Paper Code	Lectures/week (Th+Prac)	Name of paper	Theory	Practical
BIN-3001	6+3	Fundamentals of Molecular Biology	75 (60+15)	BIN-3051 25 (20+5)
BIN-3002	6+3	Computational Methods in Biomolecular Sequence and Phylogenetic Analysis	75 (60+15)	BIN-3052 25 (20+5)
BIN-3003	6+3	Computer Operational System and Organization	75 (60+15)	BIN-3053 25 (20+5)
BIN-3004	6+3	Statistical Methods	75 (60+15)	BIN-3054 25 (20+5)
BIN-3005	6+3	Object Oriented Programming In C++	75 (60+15)	BIN 3055 25 (20+5)
	Total Marks (Semester –III)		**375**	**125**

BIN-3001   FUNDAMENTALS OF MOLECULAR BIOLOGY

Theory	**: 60**
Int. ass.	**: 15**
Time	**: 3 Hours**

Objective

The Contents are related to the fundamental of molecular biology and their application in recombinant DNA technology.

General Instruction

- The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
- The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
- A candidate is required to attempt **five questions** in all by selecting two questions, from each unit and the **first compulsory question**.

UNIT I

Introduction to Molecular Biology:
DNA replication: Various modes of replication. Mechanisms of prokaryotic and Eukaryotic DNA replication.
Properties of DNA polymerases, Synthesis of Leading and lagging strands
DNA Repair: Photo-reactivation, excision repair, post replication repair, SOS repair etc.

Transcription: RNA polymerase in prokaryotes – its molecular composition, role of each component of RNA polymerase, mechanism of transcription, Eukaryotic transcription
Modification of RNA: 5' – CAP formation, 3 – end processing polyadenylation, Splicing, Editing, Nuclear export of mRNA & mRNA stability.

UNIT II

Translation: The genetic code, Wobble hypothesis. Mechanism of Prokaryotic and Eukaryotic Translation, structure and function of tRNA, rRNA, Frameshift errors, Mutagenesis: types of mutants, mutagenic agents, isolation and characterization of mutants, reversion, suppression, transposable elements.

Regulation of gene expression in prokaryotes and eukaryotic: Transcriptional control; enzyme induction and repression, constitutive synthesis of enzymes and catabolite repression. The lac operon. The trp operon.

Recommended books
1. Concepts in Biochemistry by Roodney Boyer: Brooks/Cole Publishing Co. 1st Edition, 1999.
2. Nelson DL and Cox MM. Lehninger Principles of Biochemistry, 4th edition, CBS Publishers and Distributors, New Delhi, 1984
3. Biology by Neil A. Campbell, Jane B. Reece, Published by Benjamin Cummings Co. Sixth Edition (2004)
4. Genetic: A conceptual Approach by Benjamin A. Pierce Freeman and Company 3rd Edition 2008

BIN-3051   FUNDAMENTALS OF MOLECULAR BIOLOGY (PRACTICAL)

Max Marks 25 (20+5)

1. Isolation of Genomic DNA (Microbial)
2. Isolation of DNA from WBC
3. Quantitation of DNA
4. Isolation of bacterial plasmid DNA
5. Agarose gel electrophoresis of DNA

**BIN-3002   COMPUTATIONAL METHODS IN BIOMOLECULAR
SEQUENCE AND PHYLOGENETIC ANALYSIS**

Theory	**: 60**
Int. ass.	**: 15**
Time	**: 3 Hours**

Objective
In this paper, sequence and phylogenetic analysis of proteins and nucleotides using various computational tools which are important to study conservation in different species is covered.

General Instruction
- The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
- The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
- A candidate is required to attempt **five questions** in all by selecting two questions, from each unit and the **first compulsory question**.

UNIT I

Motif and Domains: Basic concept, types of motifs and domains

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

Domain databases: CDD, SMART, ProDom

Tools for searching pattern and profile: InterPro, Pfam, Prosite, and PRATT

UNIT II

Phylogenetic analysis: Basic terminology in Phylogenetics
Introduction to phylogenetic analysis and its application, Phylogenetic tree terminology and topologies

Methods of Phylogenetic Tree Construction:
Distance Based Methods: NJ, FM & UPGMA
Character Based Methods: Maximum Parsimony & Maximum Likelihood
Brief introduction to Bootstrapping & Jackknifing.
Introduction to Phylip and MEGA packages.

Recommended books:

1. Bioinformatics: A modern approach by Vittal R. Srinivas, Prentice/ Hall of India Pvt. Ltd. New Delhi, (2005)
2. Bioinformatics by David Mount, Cold Spring Harbor Laboratory, (1989).
3. Bioinformatics: A practical guide to the analysis of genes and proteins. Ed. By Baxevanis, 3rd Edition, (1998) John Wiley & Sons, Inc. Publication
4. BLAST by Ian Korf, Mark Yandell, Joseph Bedell, O'Reilly, 1st Edition, (2003).
5. Molecular Evolution: a phylogenetic approach, (1998), 352p, ROM and Holmas FC, Blackwell Science.

BIN-3052 COMPUTATIONAL METHODS IN BIOMOLECULAR SEQUENCE AND PHYLOGENETIC ANALYSIS (PRACTICAL)

Max Marks 25 (20+5)

1. Searching Domain Databases: CDD, ProDOM
2. Searching Motif Databases: Prosite and InterPro
3. Searching Motif and domain using: ScanProsite, InterProScan and PRATT
4. Building Phylogenetic tree using distance based method & character based methods by PHYLIP or MEGA
5. Tree evaluation

BIN-3003 COMPUTER OPERATIONAL SYSTEM AND ORGANIZATION

Theory	**: 60**
Int. ass.	**: 15**
Time	**: 3 Hours**

Objective

To make students familiar with Evolution of Computers, Organization of Computers, Concepts of Assembly language and System maintenance.

General Instruction
- The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
- The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
- A candidate is required to attempt **five questions** in all by selecting two questions, from each unit and the **first compulsory question**.

UNIT I

Computer Organisation:
Evolution of computers, stored program concept and Von Neumann Architecture, Information representatin and codes, Building blocks and computer;
Combinatorial Block:
Gates, Multiplexes, decoders, Encoders etc. Sequential Building Block: Flip Flop, Registers, Counters, Random access memory; Register Transfer Language and micro-operations; concept of Bus, data movement among registers, Language to represent conditional data transfer, data movement from/to memory, Arithmetic and logical operations along with register transfer.

Architecture of a simple processor:
A simple computer Organization and instruction set, instruction execution in terms of Microinstructions, Concepts of interrupt and simple I/O organization, Implementation of the processor using building blocks; CPU organization with large registers, stacks and handling of interrupts and subroutines, instruction pipelining.

UNIT II

Concepts of Assembly Language Programming: Machine and assembly language, Pseudo operations, subroutines in assembly language, interrupt and I/O programming

I/O Organization:
Handshake based communication, vector and priority interrupts, DMA based data transfer; memory Organisation: basic cell of static and dynamic RAM, building large memories using chips associative memory, Cache memory organization, Virtual memory organization.

System Maintenance:
Introduction to various physical components of a computer, Physical Inspection of a PC and internal cards, Diagnostics on a PC, Functional description of various modules and cards. Various

types of display and other peripherals used in a PC. Installing a software. Detection of viruses and protection on a PC.

Recommended Books:
1. M. Morris Mano. Computer System Architecture, Prentice Hall International 3rd ed., (1993).
2. P. Pal Choudhar. Computer Organisation and Design, Prentice Hall of India, (1994).
3. B. Govindarajalu, IBM-PC and Clones – Hardware Troubleshooting and Maintenance, Tata – McGraw Hill, (1994).

**BIN-3053   COMPUTER OPERATIONAL SYSTEM AND ORGANIZATION
                 (PRACTICAL)**

                                                            Max Marks 25 (20+5)

Part I: Studying various physical components of computer system

1. Study of system configuration (System settings)
2. Inspection and functional description of hardware components
   - I/O Devices: Monitor, Keyboard, Mouse, Speaker, Printer, Microphone, Scanner
   - Memory: Primary – RAM, BIOS ROM
             Secondary- Hard Disk (HDD), CD Drive, Floppy Disk (FDD)
   - Mother board with Add on (Internal) cards
   - BUS: PCI, ISA etc.
          Parallel and Serial Transfer

Part II: Installing a Software
1. MS DOS: Commands, Formatting, Partitioning of Hard disk, Booting, Starting
            system with bootable disk
2. Installation of Software:
   - Windows operating system
   - MS office, Antivirus, Photoshop, C/C++ and other utility software
   - Adding / Removing new hardware devices (device drivers detection and installation)

Part III: System Maintenance
1. Disk Utilities: Defragmentation, Scanning
2. System Protection: Antivirus check for system; fixed and removable disk
3. Diagnostics on a PC
4. PC Troubleshooting

BIN-3004　　　　　　**STATISTICAL METHODS**

Theory	**: 60**
Int. ass.	**: 15**
Time	**: 3 Hours**

Objective
To study the concepts of correlation, Regression, Estimation and Testing of parametric and non-parametric Hypotheses.

General Instruction
- The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
- The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
- A candidate is required to attempt **five questions** in all by selecting two questions, from each unit and the **first compulsory question**.

UNIT-I

Bivariate data, scattered diagram, Karl Pearson's and Spearman's rank correlation. coefficient. Linear regression analysis including two variables.

Sampling distributions, Estimation of population means and proportions, confidence intervals for the parameters of normal distribution under different conditions (two sample problems also). Determination of sample size for estimating means and proportions.

UNIT-II

The basic idea of significance test. Tests of hypotheses for the parameters of a normal distribution (two sample problems also). Tests for the significance of correlation coefficient.
Categorical data: Proportions and their testing for large samples, Tests of association, goodness-of-fit using Chi-square test, Yates correction.

Analysis of variance, one-way and two-way classifications. Brief exposure of three basic principles of design of experiments, treatment, plot and block. The analysis of completely randomized design, randomized complete Block Design.
Introduction to non-parametrics: Sign test, Wilcoxon signed- rank test and mann-whitney test.

Recommended Books:
1. J.Crawshaw and J.Chamber,'Advanced level Statistics'. 4th edition, Melson Thornes, (2002).
2. S.Dobbs and J. Miller. 'Statistics (Advanced Level Mathematics)', Cambridge University Press (2002).
3. P.S.S. Sunder Rao and J. Richard, Introduction to Biostatistics and Research Methods. Fourth Edition. Eastern Economic Edition, 2006
4. Biostatistics: A Foundation for analysis in the health sciences (2000), Wayne W. Daniel.
5. Fundamentals of Statistics, 7th ed., Vol I, Vol II, Goon Gupta, Das Gupta, 1999

BIN-3054 STATISTICAL METHODS (PRACTICAL)

1. Practical Problems based on correlation coefficient, spearman's rank correlation
2. Problems based on simple regression
3. Practical based on z- test and t-test (i.e. Testing of Mean in both cases when variance is known and when variance is unknown (one sample problem). Also to find the confidence interval of population mean.
4. Practical based on testing of single proportion and difference of proportions
5. Practical on association
6. Practical on Chi-square test of goodness of fit.
7. Practical on Sign test or Wilcoxon signed- rank test and mann-whitney test

BIN-3005   OBJECT ORIENTED PROGRAMMING IN C++

Theory	**: 60**
Int. ass.	**: 15**
Time	**: 3 Hours**

Objective
To introduce the concept of object oriented programming in C++ which is helpful in writing programs to solve the problems in Bioinformatics.

General Instruction
- The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
- The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
- A candidate is required to attempt **five questions** in all by selecting two questions, from each unit and the **first compulsory question**.

UNIT-I

Methodologies: Concept of structured and object-oriented programming, Advantages of OOPs methodologies.

Introduction to object oriented programming, characteristics of OOP, Features of OOP, Abstraction, Encapsulation, Inheritance, Polymorphism; Advantages of OOP, Introduction to C++, Features of C++, Access specifier, inline functions, Reference variable, Information Hiding, Friend Functions, Friend Class.

Operator overloading and Function overloading, Inheritance: Extending classes, Types of inheritance, Virtual base class, Problems with multiple inheritance, Containership, Virtual function.

UNIT-II

Polymorphism: Compile and Runtime, Pure Virtual Function, this pointer.

Files and streams, building class Libraries in C++, File Handling in C++, Reading and Writing text files, Reading and writing binary files, Template classes and functions, Exception Handling.

Introduction to data structures like Arrays, Linked-list and stack and their implementation, Data Searching and Sorting algorithms.

Recommended Books:
1. Object Oriented Programming in C++, by Robert Lafore, Techmedia, 2002.
2. C++: How to program by Deitel and Deitel, Pearson Edition, 2002
3. The C++ Programming Languages by Stroustrup, Addison Wesely, 2001
4. Problem solving the object of Programming by by Walter Savitch Pearson Education 2003.
5. Data structures using C++, Frouzen, Thomson Learning, 2006
6. Data structures by Tanenbaum, PHI, 1997
7. Mastering Object Oriented Programming using with C++ by R. S. Salaria, Salaria Publishing house, 2014.

BIN-3055   OBJECT ORIENTED PROGRAMMING IN C++ (PRACTICAL)

Max Marks 25 (20+5)

1. Create a class employee and calculate gross salary. Demonstrate how private member functions can be accessed within a class.
2. Write a program to add, subtract, multiply and divide two complex numbers using classes.
3. Write program to illustrate the concept of various types of constructors.
4. Write program to overload binary + operator using member function.
5. Write program to demonstrate the concept of multiple inheritance.
6. Write program that implements run time polymorphism using virtual function.
7. Program to perform reading/writing operations on a file using stream classes.
8. Program to demonstrate exception handling.
9. Program to search a given number from a given list of numbers using linear as well as binary search.
10. Program to demonstrate various sorting algorithms.