application, Electronics, Environmental Science, Mathematics, Microbiology, Physics, Statistics or Life Science stream with a minimum of 50 % marks in aggregate from a recognized University or Part III Core Group (Core + Complementary + Open Courses) with not less than CGPA of 2.00 out of 4, can apply for the M. Sc Bioinformatics Program.

3. **Medium of Instruction and Assessment**

Course of study will be over a period of two academic years under semester system

a. Scheme of examination

The examinations for the award of degree consist of theory and practical papers, dissertation and comprehensive viva-voce. There will be examinations at end of each semester for theory and practical courses. Each semester consists of four theory papers and one practical examination for the first three semesters. The fourth semester has project presentation and evaluation and comprehensive viva-voce in addition to one practical examination and three theory papers which are exclusively based on elective courses.

b. Dissertation

Each candidate should submit a dissertation in four copies of the research project undertaken by him/her at the end of fourth semester for evaluation.

c. Comprehensive viva-voce

A comprehensive viva-voce will be held at the end of the fourth semester covering all the courses of the Programme taught in the entire four semesters.

4. **Faculty under which the Degree is Awarded**

   M.Sc. Bioinformatics is offered in Faculty of Science

5. **Specializations offered, if any**

   Nil

6. Note on compliance with the UGC Minimum Standards for the conduct and award of Post Graduate Degrees : The syllabus is in compliance with the minimum standard for the conduct and award of Post graduate degrees.
7. **Duration of the Course:** The duration of the course is **2 years**. First year consists of I and II semesters. Second year consists of III and IV years.

8. **Programme Outcome:**

- **PO1.** Nurturing novel ideas and meaningful insights through scientific thinking.
- **PO2.** Enabling critical analysis of problems and situations to reach solutions.
- **PO3.** Development of communication skills to present scientific data in oral and written formats.
- **PO4.** Providing a platform for individual and collective work.
- **PO5**. Understanding the significance of sustainable scientific processes to support the environment.

9. **Programme Specific Outcome:**

- **PSO1.** The programme aims to utilize and understand biological databases
- **PSO 2.** Gathering, storage, analysis and integration of biological data for generating new knowledge.
- **PSO3**. Developing and implementing computational algorithms and software for the better understanding of dynamic biological processes
- **PSO4.** Understanding the biological processes at molecular level.
- **PSO5.** To know the ethical practices in bioinformatics and related fields.

7. PROGRAMME STRUCTURE

Course Code	Title of the Course	Type of the Course	Hours per week	Credits	Total Credits
FIRST SEMESTER					
BT010101	Fundamentals Of Cell Biology And Biochemistry	Theory	4	4	19
BT010102	Introduction To Genetics And Molecular Biology	Theory	4	4	
BT010103	Fundamentals Of Applied Mathematics And Biostatistics	Theory	3	3	
BT010104	Introduction To Computing And Bioinformatics	Theory	4	4	
BT010105	Laboratory course I	Practical	10	4	
SECOND SEMESTER					
BT010201	Metabolism & Enzymology	Theory	4	4	19
BT010202	General Microbiology	Theory	4	4	
BT010203	Genomics	Theory	3	3	
BT010204	Bioinformatics & Perl	Theory	4	4	
BT010205	Laboratory course II	Practical	10	4	
THIRD SEMESTER					
BT010301	Immunology	Theory	4	4	19
BT010302	Proteomics & CADD	Theory	4	4	
BT010303	Database Concepts & Biological Databases	Theory	3	3	
BT010304	Advanced Bioinformatics & Linux Operating System	Theory	4	4	
BT010305	Laboratory course III	Practical	10	4	

Course Code	Title of the Course		Type of the Course	Hours per week	Credits	Total Credits
FOURTH SEMESTER						
BT800401	Electives Group A	Genetic engineering & IPR	Elective	5	4	23
BT800402		Bio programming	Elective	5	4	
BT800403		Data Mining in Bioinformatics	Elective	5	4	
BT810401	Electives Group B	Java programming	Elective	5	4	
BT810402		Advanced genomics	Elective	5	4	
BT810403		Research Methodology & Scientific Writing	Elective	5	4	
BT820401	Electives Group C	Basics of Nanotechnology	Elective	5	4	
BT820402		Pharmaceutical chemistry & action of Selected drugs	Elective	5	4	
BT820403		Bioinformatics data analysis	Elective	5	4	
BT010401	Laboratory course IV		Practical	10	4	
BT010402	Research Project & dissertation				5	
BT010403	Comprehensive Viva-Voce				2	

PATTERN OF QUESTIONS

a)The question shall be prepared in such a way that the answers can be awarded A+, A, B, C, D, E grades.

b). Weight : Different types of questions shall be given different weights to quantify their range as follows:

c) Maximum weight for external evaluation is **30.**Therefore Maximum Weighted Grade Point (WGP) is **150**

Sl.No.	Type of Questions	Weight	Number of questions to be answered
1.	Short Answer type questions	1	8 out of 10
2	Short essay/ problem solving type questions	2	6 out of 8
3.	Long Essay type questions	5	2 out of 4

DIRECT GRADING SYSTEM

Direct Grading System based on a 7 – point scale is used to evaluate the performance (External and Internal Examination of students)

For all courses (theory & practical) / semester/overall programme Letter grades and **GPA/SGPA/CGPA** are given on the following scale :

Range	Grade	Indicator
4.50 to 5.00	**A+**	**Outstanding**
4.00 to 4.49	**A**	**Excellent**
3.50 to 3.99	**B+**	**Very good**
3.00 to 3.49	**B**	**Good(Average)**
2.50 to 2.99	**C+**	**Fair**
2.00 to 2.49	**C**	**Marginal**
up to 1.99	**D**	**Deficient(Fail)**

1. Evaluation first stage - Both internal and external (to be done by the teacher)

Grade	Grade Points
A+	5
A	4
B	3
C	2
D	1
E	0

FIRST SEMESTER					
BT010101	Fundamentals Of Cell Biology And Biochemistry	Theory	4	4	19
BT010102	Introduction To Genetics And Molecular Biology	Theory	4	4	
BT010103	Fundamentals Of Applied Mathematics And Biostatistics	Theory	3	3	
BT010104	Introduction To Computing And Bioinformatics	Theory	4	4	
BT010105	Laboratory course I	Practical	10	4	

SEMESTER 1

BT010101 FUNDAMENTALS OF CELL BIOLOGY AND BIOCHEMISTRY

Objective:

- To introduce the fundamental concepts of Cell Biology & Biochemistry
- To integrate fundamental concepts of cell biology and biochemistry and relate the molecular mechanism with Bioinformatics
- To introduce research concepts in Cell Biology & Biochemistry

Module – 1 (15 hrs)

An overview on the origin of life. Prokaryotic & Eukaryotic Cells. Detailed study on the structural organization and function of intra cellular organelles in eukaryotes. Cytoskeleton and proteins of Extra Cellular matrix.Cell Cycle and Cell Division; Mitosis and Meosis, Cell Death and Apoptosis. Cell Signaling; Principles and Pathways

Cancer: Critical genes involved in cancer and their pathways

Module – II (15 hrs)

An overview on the structure, chemistry and function of:-

Carbohydrates; Monosaccharides, Disaccharides, Polysaccharides, Glycosaminoglycans, Proteoglycans, Glycolipids and Glycoproteins.

Lipids; Classification and function of storage and membrane lipids .

Nucleic acids: Nucleotides as building molecules of DNA and RNA; Biochemical aspects, structure and function.

Module – III

Shape and structure of Proteins(15 hrs)

Levels of Protein Structure. (Primary, Secondary, Tertiary & Quarternary)

Classification of amino acids.Letter codes for Amino acids, Helix, sheets, strand, Loops, turns, Motifs, Leucine zipper, Zinc finger, Helix Turn Helix, Helix Loop Helix, Blocks, Class ,Domains and Subunits. Ramachandran Plot.Globular and Fibrous Proteins with examples. Fine structure of Myoglobin and Hemoglobin

Module – IV (15 hrs)

An overview on Structural Modules, Chemistry and Function of Plant Hormones

An overview on Structural Modules, Chemistry and Function of Animal Hormones

Module – V (12 hrs)

An overview on Structural Modules, Chemistry and Function of Neurotransmitters

An overview on Structural Modules, Chemistry and Function of Vitamins

References

1. Lehninger Principles of Biochemistry, Fourth Edition by David L. Nelson Michael M. CoxPublisher: W. H. Freeman; Fourth Edition edition (April 23, 2004) ISBN-10: 0716743396 ISBN-13: 978-0716743392
2. **A Text Book of Biochemistry**, **E.S. West, W.R. Todd, H.S. Mason and J.T. van Bruggen**Oxford and IBH Publishing Co., New Delhi, 1974
3. Biochemistry (2004) by Donald Voet, Judith G. Voet **Publisher:** John Wiley & Sons Inc **ISBN:** 047119350X **ISBN-13:** 9780471193500, 978-0471193500
4. Principles Of Biochemistry (1995) by Geoffrey L Zubay, William W Parson, Dennis E Vance **Publisher:** McGraw-hill Book Company – Koga **ISBN:**0697142752 **ISBN-13:** 9780697142757, 978-0697142757
5. Principles Of Biochemistry, 4/e (2006) by Robert Horton H , Laurence A Moran, Gray Scrimgeour K **Publisher:** Pearson**ISBN:** 0131977369, **ISBN-13:**9780131977365, 978-0131977365
6. Biochemistry 6th Edition (2007) by Jeremy M.berg John L.tymoczko Lubert Stryer **Publisher:** B.i.publicationsPvt.Ltd **ISBN:**071676766X **ISBN-13:** 9780716767664, 978-716767664
7. Fundamentals of Biochemistry by J. L. Jain, Sunjay Jain and Nitin Jain (2008) Publishers: S. Chand & Co Ltd ISBN: 81-219-245.
8. Cell and Molecular Biology by Gerald Karp, Academic Press.
9. Cell and Molecular Biology Cooper, Hausman, ASM Press.
10. World of the Cell , Becker, Reece, Poenie, The Benjamin/Cumming's Pub.
11. Cell Biology , Lodish et al, W H Freeman and Co.,NewYork.
12. Cell Biology , Thomas D Pollard and W.C.Earnshaw, Saunder's Publishers

BT010102 INTRODUCTION TO GENETICS AND MOLECULAR BIOLOGY

Objective:

- To introduce the basics of Genetics & Molecular Biology
- To relate the basic knowledge in Genetics & Molecular Biology and see how it can be applied through Bioinformatics perspective.
- To introduce the scope of Genetics & Molecular Biology in frontiers of Life Science Research

Module – 1 – Genetics,Heredity and Variation (15 hrs)

Mendelism – Experiments in Garden Pea, Monohybrid & Dihybrid Crosses, Dominance, Segregation and Independent Assortment. Concept of Gene – Alleles, Multiple Alleles, Gene

Interactions, Epistasis, Pleiotropy. Complementation Tests. Linkage, Crossing over and chromosome maps, chromosome theory of Inheritance. Maternal effects and Cytoplasmic inheritance.

Module – II (10 hrs)

Genomic Organization in Prokaryotes and Eukaryotes. Chromosome and Chromatin Structure, Structural and Numerical alterations of Chromosomes.

Gene Mutations and their molecular basis

Module – III (15 hrs)

DNA as genetic material, Watson – Crick Model, DNA Polymorphism, DNA Super Coiling Functions of DNA and Experiments Proving genetic material is stored in DNA.

DNA replication in Prokaryotes and Eukaryotes DNA replication in λphage and ϕ X174 (Rolling Circle Replication) DNA damage and DNA repair, DNA recombination.

Mechanisms of Transposition in eukaryotes and Viruses with specific examples.

Module – IV(15 hrs)

Expression of the Genome, Transcription in Prokaryotes and Post transcriptional processing in Prokaryotes.Transcription and post-transcriptional processing in Eukaryotes .Structural and functional aspects of Genetic Code, Mechanism of Translation: Protein Synthesis and Post – Translational Modifications

Module – V (17 hrs)

Regulation of Gene Expression

Molecular mechanism of gene regulation in prokaryotes-Transcriptional regulation in prokaryotes; Inducible & repressible system,+ & -ve regulation; Operon concept, structure of operon, Lac, Trp, Ara operon, Catabolite repression, Atteunation. Multiple levels of eukaryotic gene regulation: Histone acetylation and deacetylases, methylation and demethylation, chromosome remodeling complex.

RNA Interference, Antisense RNA, SiRNA, MicroRNA, Ribozwitches & their applications; Telomerase structure and function.

References

1. Gardener E : Principles of Genetics
2. Gupta P.K : Cytology, Genetics and Evolution
3. Snustad and Simmons : Principles of Genetics.
4. Introduction to Genetic Analysis Eighth Edition, Griffiths, Wessler
5. Genes VIII : Lewin
6. Klug, Cummings : Concepts of Genetics
7. Molecular Biology of the Gene : James D.Watson

8. Robert F.Weaver : Molecular Biology
9. Gupta P.K : Cell and Molecular Biology
10. Molecular Biology of the Cell ; Sixth Edition

BT010103 FUNDAMENTALS OF APPLIED MATHEMATICS AND BIOSTATISTICS

Objective:

- To introduce the basic Mathematical concepts & Statistics
- To apply the mathematical and statistical concepts in developing bioinformatics tools applied in life science research.
- To apply mathematical and statistical logic in programming languages aiding life science research.

Module I – Sets (10 hrs)

Set Theory, Sets : Relations and Functions, Counting and Operation. Definition of Sets and Subsets, Combination, Demorgan's Laws.Factorial, Permutation, Binomial Coefficients and Mathematical Induction

Module II – Probability (11 hrs)

Laws of Probability : Probability Events, Addition and Multiplication Theorem Conditional Probability : Bayis Theorem, Random Variables : Probability Distribution, Binomial, Poisson, Normal, 't' etc. Sampling: Process : Probability Vectors, Stochastic matrices, Matrix chains.

Module – III – Vectors & Matrices (15 hrs)

Vectors: Scalars & Vectors;Addition, Subtraction, Dot, Cross and Scalar Triple Products.Matrices : Types, Addition, Subtraction, Multiplication Transpose & Inverse, Determinants, Solutions of Simultaneous equations using matrices, Transformation Matrices For Scaling, Translation, Rotation, Reflection etc.

Module – IV – Introduction to Graph Theory (7 hrs)

Basic Terminology Directed and Undirected Graphs, Vertices and Edges, Subgraphs, Isomorphism, Correctedness, Components, Weighted Graphs, Shortest paths in Weighted Graphs, Eulerian paths and Circuits, necessary and sufficient conditions

Hamiltonian Paths – Sufficient conditions Bipartite Graphs, Planar Graphs.

Module – V – Introduction to Biostatistics (11 hrs)

Collection, Classification & Diagrammatic Representation of Statistical Data, Frequency and Frequency Distribution. Measures of Central Tendency: Mean, median, mode, geometric

mean, harmonic mean, Percentile Measures of Dispersion : Range, Mean deviation, Variance & Standard Deviation.Regression & Correlation**.** Chi-Square Test and Students T-test**.**ANOVA and other statistical Packages.

References

1. Ch.Liue : Elements of Discrete Mathematics
2. Harara F : Graph Theory
3. Briley N.J.T : Statistical Methods in Biology
4. Sokal R.R., Rohl E.J : Introduction to Biostatistics
5. Jenny Olive, Maths – A Self Study Guide, Cambridge University Press.
6. Alexander Isacev-Introduction to Mathematical Methods in Bioinformatics, Springer.
7. Sundar Rao & Richard-An Introduction to Biostatistics PH1, 3e.
8. Lipschutz-Theory & Problem of Probability : Schaum's Outline' Series, Tata McGraw Hill.
9. Biostatistics PN Arora and P K Malhan Himalaya Pub

BT010104 INTRODUCTION TO COMPUTING AND BIOINFORMATICS

Objective:

- To introduce basics of working of a Computer in the modern era
- To teach basic programming languages and develop logic
- To introduce Bioinformatics, its scope, importance and outreach

Module I – Computer Basics and Networking (15 hrs)

Introduction : Characteristics of Computer Systems; Functions and Components of Computer; Memory Modules; Computer Software's .Operating Systems Functions, DBMS, Programming Languages. Mobile Technologies – Android & Other Operating Systems. Networks: Introduction; Network Classification LAN, WAN, MAN

Module – II – Introduction to Bioinformatics (8 hrs)

Bioinformatics- Definitions and brief history.Bioinformatics vs. Computational Biology; Scope / Research Areas of Bioinformatics. Nature of biological data, introduction to biological databases. Pharmaceutical, R&D and Bioinformatics industries and Institutions in India & the World. Case study on job profiles of a bioinformatician.

Module – III – Introduction to HTML, CSS & Javascript(15 hrs)

Introduction to HTML: HTML tags for formatting text, pictures, audio, forms, tables Introduction to CSS. Introduction to Javascript

Module – IV – Overview of C Programming: (17 hrs)

Introduction & Basic Structure of C Programs, Constants,Variables & Data types

Operators and Expressions; Managing I/P and O/P Operators. Decision making and Branching Decision making and Looping arrays.

Module – V

Strings, Functions, Structures & Files in C(17 hrs)

Strings;Handling of Character Strings; User defined Functions – Introduction, A Form of C Functions, Return Values and their types, Category of Functions, recursion. Structures : Introduction, Structure : Definition, Giving Values to members, Structure Initilization, Comparision of Structure Variables, Arrays of Structure Variables, arrays of Structures, union, Pointers. Introduction to FILE Concept in C Language.

References

1. Alexis Leon & Mathews Leon – Fundamentals of IT
2. E.Balaguruswamy – Programming in ANSI C
4. Barbara Wilson – Information Technology : The Basics
5. L.N.Charli – Bioinformatics and Bioprogramming in C
6. Wibas C, Jenbeck P – Developing Bioinformatics Computer Skills

BT010105 LABORATORY COURSE 1

I. Identification of Carbohydrates, Proteins and Lipids by Qualitative Analysis (Colour Reactions)

- ∗ Identification of mixtures - Carbohydrates and Proteins
- ∗ Carbohydrates - Monosaccharides, Disaccharides and Polysaccharide
- ∗ Lipids - Cholesterol
- ∗ Proteins - Albumin, Casein, Peptone

II. Quantitative Analysis of Biomolecules

a) Glucose - Anthrone Method
b) Protein - Biuret method
c) Cholesterol - Zak's method
d) DNA - Diphenyl Amine Method

III. Webpage creation using HTML & CSS

IV. C programs to represent

a. Basic Variable usage & I/O
b. Decision Making
c. Loops & Branching

d. Array Operations
e. String Manipulations
f. File Operations
g. Usage of Structures

V. Introduction to Primary Sequence Databases & PDB

SECOND SEMESTER					
BT010201	Metabolism & Enzymology	Theory	4	4	19
BT010202	General Microbiology	Theory	4	4	
BT010203	Genomics	Theory	3	3	
BT010204	Bioinformatics & Perl	Theory	4	4	
BT010205	Laboratory course II	Practical	10	4	

SEMESTER 2

BT010201 METABOLISM & ENZYMOLOGY

Objective:

- To introduce concepts of Metabolism & Enzymology
- To enable to utilize understanding concepts in Metabolism & Enzymology in Bioinformatics.
- To introduce thrust areas of research in Metabolism & Enzymology.

Module-I – Metabolism of Carbohydrates (15 hrs)

Digestion and Absorption of Carbohydrates. Degradation and Regulation of Carbohydrates.Glycolysis and Citric Acid Cycle and Bioenergetics

Glycogen Metabolism and Hormonal Regulation. Biosynthesis pathway of Gluconeogenesis. Pentose Phosphate Pathway.

Module – II Bioenergetics (15 hrs)

Concept of Chemical Energy, Free Energy, ATP as currency of energy. Hydrolysis of ATP and other high energy molecules. Substrate level phosphorylation and Oxidative Phosphorylation. Transducing membrane structure in Mitochondria. Mitochondrial Respiratory Chain. Oxidation Reduction Potential, Electron transport chain, and electron transfer complexes. Dependence of oxidative phosphorylation on electron transfer, Synthesis of ATP.Photosynthesis : An overview; Chloroplasts, Reaction Centres, Cyclic and Non Cyclic photophosphorylation, Calvin Cycle.

Module-III – Metabolism of Lipids (15 hrs)

Digestion & Absorption of Lipids. Degradation and Regulation of Lipids Beta-oxidation Pathway. Fatty acid Biosynthesis, Biosynthesis of Membrane Lipids and sterols – Phosphatidate.Metabolism of Cholesterol; Biosynthesis and regulation of Cholesterol biosynthesis. Derivatives of Cholesterol.Ketone bodies and their formation.

Module – IV

Nucleotide Metabolism (15 hrs)

Nucleotide biosynthesis; De Novo Pathway and Salvage Pathway. Catabolism of Purines and Pyrimidines ; Formation of Uric acid.

Module-V

Amino acid metabolism and Enzymology (12 hrs)

Digestion and Absorption of Dietary Proteins.

Aminoacid Metabolism; Transamination, Oxidative deamination and Decarboxylation and Urea Cycle. Biosynthesis of aminoacids, Glucogenic and Ketogenic pathways. Inborn Errors of Metabolism. Enzymology;Nature, properties , classification and nomenclature of enzymes

Active site and its prediction. Active site mapping. Enzyme Kinetics, Enzyme Inhibition and Enzyme Regulation

References:

1. Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins by Nicholas C. Price, Lewis Stevens, and Lewis Stevens (2000) Publisher:Oxford University Press, USA ISBN:019850229X ISBN-13: 9780198502296, 978-0198502296
2. Enzyme Kinetics and Mechanisms by Taylor Publisher:SpringISBN:8184890478 ISBN-13:9788184890471, 978-8184890471
3. Biochemistry (2004) by Donald Voet, Judith G. Voet **Publisher:** John Wiley & Sons
4. Enzyme Mechanism by P.K. Shivraj Kumar (2007) Publisher:RBSA Publishers ISBN:8176114235 ISBN-13: 9788176114233, 978-8176114233
5. Biochemistry 6th Edition (2007) by Jeremy M.Berg John L.tymoczko Lubert Stryer **Publisher:** B.i.publicationsPvt.Ltd **ISBN:**071676766X **ISBN-13:** 9780716767664, 978-716767
6. Principles Of Biochemistry, 4/e (2006) by Robert Horton H , Laurence A Moran, Gray Scrimgeour K **Publisher:** Pearson**ISBN:** 0131977369, **ISBN-13:**9780131977365, 978-0131977365
7. Enzymes: Biochemistry, Biotechnology, Clinical Chemistry (second Edition) by Trevor Palmer, Philip Bonner (2007) Publisher:Horwood Publishing Limited ISBN:1904275273ISBN-13:9781904275275,978-1904275275
8. Lehninger Principles of Biochemistry, Fourth Edition by David L. Nelson Michael M. Cox Publisher: W. H. Freeman; Fourth Edition edition (April 23, 2004) ISBN-10: 0716743396 ISBN-13: 978-0716743392

BT010202 GENERAL MICROBIOLOGY

Objective :

- To introduce the concepts of Microbiology
- To introduce the research areas in Microbiology and see how they can be manipulated using Bioinformatics.
- To introduce pathogenic microorganisms, their modes of infection, diagnosis and care.
- To introduce basic concepts of gene cloning.

Module – I (10 hrs)

Principles of Bacterial Taxonomy and Identification of Bacteria.Ultra Structures of Yeast and Ultra Structure of Bacterial Cells. History of Microbiology. Five Kingdom Classification of Living System. Study of Microbial morphology

Microscopy, Specimen Preparation and Staining Methods

Module – II (10 hrs)

Transport & Storage of Microbes and impact of environmental parameters on growth of microorganisms. Microbial Physiology, Factors determining microbial growth. Nutrition, Growth curve, Growth Kinetics, Microbial metabolism.Culture media and methods cultivation of bacteria.

Module – III (10 hrs)

Sterilization principles and Techniques .Mechanism of action of Antibiotics and methods of testing antimicrobial substances Drug Resistance in Bacteria.

Module – IV(12 hrs)

Medically significant Bacteria; Prominent examples and their study:Staphylococcus, Coryne bacterium, Bacillus anthracis, Mycobacterium, Mycoplasma.Features and classification of Viruses.Medically significant viruses; Prominent examples and their study:Herpes, Oncogenic viruses, HIV, Arboviruses, Myxovirus Bacteriophage Lambda : Life Cycle : Lysogeny and Lytic pathway.

Module V (12 hrs)

Recombinant DNA Technology, Techniques of Gene Manipulation and Enzymes involved.Vectors- Plasmids and Phages, Artificial vectors –Cosmids, Phasmids, Fosmids, and Expression vectors, vectors used in Genome Sequencing strategies. Methods of Gene Transfer; Transformation,Transfection and Invitro packaging Identification of recombinant DNA, Selection of transformants. Applications of rDNA Technology

References:

1. Russel A.D : Principles and Practice of Disinfection Preservation and steriolization.
2. Bryan L.E : Antimicrobial Drug Resistance
3. Pelczar Jr Chan, Kreig : Microbiology concepts and applications
4. Prescott Harley & Klein : Microbiology
5. Ananthanarayanan & Jayaram Panicker : Textbook of Microbiology
6. Kucera and Myrvik : Fundamentals of Medical Virology.
7. Mackie and McCartney : Medical Microbiology

8. Kreig N.R., Williams and Wilkins : Bergey's Manual of Systematic Bacteriology.
9. Principles of gene manipulation – Old and Primrose, Blackwell Scietific publishers, Edns 5th , 6th and 7th.
10. Molecular Biotechnology – Glick and Pasternac
11. Gene cloning :An Introduction, T A Brown, Chapman and Hall

BT010203 GENOMICS

Objective :

- To introduce the concept of genome and its classification.
- To effectively understand the nature and sequences of genome.
- To devise and extrapolate understanding of genomic data into analytical knowledge.

Module – 1 – Sequence Architecture of Genomes (12 hrs)

Organization of genome : Single sequence DNA, GC content, Intermediate repeat DNA, Highly repetitive DNA, CpGislands , Gene Families, Pseudogenes, Duplicated genes, SNPs, STS, Tandemly repeated genes. Non protein Coding genes, Split genes, Overlapping genes, Spacer regions, ORF's Cryptic genes. Multigene Families in Eukaryotes, LINE's, SINE's, Transposons and Retrotransposons, Microsatellites and Minisatellites RAPD,RFLP & Other molecular markers DNA Fingerprinting & DNA Foot printing.

Module II – Genome maps (12 hrs)

Physical Maps – Clone Maps, RH Maps, EST's, STS Maps, FISH (Fluroscent Insitu Hybridization) **.**Genetic Maps – Map Modules, Informative and Non informative phases, Haplotype, CEPH Families, LOD – Score Analysis.

Module – III – Sequencing the Human Genome (15 hrs)

History of sequencing, Early Strategies for sequencing. Sanger's sequencing (Automated whole Genome shotgun sequencing), Next generation sequencing techniques, Introduction to NGS data analysis. Human Genome Project: Timeline, Methods, Outcome, Applications, Advantages and Ethical issues. Making the Clone Map: Generating, Assembling and Finishing the sequence.

Module-IV –Comparative Genomics. (15 hrs)

Annotating genomes: Gene prediction in Prokaryotes and Eukaryotes, ORF prediction

Functional annotation: sequence based and structure based annotation.Comparative Genomics – Purpose and Methods of Comparison. Applications of comparative Genomics, Case studies on target prediction using Comparative genomics.

References:

1. Genomes 3 : T.A.Brown
2. Human Molecular Genetics 2nd Edition : Peter Sudbury
3. Sequence and Genome Analysis : David.W Mount
4. A.Malcolm Campbell, Laurie J.Heyer : Discovering Genomics, Proteomics and Bioinformatics
5. Bioinformatics: A Laboratory guide to the Analysis of Genes and Proteins : Andreas DBaxevanis, B.F.Francis Ouelette.
6. Genomics and Cloning; Technology & Applications H.D.Kumar
7. Microarray Bioinformatics : Dov Stekel
8. Data Analysis and Visualization in Genomics and Proteomics : Azuaje

BT010204 BIOINFORMATICS & PERL

Objective:

To make the students understand:

- the basic methodology in Bioinformatics
- The programming languages PERL & BIOPERL for beginners in Bioinformatics.
- The utilization of bioinformatics tools and databases for retrieving, analyzing, understanding and managing biological data.

Module I Biological sequence Analysis (17 hrs)

Concept of sequence Alignment, Scoring matrices: PAM &BLOSUM; Alignment of Pairs of sequences: Dot Plot. Alignment Algorithms-Needleman and Wunsch Algorithm, Smith Waterman Algorithm**.** Search for Homologous sequences using BLAST & FASTA programs**.** Multiple Sequence Alignment: Dynamic Programming and progressive alignment. Tools: Clustal, T-Coffee, Mega

Module II Evolutionary Analysis and Molecular Phylogeny: (15 hrs)

Concept of Molecular Phylogeny, Representation of Phylogeny, Types of trees, Molecular clock Hypothesis, Distance based methods-UPGMA and NJ Algorithm. Character based methods: Maximum Parsimony and Maximum likelihood; validating trees, Boot strapping and Jack knifing. Study of Phylogenetic software-PHYLIP,PAUP, Tree viewing software.

Module III PERL(17 hrs)

Introduction to PERL, Variable Types, Data types, operators, control structures, lists and Arrays, Subroutines, Hash functions, other useful functions, Regular expressions. Basic Input output, special variable @ ARGV, Command live Args, File Handles and Tests. Directory Operations, PERL graphics, PERL DBI module.

Module IV CGI Programming (13 hrs)

Introduction to CGI Programming: Using GET and Post Methods;Passing information using GET & POST methods. CGI Modules & Libraries, Cookies in CGI.

Module V BIOPERL(10 hrs)

Introduction to BIO-PERL, BIO-PERL objects. Implementation of Bioinformatics algorithms for searching and matching in PERL. BLAST parsing, handling PDB files, sequence retrieval, alignments.

References

1. C.A.Orango, D.T. Jones and J.M.Thornton-Bioinformatics –Genes Proteins and computers
2. Andreas D. Baxevaris Bioinformatics A Laboratory Guide to the Analysis of Genes and Proteins
3. Zhumur Ghosh & Mallick Bioinformatics Principles and Applications
4. Jeremy J. Ramsden –Bioinformatics: An Introduction
5. D.Maunt Bioinformatics sequence & Genome Analysis
6. James D Tisdall- Mastering Perl for Bioinformatics
7. Wall, Christian & Orwant- Programming Perl
8. Harshawardhan P.Bal - Perl Programming for Bioinformatics
9. Ingvar Eidhammer, Inge Jonassen and William R Taylor - Protein Bioinformatics:An Algorithmic Approach to sequence and structure Analysis.

BT010205 LABORATORY COURSE II

I Sterilization techniques, Preparation of Nutrient media, Plating techniques, Isolation of Bacteria, Yeast and fungi, Growth of Bacteria, Growth curve by turbidity and colony counting Bacterial staining procedures.

II Isolation and characterization of bacteria of medical importance.

III 1. Working knowledge of Perl and Bio-Perl Programming
(15 Programs minimum)
2. Gene Structure and Function prediction.

3. ORF Prediction
4. Sequence Similarity Searching
5. Multiple Sequence Alignment
6. Molecular Phylogeny
7. Analysis of Nucleic Acid Sequences

THIRD SEMESTER					
BT010301	Immunology	Theory	4	4	19
BT010302	Proteomics & CADD	Theory	4	4	
BT010303	Database Concepts & Biological Databases	Theory	3	3	
BT010304	Advanced Bioinformatics & Linux Operating System	Theory	4	4	
BT010305	Laboratory course III	Practical	10	4	

SEMESTER 3

BT010301IMMUNOLOGY

Objective:

- To introduce the basic concepts of Immunology
- To acknowledge the scope of immune mechanism in life science research.
- To integrate the scope of Bioinformatics tools in better understanding of immunological approaches.

Module I(12 hrs)

Introduction to immunology, infection, immModuley, types of immModuley, Cells and organs of immune system. Antigen,Antibodies,Hybridoma Technology, Monoclonal antibodies, Humoral and cellular immune response.

Module II(15 hrs)

Genetic basis of antibody diversity,antigen processing and presentation.Major Histocompatibility complex, MHC restriction.Cytokines. Complements and complement activation.

Module III(15 hrs)

B cell receptor,B cell maturation, activation, proliferation and differentiation proteins. Tcell receptor, T- cell maturation, activation, proliferation and differentiation proteins. Immunostimulants, immunomodulantsImmunoregulation, Immunologic tolerance.

Module IV(15 hrs)

Hypersensitivity, Auto immModuley, Immuno deficiency diseases. Transplantation immunology, tumor immunology and immune hematology.

Module V(15 hrs)

Computational Immunology: MHC peptides –Structure and interactions, QSAR based predictions of epitopes.Principles of B-cell and T-cell epitope prediction, epitope mapping tools, Epitope modification, Allergenicity prediction. Vaccine design and system immunology, Reverse vaccinology

References

1. Roitt Elbs: Essential Immunology
2. Kuby immunology Kindt Goldsby
3. DAVID J Hentges Microbiology and Immunology
4. Paul W.E Fundamental immunology
5. Helen Chappel $ Mansel Haeney Essential clinical immunology
6. R.Ananthanarayan and C.K. Jayaram: Text book of Microbiology

7. John W Kimball MAXWELL Introduction to immunology
8. Daren R. Flower Immunoinformatics predicting Immunogenicity In Silico.

BT010302 PROTEOMICS & CADD

Objective:

- To introduce basic concepts in Proteomics and their role in Life Science Research.
- To introduce concepts in Computer Aided Drug Design and molecular Modeling
- To signify the role of computational drug discovery methods by providing knowledge on various tools in Bioinformatics.

Module I (12 hrs)

Classification of proteins, Protein separation & analysis; 2D Gel Electrophoresis, Liquid chromatography, Mass spectrometry. Protein structure determination with X-ray Crystallography & NMR spectroscopy.

Protein databases: UniProtKB/Swiss-Prot, Interpro, PIR, PDB, SCOP & CATH, Pro- Dom, PFAM; Protein visualization tools- Swiss PDB Viewer, Pymol, Expasy proteomic tools

Module II (15 hrs)

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. 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. Tertiary and quaternary structures, protein folding, protein domains.PDB, Principles of classification based on structural features based on Databases CATH-Classification by class, Architecture, Topology, Homology SCOP-Structural Classification of Protein, FSSP-Fold Classification based on structure.

Module III(15 hrs)

Protein structure prediction: Chou Fasman method, GOR method, Threading, Homology modeling, CASP, Abinitio prediction, Introduction to software: JPred, 3DPSSM, Modeller, ITASSER, Procheck; Ramachandran plot. Molecular dynamics & conformational energy calculation, Prediction of function.

Module IV(15 hrs)

Drug Discovery: Review of basic biological concepts- Diseases and their causes molecular basis of diseases. Molecular targets, Characteristics of a drug compound, mechanism of drug action, small molecular drugs, peptide drugs. Traditional approaches in drug discovery,

serendipity, high throughput screening, and drug discovery in post-genomic era. Drug discovery pipeline.

Module V(15 hrs)

Applications of bioinformatics in target identification & validation, binding site prediction. Lead compound identification: Structure-based & ligand based approaches; Molecular docking algorithms and scoring functions; Virtual screening- combinatorial chemistry and ligand databases; Design of ligands for known target sites- de novo techniques. Lead optimization. Pharmacophore -ligand based & target based. QSAR- molecular descriptors, bio-activity predictions. ADME Predictions.

References

1. Krane, D. E. (2003). Fundamental concepts of bioinformatics. Pearson Education India.
2. 4. Setubal, J. C., Meidanis, J., & Setubal-Meidanis. (1997). Introduction to computational molecular biology. PWS Pub.
3. Pevsner, J. (2009). Bioinformatics and functional genomics. John Wiley & Sons
4. Lesk, A. (2013). Introduction to bioinformatics. Oxford University Press.
5. Higgins, D., & Taylor, W. (2000). Bioinformatics: sequence, structure, and databanks: a Laboratoryapproach. Oxford University Press, Inc.
6. Bergeron, B. P. (2003). Bioinformatics computing. Prentice Hall Professional
7. Propst, C. L., & Perun, T. (1989). Computer-aided drug design: methods and applications. Marcel Dekker, Inc.
8. Charifson, P. S. (1997). Laboratory application of computer-aided drug design. Marcel Dekker, Inc. Liljefors, T., Krogsgaard-Larsen, P., & Madsen, U. (Eds.). (2002). Textbook of drug design and discovery. CRC Press.

BT010303 DATABASE CONCEPTS & BIOLOGICAL DATABASES

Objective:

- To teach concepts in developing & creating databases
- To introduce programming languages and applying them to create databases.
- To comprehensively understand biological databases.

Module I(12 hrs)

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

Module II (12 hrs)

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 III (12 hrs)

PHP-MySql: Introduction; Basic Syntax; Operators; Variables; Constants; Data types; PHP strings; Conditional statements; Loop statements; Arrays; PHP form handling; Connecting to MYSQL; Creating and Selecting a database; creating tables; MySql Insert, Delete, Update and Select data

Module IV (10 hrs)

Biological Databases: Classification and Importance of Biological Databases; Nucleic acid databases: GenBankMBL, DDBJ; Protein Sequence Databases-SwissProt, PIR; Structure Database-RCSB PDB, CSD; Chemical Structure Database: Pubchem

Module V (8 hrs)

Derived Databases: Sequence – InterPro, Prosite Pfam, ProDom;
Structure Classification Database - CATH, SCOP, FSSP;
Specialized Databases: OMIM; KEGG; Genecard; GPCRdb; Viral Databases; Drugbank

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. Orpita Bosu, Simminder Kaur Thukral: Bioinformatics Databases, Tools and Algorithms
7. Gibas C. Jembecl P: Dereloping Bioninformatics computer skills.
8. Misner S, Krawetz : Bioinformatics-Method and Protocols.

BT010304 ADVANCED BIOINFORMATICS & LINUX OPERATING SYSTEM

Objective:

- To teach advanced topics in Bioinformatics
- To introduce Free Software; Linux Operation System and working in a command line environment.
- To introduce the concepts of Machine learning and their application in Bioinformatics.

Module I (15 hrs)

Sequence patterns and profiles:

Repeats: Tandem and Interspersed repeats, repeat finding, Motifs, consensus, position weight matrices,

Algorithms for derivation of and searching sequence patterns: MEME, PHI-BLAST, SCanProsite and PRATT, Algorithms for generation of sequence profiles: Profile Analysis method of Gribskov, HMMer, PSI-BLAST

Module II (15 hrs)

Markov Chains & Hidden Markov Models:

Introduction to Markov chains and HMM using Markov chains for discrimination of biological sequences. Forward and backward algorithms. Parameters estimation for HMMs. HMMs for pairwise and multiple sequence alignments. Profile HMMs.

Module III (15 hrs)

Machine Learning and Bioinformatics:

Introduction to various Machine Learning techniques and their applications in Bioinformatics. Genetic algorithms, Support Vector Machine, Neural Networks and their applications in Bioinformatics.

Module IV(15 hrs)

Linux Operating System

History and features of UNIX and GNU/Linux. Linux ,file and directory commands, file permissions. Basic commands, I/O redirection and piping, simple filters, vi as text editor. archives and file compressions.

Module V (12 hrs)

Linux Shell Programming

Multiple commands as a shell script simple shell script creation and execution. Variables: System variables and User defined variables, read values to variables, Mathematic and String handling. Decisions and loopings: if, for and while loops, case statement;

References:

1. Chemoinformatics: A Textbook by Johann Gasteiger.
2. Bioinformatics second edition by Devid M mount
3. Essential Bioinformatics by Jin Xiong
4. Bioinformatics: Concepts, Skills & Applications By R.S. Rastogi
5. Operating System - Linux, NUT Press, PHI Publisher,
6. Red Hat Linux Bible, Christopher Negus, Wiley Dreamtech India
7. UNIX Shell Programming by Yeswant Kanetkar,
8. BPB Linux Administration Handbook, Evi Nemeth,Garth Snyder, Trent K Hein - Pearson Education.
9. Beginning Linux Programming by Neil Mathew & Richard Stones, Wiley Dreamtech India

BT010305 LABORATORY COURSE III

Immunology

Agglutination Reaction-ABO Blood Grops and Rh Typing

Immuno Diffusion Assays-Single radial Immuno Diffusion assay (Mancini Technique)Double diffusion Immuno assay (Ouchterlony Technique)

ELISA Tests

WIDAL and VDRL slide tests for Diagnosis of Typhoid and syphilis respectively

Linux & Shell Programming

1. Basic Linux Commands
2. Basic Shell Programming
3. SQL Commands & PL/SQL Programming
4. Database creation using php-mysql
5. Proteomics Tools - Any five

Course Code	Title of the Course		Type of the Course	Hours per week	Credits	Total Credits
FOURTH SEMESTER						
BT800401	Electives Group A	Genetic engineering & IPR	Elective	5	4	23
BT800402		Bio programming	Elective	5	4	
BT800403		Data Mining in Bioinformatics	Elective	5	4	
BT810401	Electives Group B	Java programming	Elective	5	4	
BT810402		Advanced genomics	Elective	5	4	
BT810403		Research Methodology & Scientific Writing	Elective	5	4	
BT820401	Electives Group C	Basics of Nanotechnology	Elective	5	4	
BT820402		Pharmaceutical chemistry & action of Selected drugs	Elective	5	4	
BT820403		Bioinformatics data analysis	Elective	5	4	
BT010401	Laboratory course IV		Practical	10	4	
BT010402	Research Project & dissertation				5	
BT010403	Comprehensive Viva-Voce				2	

ELECTIVE GROUP A

BT800401 GENETIC ENGINEERING & IPR

Objective:

- To teach Genetic Engineering Techniques.
- To introduce concepts in IPR and bioethics.
- To effectively signify the relevance of applications in Genetic Engineering in today's industry

Module 1 (12 hrs)

Scope and applications 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 quantification of DNA by Gel electrophoresis.Methods of gene transfer in plants and animals (Agrobacterium mediated, electroporation and particle gun, liposome, PEG).

Module 2:(15 hrs)

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, optimization of PCR parameters, variations in PCR and applications. Principles of cell based DNA cloning, cloning system for producing single stranded and mutagenized DNA.

Module 3 (15 hrs)

Gene Cloning Vectors Plasmids, bacteriophages, phagemids, cosmids, Artificial chromosomes. Alternative Strategies of Gene Cloning.Cloning interacting genes-Two-and three hybrid systems, cloning differentially expressed genes, Nucleic acid microarrays.

cDNA Synthesis and Cloning mRNA enrichment, reverse transcription, DNA primers, Linkers, adaptors and their chemical synthesis, Library construction and screening, construction and screening of genomic libraries.

Module 4 (15 hrs)

Nucleic acid hybridization: Principles and applications, preparation of probes, principles of nucleic acid hybridization, nucleic acid hybridization assays and microarrays. Tools for analyzing gene expression: Reporter genes , Analysis of gene regulation, purification & detection tags, analysis at the level of gene transncription. Northern blot, in situ hybridisation, RNAse protection assay, RT-PCR analysis at the level of translation – Western blot, in situ

analysis, ELISA, protein gel electrophoresis, antibody production. DNA Fingerprinting, DNA foot printing, CRISPR Technology

Module 5 (15 hrs)

Introduction and the need for intellectual property right (IPR). Patent document, How to protect your inventions? Granting of patent Rights of a patent, how extensive is patent protection? Why protect inventions by patents?Searching a patent, Drafting of a patent, Filing of a patent, Environmental impacts - Ethical issues - ethical committees - Commercialisation – Copy right – royalty.Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights, Rights of Trademarks, Types of Trademarks, signs used in Trade marks, Geographical indications**.**Ethical Issues of Genetic Engineering.

REFERENCES:

1. Molecular Cell Biology-Lodish , Berk, 5th Edn. Freeman 2003
2. Molecular Biology of the Cell, 5th edn, Alberts 2008, Grandland science
3. Cells-Levin, 1st Ed. Jones & Bartlett Publisher 2006
4. The cell – A molecular Approach 4th Edu. Geoffrey M. Cooper, Rober E. Hausman
5. Genes IX - Lewin B. 2004, Prentice Hall
6. Biochemistry – Voet D. Voet J. G. 3rd Edn., Johnwiley & Sons inc. 2004
7. Cell & Molecular & William & Wilkins 2006
8. DNA repair mutagenesis: Friedberg E. C. ASM press 1995.
9. Enzymology primer for Recombinant DNA technology Eun HM, Elservier, 1996.
10. Glick, B.R. and Pasternak, J.J. (1994) Molecular Biotechnology, ASM Press.
11. John G. Webster. (2004) Bioinstrumentation. Univ. of Wisconsin, John Wiley & Sons, Inc.
12. Sambrook, J. and Ruseell, D.W. (2001) Molecular Cloning – A Laboratory Manual (3rd edn., Vol. 1,2,3) Cold Spring Laboratory Press, New York.
13. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
14. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
15. P. Narayanan; Law of Copyright and Industrial Designs;Eastern law House, Delhi , 2010

BT800402 BIO PROGRAMMING

Objective:

- To teach R programming language and its application in scientific and commercial domain.
- To learn and to apply languages of Python & Biopython in Bioinformatics.
- To learn and to apply Scilab in Bioinformatics Data Analysis.

Module I (10 hrs)

R introduction :datatypes,variable,operators,decision making, loops,functions, string**.**Vectors ,list, matrices, arrays, factors, data frames, R charts & graphs**.** Applications of R in Bioinformatics**.** R Packages :Bio Conductor: Analysis of Genomic data using tools from Bio conductor Project. Analysis of gene regulators, ontologies, and microarray expression profilesCADMIM: Microarray Data Analysis

MaxR: An R package for maximum-likelihood analysis of nucleotide sequence data

Module II (16 hrs)

Python: Features; Variables; Operators; Data types**;**Decision making statements; Loops; Data structures in python; Functions; Regular expressions in python; File handling; GUI programming; Database Connectivity, Python Graphics modules.

Module III (12 hrs)

Biopython: Working with sequences**.**Parsing Genbank files; Parsing Swissprot files; Accessing Entrez; BLAST; Multiple Sequence Alignment; Handling PDB files using Biopython.

Module IV (17 hrs)

Scilab: Overview; Workspace; Variables; Data Types**;**Conditional statements; Loops; Scalars; Vectors**,** Matrices – creating matrix, Accessing elements, eye matrix, Matrix computation; String handling; Plotting – 2D; Reading from and writing to files.

Module V (17 hrs)

Soft Computing: Neural Networks and their applications in bioinformatics. Hidden Markov model and its Applications. SVM and its application in Bioinformatics.

References:

1. Dr. Mark Gardener: Beginning R- The Statistical Programming Language
2. Nathan Yan- The Art of R Programming
3. Sebastian Bassi: Python for Bioinformatics; CRC
4. Mark Lutz: Programming Python
5. David M.Beazly Python Essential Reference.

6. Dr. Hema Ramachandran, Dr.Achuthsankar S Nair: Scilab (A free software to MATLAB)
7. Pratihar: Soft Computing
8. Martin Gollery: Handbook for Hidden Markov Model For Bioinformatics; CPC Press.
9. J.Han and M.Kamber: Data Mining Concepts and Techniques; Elsevier Science 2007.
10. Margaret.H.Dunham:Data Mining Introductory and Advanced Topics; Pearson Education 2004

BT800403 DATA MINING IN BIOINFORMATICS

Objective:

- To introduce to concepts of Data Mining
- To utilize data mining techniques and enhance its application in acquiring Biological Data
- To teach large scale biological data analysis using Bioinformatics Softwares.

Module I(15 hrs)

Introduction to Data mining, Data mining Functionalities, Classification of Data mining Systems, Data Mining Task Primitives, Integration of Data mining systems, Major issues of Data mining. Data mining: Basic concepts of Knowledge discovery and Data Mining, Application of data mining in bioinformatics.Data Preprocessing, Data Cleaning, Data Integration and Transformation, Data Reduction, Data discretization and concept hierarchy generation.

Module II(10 hrs)

What is Data Warehouse, Multidimensional Data Model, A three-tier Data Warehousing Architecture. Association Rules Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods**:** Apriori Algorithm, Generating association Rules from Frequent Item sets

Module III(12 hrs)

Introduction to Classification and Prediction, Issues Regarding Classification and Prediction

Classification by Decision Tree Induction: Decision Tree induction, Attribute Selection Measures, Tree Pruning, Rule Based Algorithms: Using If - Then rules of Classification, Rule Extraction from a Decision Tree, Rule Induction Using a Sequential Covering algorithm. Linear Regression, Nonlinear Regression, Other Regression-Based Methods

Module IV(18 hrs)

Microarray data analysis- general workflow, ImageProcessing, Normalisation, Measuring and Quantifying Microarray Variability. Analysis of Differentially Expressed Genes, classification(ANN,SVM). Genomic Data Science with Galaxy: Using Tools available from Galaxy to utilize genomic data for their visualization, alignment and functional annotation.

Module V(17 hrs)

ChipSeq: Analyzing data and producing inference.
RNAseq: Analyzing data and producing inference.
Metagenomics: Analyzing data and producing inference
Phylogenetic analysis: Analyzing data and producing inference.
Genome Assembly: Analyzing data and producing inference

References

1. Data Mining Concepts and Techniques – Jiawei Han and Micheline Kamber, Second Edition, Elsevier, 2006
2. Data Mining – BPB Editorial Board, BPB Publications, First Edition, 2004
3. Data Warehousing, Data Mining, & OLAP – Alex Berson, Stephen J Smith, Tata McGraw Hill, 2004.
4. Data Warehousing, Sinha, Thomson Learning, First Edn.
5. Microarray bioinformatics- Dovstekel
6. http://genome-www5.stanford.edu/MicroArray/MDEV/index.shtml
7. http://www.ebi.ac.uk/microarray/ArrayExpress/arrayexpress.html
8. http://www.ncbi.nlm.nih.gov/geo
9. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240089/

ELECTIVES GROUP B

BT810401 JAVA PROGRAMMING

Objective:

- To teach programming language JAVA
- To integrate understanding of JAVA in Bioinformatics.
- To apply JAVA in Database connectivity.

Module I(15 hrs)

JAVA and Internet ,JAVA environment., JAVA program structure, Statements, JAVA virtual machine, Constant & Variables, Data Types, Declaration of Variables, Scope of Variables, Symbolic Constants, Type Casting. Operators : Arithmetic, Relational, Logical Assignments, Increment and Decrement, Conditional,Bitwise, Special, Expressions & its evaluation. If statement, if…else… statement, Nesting of if…else… statements, else…if Ladder, Switch, ? operators, Loops – While, Do, For, Classes and Methods – Inheritance.

Module II(15 hrs)

Packages and Interfaces –Exception Handling – Input/Output String Handling. Generic methods. Arrays: One Dimensional & two Dimensional, strings, System Packages, Using System Package

Module III(15 hrs)

Java applets- Applets in Java, Local and Remote Applets Vs Applications, Writing Applets, Applets Life Cycle, Adding images to an applet – Adding sound to an applet. Passing parameters to an applet.

Module IV(12 hrs)

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

Module V(15 hrs)

Working with Graphics, Controls and Text : Working with Graphics, Working with Color, Setting the Paint Mode, Working with Fonts,

Exploring Text and Controls: Introduction, Adding and Removing Controls, Responding to Controls such that Label, Buttons, Checkboxes, Choice, Lists, Scroll Bar, Text Field, Text Area. Graphics: Working with AWT Controls, Menus , Introduction to Biojava

REFERENCE :

1. E. Balaguruswamy, “Programming in Java”, TMH Publications
2. Java The Complete Reference , Herbert Schildt 7th Edition. Tata• McGraw- Hill Edition
3. Java 6 by Rogers Cadenhead, Laura Lemay, Pearson education
4. Java Programming – A Laboratory Approach – C Xavier, Tata• McGraw-Hill Edition
5. K. Arnold and J. Gosling, “The JAVA programming language”, Third• edition, Pearson Education, 2000
6. Joyce Farrell, “Java Programming”
7. BioJava: CookBook4.0

BT810402 ADVANCED GENOMICS

Objective:

- To teach advanced concepts for understanding genomes
- To teach high end sequencing strategies for genomes.
- To learn applications associated with genome analysis.

Module I (15 hrs)

Development of sequence based molecular markers - SSRs and SNPs; Advanced methods of genotyping; Mapping genes for qualitative and quantitative traits. Next Generation Sequencing Techniques

Module II (15 hrs)

QTL mapping using structured populations; AB-QTL analysis; Association mapping of QTL; Fine mapping of genes/QTL; Map based gene/QTL isolation and development of gene based markers;

Module III (15 hrs)

Marker assisted selection (MAS) in backcross and heterosis breeding;Transgenic breeding; Foreground and background selection; MAS for gene introgression and pyramiding: MAS for specific traits with examples.

Module IV (15 hrs)

Importance of gene mapping, methods and techniques used for gene mapping, physical mapping, linkage analysis, cytogenetic techniques,FISH technique in gene mapping, somatic cell hybridization, radiation hybrid maps, *in-situ* hybridization, comparative gene mapping. Genetic distance analysis, restriction fragment length polymorphism (RFLP) of different structural genes

Module V (12 hrs)

MHC and its relevance to disease resistance and immune response, genes influencing production traits, mitochondrial DNA & evolutionary significance, Applications of genome analysis.

Suggested Readings

Chittaranjan K. 2006-07. *Genome Mapping and Molecular Breeding in Plants.* Vols. I-VII. Springer

Newbury HJ. 2003. *Plant Molecular Breeding*. Blackwell Publ.

Weising K, Nybom H, Wolff K & Kahl G. 2005. *DNA Fingerprinting inPlants: Principles, Methods and Applications*. Taylor & Francis.

Gibson G & Muse SV. 2004. *A Primer of Genome Science*. Sinauer Associates.

Primrose SB & Twyman RM. 2007. *Principles of Genome Analysis and Genomics*. Blackwell.

Sensen CW. 2005. *Handbook of Genome Research*. Vols. I, II. Wiley-CVH

Gordon I. 2005. *Reproductive Techniques in Farm Animals*. CABI.

Kindt TJ, Goldsby RA & Osbrne BA. 2007. *Kuby Immunology*. WH Freeman.

Kun LY. 2006. *Microbial Biotechnology*. World Scientific.

Levine MM, Kaper JB, Rappuoli R, Liu MA, Good MF. 2004. *NewGeneration Vaccines*. 3rd Ed. Informa Healthcare.

Lincoln PJ & Thomson J. 1998. *Forensic DNA Profiling Protocols*. Humana Press.

Portner R. 2007. *Animal Cell Biotechnology*. Humana Press.

Spinger TA. 1985. *Hybridoma Technology in Biosciences and Medicine*. Plenum Press.

Twyman RM. 2003. *Advanced Molecular Biology*. Bios Scientific.

BT810403RESEARCH METHODOLOGY & SCIENTIFIC WRITING

OBJECTIVES

- To understand the significance of research methods
- To understand and learn statistical methods involved in Biological research.
- To teach the fundamentals of scientific writing.

Module I (12hrs)

Introduction to Research Methodology

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

Module II (15 hrs)

Defining the Research Problems

Identification of Research Problem Sources of research problem, Criteria for the selection of research problem. Research design, Rationale, Statement of problem, Setting objectives. Definition of concepts, operational definition, variables independent and dependent, control

and intervening variables, limitations and delimitation. Hypothesis - Meaning and importance, types of hypotheses.

Module III (15 hrs)

Research Methods and Tools

Methods of Collecting Primary Data- Questionnaire, preparation of schedules, interview method, case study method, experimentation method and sources of secondary data. Editing and Coding the Data

Organization of Data - Classification - meaning and objectives, types of classification.

Representation of Data - Diagrammatic and graphical representation - significance of diagrams and graphs - general rules for constructing diagrams - types of diagrams, graphs of time series, graphs of frequency distribution. Interpretation and Report Writing-Meaning of interpretation, precautions and essentials for good report, footnotes and bibliographical citations

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

Module IV (15hrs)

Data collection and presentation:

Introduction to Biostatistics: Variable and attribute; Population vs. sample; Census vs sample survey; Arrangement of data; Frequency distribution. Graphical presentation of data: Line diagram; Bar diagram; Pie chart; Histogram,Level of significance, Probability, Normal distribution, Error of inference, Student's t-test, Paired t-test, Fisher's t-test, Chi-square test. Introduction to SPSS

Module V (15 hrs)

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

References

- Bandarkar, P.L. and Wilkinson T.S. (2000): Methodology and Techniques of Social Research, Himalaya Publishing House, Mumbai.
- Batnagar, G.L. (1990): Research Methods and Measurements in Behavioural and Social Sciences, Agri. Cole Publishing Academy, New Delhi.

- Mukherjee, R. (1989): The Quality of Life: Valuation in Social Research, Sage Publications, New Delhi.
- Biju Dharmapalan (2012) .Scientific Research Methodology. Narosa Publications ,New Delhi
- Kothari, C.R. (2000) Research Methodology- Methods and Techniques, 2nd edition, New age International (P) Ltd. Publishers, New Delhi,
- Gupta, S.F., (2002).Statistical Methods, Sultana Chand and Sons, 3l Revises Edition,

ELECTIVES GROUP C

BT820401BASICS OF NANOTECHNOLOGY

Objective

- To introduce the concepts of Nano technology
- To foresee the scope of nano technology in cancer research
- To apply the concepts of nano technology in biological research.

Module I(15 hrs)

Fundamental Concepts: Nanotechnology: Foundations in nanosciences- introduction-scientific revolutions-basic science behind nanotechnology-nanometre: how big or small-nanotechnology-materials at nanoscale-quantum confinement in nanomaterials-rationale behind the downsizing of the materials- prime materials in nanotechnology-nanomaterials: biomaterials-unique properties of nanomaterials-microstructure and defects in nanocrystalline materials.

Module II(15 hrs)

Nano Fabrication: Introduction-synthesis of nanopowders using top down and bottom up methods-top down fabrication methods-arc discharge method-laser ablation method –ball milling-inert gas condensation-bottom up fabrication methods

Module III(15 hrs)

Nanoscale Characterization: Introduction-XRD (principle and theory)–SEM (principle, construction and working, advantages and disadvantages) -TEM (principle, construction and working, advantages and disadvantages)-AFM (principle, construction and working, advantages and disadvantages)-STM (principle, construction and working, advantages and disadvantages) - Raman spectroscopy (principle, construction and working)-Nanoindentation.

Module IV(15 hrs)

Nanoparticles for Cancer Drug Delivery: Cancer and current approach to its cure through nanoparticles, characteristics of tumor tissues, drug delivery to tumors, physio-chemical properties of nanoparticles in cancer therapy, site specific delivery of chemotherapeutic agents using nanoparticles.

Module V(12 hrs)

Non-viral Gene Therapy with nanoparticles: Introduction, Hyperthermia, controlled delivery of chemotherapeutic drugs, nanoparticles to circumvent MDR, potential problems using nanoparticles. Application of Nanotechnology in Agriculture, Medicine, Communication technology, Biotechnology and Bioinformatics.

References

1. Bharat Bhushan., Nanotribology and Nanomechanics - An introduction, Springer.
2. Mark, Ratner Daniel Ratner, Nanobiotechnology- next big idea.
3. Challa S.S.R.Kumar, Joseph Hornes, Carola Leuschner, Nanofabrication towards Biomedical applications.

BT820402PHARMACEUTICAL CHEMISTRY & ACTION OF SELECTED DRUGS

Objective :

- To discuss different mode of actions of various drugs in market
- To understand the chemistry and metabolism of drugs
- To learn to identify the potency and effectiveness of drugs.

Module-I(17 hrs)

Introduction to Antibiotics and mechanism of their action :Structure,chemistry and SAR of: Beta lactam Antibiotics, Pencillins, Cephalosporins, Tetracyclines, Macrolides,Aminoglycoside antibiotics and other miscellaneous antibiotics .

Antitubercular Agents and their mechanism of action.

AIDS. Life Cycle of HIV-Virus ,Potential Targets for Anti-HIV agents; Nucleoside and Non Nucleoside Analogues.

Module-II (10 hrs)

Introduction to Cancer; Classification of Anti cancer Agents, Structure, Chemistry, SAR and Mechanism of action of :- Alkylating Agents, Antimetabolites, Antibiotics, Plant Products, Miscellaneous Agents.

Module-III(15 hrs)

Antipyretics and Non-steroidal Anti-Inflammatory Drugs. Biosynthesis of Eicosanoids,Mechanism of Anti-Inflammatory Action and their side effects.

Chemistry,Structure and SAR of Salicylates - Aspirin as an example, p-Aminophenol derivatives-Paracetamol as an example.

Pyrazolidinedione derivatives- Any one example

Anthranilic acid derivatives.

Oxicams and Miscellaneous examples.

Module-IV(15 hrs)

Anti-Parkinson's Agents, Chemistry,structure,Mechanism of Action and SAR of :-

- Dopamine agonists
- Dopa decarboxylase inhibitor
- Dopamine releasing agents
- Synthetic anticholinergics
- Other miscellaneous antiparkinson agents

Introduction to Dementia and Alzeheimer's Disease: Chemistry ,Structure, Mechanism of action and SAR of: Cholinergic Agonists and Acetyl Choline Esterase Inhibitors.

ModuleV(15 hrs)

Narcotic Analgesics: Chemistry of Morphine and its analogues Chemistry of Piperidines, Diphenyl heptanones Narcotic Antagonists. Antidepressants and mechanism of action. Role of monoamine oxidase.

REFERENCES

1) Essentials of Pharmaceutical Chemistry; Donald Cairns
2) Medicinal Chemistry;D.Sriram,P.Yogeeswari
3) An Introduction to Medicinal Chemistry ;Graham.L.Patrick ,John Spencer 2009
4) Medicinal Chemistry;Ashuthosh Khar Revised Third Edition,New Age Publishers
5) Textbook of Medicinal Chemistry,Volume 2;Prof.Dr.V.Alagarswamy
6) Pharmaceutical Chemistry 2;Dr.A.V.Kasture,Dr.S.G.Wadodkar

BT820403BIOINFORMATICS DATA ANALYSIS

Objective :

- To teach Bioinformatics Data Analysis using Softwares
- To introduce MATLAB as a programming language.
- To learn avenues in genomic research and their potential.

Module I: (15 hrs)

Introduction to MATLAB, standard Matlab windows, operations with variables, arrays, writing script files, writing functions, simple graphics, Data types, File Input-output, Communication with external devices.

Module II (15 hrs)

DNA Sequencing methods (sanger's method,Shotgun sequencing, High-throughput sequencing) NGS:- Sequencing Steps:Experiment design, Sample collection, Sample preparation, Sequencing, Pre-processing, Assembly(denovo assembly & comparative assembly), Post-assembly analysis NGS technologies :Ilumina, Ion torrent, Roche 454

NGS- quality control, NGS data formats, indexing, mapping reads, Burrows Wheeler Transform, FM index DNAseq, RNAseq, Chipseq, BSseq, methyl seq

Module III: (15 hrs)

Microarray data analysis- general workflow, ImageProcessing, Normalisation, Measuring and Quantifying Microarray Variability, Analysis of Differentially Expressed Genes, classification(ANN,SVM) Genomic Data Science with Galaxy: Using Tools available from Galaxy to utilize genomic data for their visualization, alignment and functional annotation.

Module IV: (15 hrs)

Microarray software packages:- BASE, GeneTraffic, Expression Profiler

Microarray databases:-Stanford Microarray database, GEO, ArrayExpress,

DB NGS:- Aligners for illumina platform(ELAND,Bowtie,Novoalign,SOAP,MRfast) Aligners for SOLidPlatform(corona-lite,SHRiMP) Aligners for 454 platform(BWA-SW,newbler) Multi-platform(BFAST,BWA,Maq)

Crossbow pipeline- genotyping of short reads using cloud computing

Module V:(12 hrs)

Research areas of genomics

Functional genomics and structural genomics Epigenomics, metagenomics,

Pharmacogenomics – Case study

REFERENCES

1. Rudra Prathap –Getting started with MATLAB
2. D.M.Etter et al –Introduction to MATLAB
3. Genomics protocols (Starkey M.P., Elaswarapu R. - 2002 - Humana press)
4. Principles of Genetics Tamarin. 7th_Edition
5. Bioinformatics and functional genomics - Jonathan Pevsner
6. Genomes_by_T.A.Brown
7. Principles of Gene Manipulation- Old & Primrose
8. Microarray bioinformatics- Dov stekel
9. http://genome-www5.stanford.edu/MicroArray/MDEV/index.shtml
10. http://www.ebi.ac.uk/microarray/ArrayExpress/arrayexpress.html

11. http://www.ncbi.nlm.nih.gov/geo
    http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240089/

BT010401LABORATORY COURSE IV

Working knowledge, understanding and demonstration of

- DNA isolation
- RNA isolation
- Conjugation
- cDNA preparation
- Competent cell preparation
- Transformation
- Plasmid isolation
- Restriction enzyme digestion
- Ligation
- RFLP
- Amplification of selective gene by PCR
- Java & Biojava Programming(15 programs) or R programming(10 programs) or Python & Biopython Programming(15 programs)
- Drug Design & Docking using HEX
- Molecular Visualization Softwares – Rasmol, SPDBV etc.
- Homology Modeling

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

First Semester Faculty of Science

BT010101 FUNDAMENTALS OF CELL BIOLOGY AND BIOCHEMISTRY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A(Answer any **eight** questions. Each question carries a weight of 1)

1. What is muta-rotation?
2. Write down the structure of any two essential amino acids.
3. Highlight the functions of cholesterol.
4. Give a brief description on the structure of mitochondria.
5. What are catecholamines?
6. What are the functions of Abcissic Acid?
7. Comment on the role of the genes involved in apoptosis.
8. What are domains? How do they differ from motifs?
9. Comment on the functions of insulin.
10. Define apoptosis.

(8 x 1 = 8)

Section B(Answer any **six** questions. Each question carries a weight of 2)

11. Comment on the structure and functions of cell wall polysaccharides.
12. Explain Dihedral angles and their relevance with the help of a plot.
13. What are G-Protein coupled receptors? Explain
14. Give a brief note on Watson- Crick model of DNA.
15. What is active transport? Explain Na^+K^+ ATPase.
16. List out the sequence of events taking place in Cell Cycle.
17. Explain the mechanism of action of steroid hormones.
18. Give an account on fat soluble vitamins (**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. With the help of diagrammatic sketches explain the levels of protein structure.
20. Write an essay on transport of molecules across the cell membrane.
21. Explain in detail the classification and function of lipids.
22. Give a detailed account on the critical genes and pathways involved in cancer.

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

First Semester Faculty of Science

BT010102 INTRODUCTION TO GENETICS AND MOLECULAR BIOLOGY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A(Answer any **eight** questions. Each question carries a weight of 1)

1. Define multiple allelism with suitable examples.
2. What is frame shift mutation?
3. Explain role of microRNAs in gene regulation.
4. Discuss the structure and function of telomerase.
5. What is tautomerism?
6. Discuss chromatin remodeling.
7. Comment on chromosome mapping.
8. What is RNA editing?
9. Describe wobble hypothesis.
10. What is dihybrid cross ?

(8 x 1 = 8)

Section B(Answer any **six** questions. Each question carries a weight of 2)

11. Explain how tryptophan operon is fine tuned?
12. Describe Rolling circle replication in detail.
13. Explain mechanism of transposition.
14. Discuss the post translational modifications.
15. Explain Catabolite repression.
16. Give an account on complementation test.
17. Discuss Holliday model of DNA recombination.
18. Explain spliceosomal splicing.

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Write briefly on Mendel's experiments on Garden Pea. Comment on the deviations of Mendel's law.

20. Explain in detail about the steps involved in transcription of prokaryotes. How it is differ from eukaryotic transcription.
21. Define mutation. Describe structural and numerical alterations of chromosome. Comment on the different methods to detect mutations.
22. Explain the genomic organization of prokaryotes and eukaryotes in detail with suitable diagrams.

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

First Semester

Faculty of Science

Fundamentals of Applied Mathematics And Biostatistics

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Basic logic operators.
2. Define Biostatistics?
3. Differentiate walks and paths.
4. Explain the term sample space?
5. Basic logic operators.
6. Define sub graph with examples.
7. What is cyclic and acyclic graph?
8. What is De-Morgan's law? State with an example?
9. What is mean value?
10. What is median value?

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Write one merit and demerit of geometric mean.
12. What is a function? Give two examples.
13. Write the power set of (3,-1).
14. What are the conditions that should be satisfied by a tree?
15. Prove, In every graph, the number of nodes with odd degree is even.

16. Draw the truth table for exclusive NOR gate and give the Boolean notation.
17. Explain different logical operations with truth table.
18. Explain biostatistics and its applications

(6 x 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Show that the function $f(x) = \frac{2x}{x-1}$ is one-one and onto.
20. What is meant by equivalence and implication? Give detailed explanation.
21. Find Arithmetic Mean:

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

22. 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

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

First Semester Faculty of Science

BT010104 INTRODUCTION TO COMPUTING AND BIOINFORMATICS

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is meant by real time processing?
2. What is DBMS?
3. Discuss the role of main memory.
4. Briefly compare Bioinformatics and Computational Biology
5. What is meant by tags in HTML?
6. Differentiate between a constant and variable with suitable examples

7. List any two relational and logical operators in C
8. Briefly explain exception handling in Java
9. Mention on any significant biological databases.
10. Comment on premier Bioinformatics research institutes in India.

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Discuss on various mobile technologies
12. What is an OS? Explain different OS and their features
13. What is software? Explain different types of software
14. Give an account on connectivity in Networks?
15. What are the different types of return values in C.
16. Differentiate array and structure with suitable examples.
17. What are pointers in C. Explain how memory management is efficient using pointers.
18. Briefly describe style sheets.

(6 x 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Explain the structure of a digital computer and discuss its working?
20. What is bioinformatics? Detail on the applications of bioinformatics.
21. Which are the different decision making statements in C. Explain with suitable examples
22. Explain different tags used to define the following:
    a) Table structure
    b) Ordered list
    c) Hyperlink
    d) Image(background)
    e) Form structure

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Second Semester

Faculty of Science

BT010201 METABOLISM & ENZYMOLOGY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is Michaelis-Menten Equation?
2. What is the significance of Pentose Phosphate Pathway?
3. What are uncouplers in ETC?
4. Give a brief note on Salvage pathway.
5. Why is TCA cycle called an amphibolic pathway?
6. What is the rate limiting ezyme and its reaction in cholesterol biosynthesis?
7. Write down the structure and function of ATP.
8. What do you mean by allosteric feed back inhibition?
9. Mention on the structural significance of chloroplasts.
10. What is Transamination?

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Comment on Urea Cycle.
12. Explain the steps in Beta-oxidation of lipids.
13. What is Calvin Cycle?
14. Give a brief note on inborn errors of metabolism.
15. What is enzyme regulation? Explain using Glycolysis as an example.
16. Explain hormonal regulation in glycogen metabolism.
17. Suggest and explain any two methods of active site mapping.
18. Give an account on Enzyme Inhibition.

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Explain in detail on De novo synthesis of nucleotides.
20. Write down the steps, chemical reactions, regulation and bioenergetics of Krebs Cycle.
21. Elucidate on electron transfer complexes, their role and mechanism of oxidative phosphorylation in mitochondria.
22. Describe in detail Cholesterol metabolism and its impact on cardiovascular diseases.

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Second Semester

Faculty of Science

BT010202 GENERAL MICROBIOLOGY

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Discuss Koch's postulates.
2. Comment on the advantages of Electron microscopy.
3. What is Phenol co-efficient test?
4. Explain Whittaker's five kingdom classification.
5. Describe Diauxic growth curve.
6. Write briefly on extremophiles.
7. Explain the characteristic features of mycoplasma.
8. Why is the TCA cycle called an amphibolic cycle
9. What are cosmids?
10. Describe a method of sterilization.

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Explain in detail about viral cultivation.
12. Discuss different gene transfer methods employed in rDNA technology.
13. Explain the nutritional requirements of bacterial growth.
14. Discuss the mechanism of action of antibiotics.
15. Give a brief account on culture preservation techniques employed in microbiology.
16. Comment on oncogenic viruses.
17. Write briefly on phage based vectors.
18. Explain drug resistance in bacteria.

(6 x 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Discuss the major characterization of microorganisms .Why is it essential to classify them?
20. Explain the fine structure of bacteria. Give an account on Gram's staining technique.
21. Explain in detail about the replication of bacteriophages. Comment on transduction as a method of gene transfer in bacteria.
22. Give an account on different agents used in sterilization of microbes.

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Second Semester Faculty of Science

BT010203 GENOMICS

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is an ORF? Mention its significance.
2. What is the purpose and rationale behind comparative genomics?
3. What are pseudogenes?
4. Give a brief note on genes involved in breast cancer.
5. What are the ethical issues in HGP?
6. Write a short note on EST'S.
7. Comment on LOD Score analysis?
8. Define Functional Genomics.
9. What is chromosome jumping ?
10. What is pharmacogenomics? **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Comment on SNP's and their role in Pharmacogenomics.
12. Write a short note on multigene families in Eukaryotes.
13. Which are the different molecular markers used in Genomics? Explain.

14. Give a brief note on gene prediction and functional annotation of genes.
15. What are LINE's and SINE's?
16. Explain FISH.
17. Compare and Contrast c DNA and Genomic Libraries.
18. Give an account on Next Generation Sequencing.

(6 x 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Give a detailed explanation on the organization and classification of eukaryotic genome.
20. Explain how can you use cDNA libraries for analyzing gene expression?
21. Write an essay on the various aspects of Human Genome Project.
22. Explain in detail Sanger- Coulson method of DNA Sequencing.

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Second Semester Faculty of Science

BT010204 Bioinformatics & Perl

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Define phylogenetic analysis
2. Differentiate global and local alignment
3. How is dotplot analysis performed?
4. Define various terms related to phylogenetic trees
5. What is GET and POST method?
6. What is molecular clock hypothesis?
7. Differentiate chomp and chop functions in Perl.
8. Perl is an interpreted language. Comment
9. What is Dynamic Programming?
10. Comment on E-Value in BLAST.

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. What are the advantages of MSA over pairwise alignment?
12. What is PSI-BLAST. Give a note on its advantages?
13. Comment on PAM matrix
14. Explain character based method for phylogenetic analysis
15. Explain the uses of Bioperl
16. Explain arrays and hash variables in Perl
17. Write notes on Perl in Bioinformatics
18. Explain regular expressions in Perl with examples.

(6 x 2 = 12)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Explain BLAST
20. Which are the different steps in constructing a phylogenetic tree. Explain
21. Explain in detail about Perl-CGI programming.
22. Describe various tools used for Multiple Sequence Alignment

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Third Semester Faculty of Science

BT010301 Immunology (2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

Section A (Answer any eight questions) (each question carries a weightage of 1)

1. Definition, function of plasma cell
2. Definition of class switching with example
3. What is rhesus factor and its biological importance
4. Classification and functions of lymphocyte
5. What is MAC
6. Different types of agranulocytes with structure
7. Definition for clonal selection theory
8. SCID
9. Epitope mapping
10. MHC (8 x 1 =8)

Section B (Answer any six questions) (each question carries a weightage of 2)

11. Definition for immunotoxins, mode of action with example
12. Structure and functions of IgA
13. What is autoimmunity, classification of autoimmune diseases
14. RSS and its importance in immunoglobulin gene rearrangement
15. Definition of clonal anergy, importance
16. Importance of epitope mapping, tool for epitope mapping
17. Definition for immunological tolerance and its importance
18. Definition for adjuant, function, mode of action with example (6 x 2 =12)

Section C (Answer any two questions) (each question carries a weightage of 5)

19. Organs of immune system, primary lymphoid organ, detailed structure of thymus, mode of action of thymus in immune system
20. Definition for immunity, innate immune system, different types of defense barriers in innate immunity
21. Complement system, three different pathways complement complement system to kill foreign particle
22. Hypersensitivity reactions, different types, type I hypersensitivity reaction, mechanism of action Type I hypersensitivity reaction

(2 x 5 =10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Third Semester Faculty of Science

BT010302 PROTEOMICS & CADD (2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

Section A (Answer any eight questions) (each question carries a weightage of 1)

1. What is the cadd
2. How binding site is predicted?
3. Briefly explain the secondary structure of protein
4. Give notes on structure classification databases
5. Write on Pfam database
6. What is threading?
7. What is virtual screening?
8. What is pharmacophore?
9. What is SBDD?
10. Explain Rule 5

(8 x 1 =8)

Section B (Answer any six questions) (each question carries a weightage of 2)

11. Write briefly on interatomic forces in protein structure
12 Explain Ramachandran plot
13 Write on the mechanism of drug action
14 Explain any one protein visualization tool
15 Write on QSAR
16 Explain 2D gel electrophoresis and its application.
17 How structure based drug design is carried out?
18 Explain the significance of ADME prediction

(6 x 2 =12)

Section C (Answer any two questions) (each question carries a weightage of 5)

19 Explain protein secondary structure prediction methods.
20 Explain homology modelling
21 Explain the concepts in molecular dynamics
22 Explain techniques for protein purification and its characterization

(2 x 5 =10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Third Semester Faculty of Science

BT010303 Database Concepts & Biological Databases (2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

Section A (Answer any eight questions) (each question carries a weightage of 1)

1. Why is group-clause in SQL used? Give example.
2. What are the various kinds of operations catered by DBMS?
3. What is PL/SQL
4. Significance of Swissprot and the file format
5. What is the importance of using set operators?
6. How connection is made to mysql in php
7. Give notes on structure classification databases
8. What is a trigger?
9. What is database connectivity
10. What is My SQL (8 x 1 = 8)

Section B (Answer any six questions) (each question carries a weightage of 2)

11. What is the difference in execution of triggers and stored procedures?
12. Explain the three level architecture of database
13. Importance of OMIM database
14. Explain string manipulating functions in PHP
15. Give notes on PDB
16. What is an SQL constraint? Explain the importance of SQL constraints with any two examples.
17. How scientific literature search can be carried out using databases?
18. Write briefly on DML commands with examples

(6 x 2 = 12)

Section C

(Answer any two questions) (each question carries a weightage of 5)

19. Explain PL/SQL in detail with examples.
20. How data can be inserted into MySql table through PHP function
21. Explain RCSB PDB
22. What is a cursor? Explain the types of cursors.

(2 x 5 =10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Third Semester Faculty of Science

BT010304 Advanced Bioinformatics & Linux Operating System (2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A(Answer any **eight** questions. Each question carries a weight of 1)

1. What is repeats in genome?
2. Explain the use of PHI-BLAST.
3. What is Open Source?
4. Explain the use of HMMer
5. What is the use of Markov chains.
6. What is Support Vector Machine?
7. Explain the use of Neural Network.
8. What are the features of Linux
9. Explain chmod command
10. Explain filters in Linux

(8 x 1 = 8)

Section B (Answer any six questions) (each question carries a weightage of 2)

11. Explain Directory commands in Linux?
12. Compare between Unix & Linux.
13. Explain if statements in Linux
14. Explain the application of HMMs in sequence alignment.
15. Explain the difference in Tandem and Interspersed repeats
16. What is ANN?
17. What is Genetic Algorithm?
18. Explain machine learning techniques

(6 x 2 = 12)

Section C

(Answer any two questions) (each question carries a weightage of 5)

19. Explain different Algorithms for derivation of and searching sequence patterns
20. Explain different loop structures in Linux shell programming
21. Explain the concepts of Genetic Algorithm in Bioinformatics
22. Explain the application of ANN in Bioinformatics

(2 x 5 =10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Fourth Semester Faculty of Science

Elective – BT800401 Genetic Engineering & IPR (2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Comment on the milestones in Genetic Engineering.
2. Describe any two physical methods of gene transfer.
3. What are the basic features of a thermocycler?
4. What do you mean by homopolymeric tailing ?
5. Comment on artificial vectors used in genetic engineering.
6. What is a copyright?
7. What are the ethical issues associated with GM crops in India?
8. What is ELISA? Mention its applications.
9. Comment on probes used in genetic engineering .
10. What is hybridoma technology ?

(8 x 1 = 8)

Section B (Answer any **six** questions. Each question carries a weight of 2)

11. What are the characteristic features of cosmids?
12. Descrbe briefly on Agrobacterium mediated gene transfer.
13. Describe the preparation of a cDNA library.
14. Comment on enzymes used in gene manipulation.
15. Briefly describe the need for Intellectual Property Rights.
16. What are the patent laws in India?
17. Give a short account on RT-PCR.
18. Briefly describe on nucleic acid microarray (**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Write an essay on cloning vectors used in recombinant DNA technology.
20. Give a detailed account on molecular techniques that employ nucleic acid hybridization in biotechnology.
21. Explain the construction,principle, screening and applications of cDNA and genomic libraries.

22. Describe PCR, its variants and applications. What is RAPD?

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Fourth Semester Faculty of Science

Elective BT800402 Bioprogramming (2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Comment on CADMIM?
2. Which are the different R datatypes?
3. Give an account on various Scilab windows
4. What is datamining?
5. Explain working with files in Python
6. What is soft computing?
7. Which are the various Python datastructures?
8. What are dataframes?
9. Enumerate the applications of artificial intelligence.
10. What is HMM? **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Write notes on applications of R in Bioinformatics
12. What is Biopython?
13. Which are the various matrix handling functions provided by Scilab?
14. What is back propogation algorithm?
15. Write notes on functions in Python
16. Explain a few applications of ANN in bioinformatics
17. Describe plotting commands in Scilab
18. Comment on datamining in Bioinformatics. **(6 x 2 = 12)**

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. How can you analyse genomic data using the Bioconductor package?
20. Explain the various features of python.
21. How can you use HMM for bioinformatics analysis.
22. What is SVM? Explain

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Fourth Semester

Faculty of Science

Elective BT800403 - DATA MINING IN BIOINFORMATICS

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is Data Mining?
2. Explain microarray feature extraction.
3. How data warehouse is different from a database
4. Give a brief note on various microarray databases?
5. What is crossbow pipeline?
6. What is data cleaning
7. Comment on Refseq
8. Briefly describe tools used in Phylogenetic analysis.
9. What are the steps in knowledge mining
10. What is Deep Sequencing?
11. What is yeast two hybrid system? **(8 x 1 = 8)**

Section B

(Answer any **six** questions. Each question carries a weight of 2)

12. With suitable figures, discuss the architecture of Data Warehouse
13. How can you analyze differential gene expression using microarray technology
14. Describe Galaxy project.
15. Explain the various technologies for structural and functional metagenomic analysis.
16. Write short note on softwares used in assembly of genomes

17. Explain three-tier Data Warehousing Architecture
18. Comment on Chipseq analysis (**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Give a detailed account on NGS Technology and how it has revolutionized modern research.
20. Write down a comprehensive account on microarray data analysis.
21. Describe on the softwares used in assembly of genomes and metagenomes.
22. Explain Classification and Prediction in data mining

(**2 x 5 = 10)**

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Fourth Semester Faculty of Science

Elective BT810401 -Java programming

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is JVM?
2. Which are the different JAVA datatypes?
3. What is type casting in JAVA?
4. Explain the creation of single dimensional array using JAVA.
5. What is JAVA applet?
6. Comment on Applet in HTML.
7. What is the use of JDBC?
8. Explain assignment operators in JAVA
9. What is a token in Java
10. Comment on if statements in java **(8 x 1 = 8)**

Section B (Answer any **six** questions. Each question carries a weight of 2)

11 Explain conditional operators in JAVA

12 Explain variable declaration rules?
13 Explain with example exception handling in JAVA
14 Explain the life cycle of a JAVA Applet?
15 Explain the code to add an image to a JAVA applet.
16 Explain how to handle database queries in JAVA
17 Explain Biojava modules usage.
18 Explain the input/output operations in JAVA

(6 x 2 = 12)

Section C (Answer any **two** questions. Each question carries a weight of 5.)

19 Explain the construct and usage of JAVA applet.
20 Explain different types of operators in JAVA.
21 Explain different Loops structures in JAVA
22 Explain different BIOJAVA modules with example of its usage
(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Fourth Semester

Faculty of Science

Elective BT810402 –Advanced Genomics

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. Explain SNPs
2. What are molecular markers?
3. What is QTL.
4. What do you mean by marker assisted selection
5. What is linkage analysis.
6. Explain RFLP
7. Explain the applications of genome analysis.
8. Explain the use of mitochondrial DNA
9. Explain gene mapping.
10. What is MHC?

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11 Explain the role of MHC in disease resistance
12 Explain *in-situ* hybridization.
13 Explain FISH technique in gene mapping.
14 Explain Marker assisted selection (MAS).
15 Explain QTL isolation.
16 Explain different gene based markers
17 Explain different methods of Genotyping.
18 What are qualitative and quantitative traits.

(**6 x 2 = 12**)

Section C(Answer any **two** questions. Each question carries a weight of 5.)

19. Explain development of gene based markers.
20. Explain MAS for specific traits with examples.
21. Explain gene mapping , methods and techniques used for gene mapping
22. Explain the evolutionary significance of mitochondrial DNA.

(**2 x 5 = 10)**

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Fourth Semester Faculty of Science

Elective BT810403 –Research Methodology & Scientific Writing

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is impact factor? What factors affect its credibility?
2. When is a student t-test done?
3. What is meant by experimental design?
4. Explain variables and attributes.
5. What is the general format of a research paper?

6. Graphical representation of data
7. What are the prospects of publishing in an Open Access Journal?
8. Write briefly about Fisher's t-test?
9. What is meant by pure and applied research?
10. How is research carried out effectively?

(8 x 1 = 8)

Section B(Answer any **six** questions. Each question carries a weight of 2)

11. Give an account of experimental designs.
12. Give an account of different reference citation styles.
13. Discuss the characteristics of research
14. Define hypothesis and explain its types
15. Explain a chi-square test.
16. Compare and contrast census and sample survey
17. Write a short note on report writing
18. Discuss on ethical issues in scientific research and academics.

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Write an essay on data collection, organization and representation.
20. Discuss on the basic statistical tools used in a biological research.
21. Write an essay on scientific writing
22. Elaborate on the various factors and aspects linked to research publication.

(**2 x 5 = 10)**

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Fourth Semester

Faculty of Science

Elective BT820401 Basics of Nanotechnology

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1 . What is quantum confinement in nanomaterials?
2. Explain the working principle of TEM?
3. What is ball milling?
4. What is nanotechnology?
5. What are the outputs produced from different top down methods?
6. What are the properties and applications of ceramic nanomaterials?
7. Explain XRD?
8. Write the advantages and disadvantages of top down and bottom up methods?
9. What is targeted drug delivery?
10. What is Nano Powders?

(8 x 1 = 8)

Section B (Answer any **six** questions. Each question carries a weight of 2)

11. Explain nanoindentation?
12. Write a short note on applications of nanomaterials?
13. Briefly explain different modes of STM and AFM.
14. Briefly explain molecular beam epitaxy?
15. Explain the distortions in nanomaterials?
16. What is Raman spectroscopy?
17. Explain chemical vapour deposition method?
18. What is meant by arc discharge method?

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Explain development of gene based markers.
20. Explain MAS for specific traits with examples.
21. Explain gene mapping , methods and techniques used for gene mapping
22. Explain the evolutionary significance of mitochondrial DNA. (**2 x 5 = 10)**

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Fourth Semester

Faculty of Science

BT820402 Pharmaceutical chemistry & action of Selected drugs

Time: 3 hours **Maximum marks: 80**

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What are Nucleoside and Non Nucleoside Analogues?
2. Comment of different Antitubercular Agents.
3. What are Alkylating Agents?
4. What are Anti metabolites?
5. What are Eicosanoids?
6. What is SAR with respect to a drug.
7. What is the use of Dopamine agonists
8. What is the use of anticholinergics
9. What is agonist?
10. What is antagonist?

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Explain the chemistry of morphine.
12. Explain different Narcotic Antagonists
13. Explain the SAR of Acetyl Choline Esterase Inhibitors.
14. What are different Anti-Parkinson's Agents.
15. Explain the Chemistry,Structure and SAR of Salicylates
16. Explain the classification of anticancer agents.
17. Explain potential anti HIV targets
18. Explain the SAR of Pencillins

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Explain the Life cycle of HIV.

20. Explain the action of anticancer agents.
21. Explain the Mechanism of Anti-Inflammatory Action and their side effects.
22. Explain different Narcotic Analgesics.

(2 x 5 = 10)

Model Question Paper - Format

QP Code (to be assigned by Exam Section) **Reg. No. …..**

Name ……

M Sc Degree Bioinformatics (C.S.S) Examination

Fourth Semester Faculty of Science

BT820403 Bioinformatics data analysis

Time: 3 hours **Maximum marks: 80**

(2019 admissions onwards)

Time: Three hours Max. Weight: 30

Section- A

(Answer any **eight** questions. Each question carries a weight of 1)

1. What is a De-Bruijn graph ?
2. Explain microarray feature extraction
3. Which are the different MATLAb windows?
4. Give a brief note on various microarray databases?
5. What is crossbow pipeline?
6. Explain FISH
7. Comment on Chipseq
8. What is ANOVA and how is it used in Bioinformatics Data Analysis?
9. What is FM index?
10. What is yeast two hybrid system?

(8 x 1 = 8)

Section B

(Answer any **six** questions. Each question carries a weight of 2)

11. Explain writing script files and writing functions in MATLAB.
12. How can you analyze differential gene expression?
13. Write notes on the Galaxy project.
14. Explain the various technologies for structural and functional metagenomic analysis.
15. What are the softwares used in assembly of genomes?

16. Describe the efficiency characteristics of BLAST.
17. Comment on ANN & SVM.
18. Briefly describe tools used in Phylogenetic analysis.

(**6 x 2 = 12**)

Section C

(Answer any **two** questions. Each question carries a weight of 5.)

19. Give a detailed account on NGS Technology and how it has revolutionized modern research.
20. Write down a comprehensive account on microarray data analysis.
21. Describe on the softwares used in assembly of genomes and meta genomes.
22. Write an essay on analyzing data using substitution matrices using suitable examples.

(**2 x 5 = 10)**