

M.Sc. Bioinformatics

PROGRAMME OUTCOMES

PO1 The program aims to utilize and understand biological databases to gather, store, retrieve, manage, analyze and integrate biological data for generating new knowledge.

PO2 The program aims to impart extensive understanding and learning of theoretical concepts in Life Sciences. Each semester exclusively devotes at least one core course in life sciences in each semester. Basic practical methodology is incorporated as practical sessions in Laboratory courses in each semester.

PO3 Developing and implementing computational logic, learning programming languages, algorithms and software for progressive life science solutions.

PO4 Better understanding of dynamic biological processes and their understanding at molecular level enabled through and correlated using internet and Bioinformatics.

PO5 To develop skilled bioinformatics professionals who have life science background and who are simultaneously proficient in computational aspects.

PO6 To introduce new age concepts of big data in the 'omics' era and their analysis.

PO7 To learn basic novel strategies implemented through machine learning and artificial intelligence and understanding how their applications in bioinformatics and allied domains.

M.Sc. Bioinformatics

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO 1 Students undertaking the course shall have fundamental knowledge in theoretical Biochemistry, Cell Biology, Molecular Biology and Genetics. They will possess basic biochemistry practical skills and its application in research and industry.

PSO 2 Students undertaking the course shall have fundamental knowledge in theoretical Microbiology and Immunology, possess basic practical skills in these fields and its application in research and industry.

PSO 3 Students will learn on various aspects in Biotechnology and have hands on skills in Molecular Techniques.

PSO 4 Students will learn basic mathematical and statistical concepts and learn to apply them in aiding life science research and analysis.

PSO 5 As beginners the students will learn to use a computer, internet, scope and applications of bioinformatics.

PSO 6 Students will later learn to use the vast array of biological databases and their resources. Knowledge in life sciences would be the key and tools, methodologies and softwares used in bioinformatics will give them a comprehensive edge in data analysis.

PSO 7 Differential skills on basis of bioinformatics and computational biology proficiency would be later validated through academic supervision and systematically guided according to their skill.

- A) Some students are stronger in Life Sciences and are good in Bioinformatics Analysis
- B) Some students develop programming logic and skill and are good at developing tools and software's used in Bioinformatics

PSO 8 Students as a part of curriculum will learn many programming languages from basic C, HTML etc. to PERL, PYTHON, R Programming,, Scilab etc. Good skills in these languages will enable students to apply these languages not only in life sciences but also in other commercial domains in information technology enhancing their employability options.

PSO 9 Students will be able to use free software, operating systems, work in command line environments and extensively work in databases, their creation and management. This will be ideal for job opportunities for them in IT enabled services as well.

PSO 10 Drug discovery strategies from life science point of view and the concerted computational approach are learned, evaluated and practiced through experimental sessions and thoroughly learned.

PSO 11 Students learn Genomics and Proteomics as primary subjects in their quest for biological repositories of information where in they will find their data which they will later analyze using next generation techniques for prediction of function and annotation.

PSO 12 Students also learn basics of data mining, machine learning, and artificial neural networks as a part of curriculum in bioinformatics which can be considered as a stepping stone in comprehending industry demands and hype surrounding big data analysis.

Course Outcomes: (CO's)

Semester 1

PAPER-1 FUNDAMENTALS OF CELL BIOLOGY AND BIOCHEMISTRY

Course Outcomes:

On completion of the course the students are able

1. To understand the fundamental concepts in Cell Biology & Biochemistry
2. To integrate fundamental concepts of cell biology and biochemistry and relate the molecular mechanism with Bioinformatics
3. To learn research concepts in Cell Biology & Biochemistry

PAPER- 2 INTRODUCTION TO GENETICS AND MOLECULAR BIOLOGY

Course Outcomes:

On completion of the course the students are able

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

PAPER-3 FUNDAMENTALS OF APPLIED MATHEMATICS AND BIostatISTICS

Course Outcomes:

On completion of the course the students are able

1. To learn the basic concepts in Mathematics & Statistics
2. To apply the mathematical and statistical concepts in developing bioinformatics tools applied in life science research.
3. To apply mathematical and statistical logic in programming languages aiding life science research.

PAPER 4-INTRODUCTION TO COMPUTING AND BIOINFORMATICS

Course Outcomes:

On completion of the course the students are able

1. To learn the basic working of a Computer in the modern era.
2. To apply basic programming languages C, HTML etc. and develop logic
3. To know Bioinformatics, its scope, importance and outreach

LABORATORY COURSE 1

Course Outcomes:

On completion of the course the students are able

1. To learn basic experiments in Biochemistry which include
 - a. Identification of Carbohydrates, Proteins and Lipids by Qualitative Analysis (Colour Reactions). Quantitative Analysis of Biomolecules
2. Webpage creation using HTML & CSS
3. C programming
4. Introduction to Primary Sequence Databases & PDB

SEMESTER 2

PAPER-1 METABOLISM & ENZYMOLOGY

Course Outcomes:

On completion of the course the students are able

1. To learn concepts in Metabolism & Enzymology
2. To enable to utilize understanding concepts in Metabolism & Enzymology in Bioinformatics.
3. To learn thrust areas of research in Metabolism & Enzymology that can be remodeled, interpret and understood through Bioinformatics

PAPER -2 GENERAL MICROBIOLOGY

Course Outcomes:

On completion of the course the students are able

1. To learn the concepts of Microbiology
2. To understand the research areas in Microbiology and see how they can be manipulated using Bioinformatics.
3. To learn on pathogenic microorganisms, their modes of infection, diagnosis and care.
4. To know the basic concepts of gene cloning

PAPER -3 GENOMICS

Course Outcomes:

On completion of the course the students are able

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

PAPER-4 BIOINFORMATICS & PERL

Course Outcomes:

On completion of the course the students are able

1. To learn the basic methodology in Bioinformatics
2. To learn programming languages PERL & BIOPERL for beginners in Bioinformatics.
3. To utilize bioinformatics tools and databases for retrieving, analyzing, understanding and managing biological data.

LABORATORY COURSE II

Course Outcomes:

On completion of the course the students are able

1. To learn practical Microbiological techniques which include
 - a. 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. Isolation and characterization of bacteria of medical importance.
2. Possess working knowledge of Perl and Bio-Perl Programming
3. Understanding fundamental applications of Bioinformatics in Life Sciences which includes
 - a. Gene Structure and Function prediction, ORF Prediction, Sequence Similarity Searching, Multiple Sequence Alignment, Molecular Phylogeny and Analysis of Nucleic Acid Sequences

SEMESTER 3
PAPER 1-IMMUNOLOGY

Course Outcomes:

On completion of the course the students are able

1. To learn the basic concepts of Immunology
2. To acknowledge the scope of immune mechanism in life science research.
3. To integrate the scope of Bioinformatics tools in better understanding of immunological approaches.

PAPER-2 PROTEOMICS & CADD

Course Outcomes:

On completion of the course the students are able

1. To learn basic concepts in Proteomics and their role in Life Science Research.
2. To learn theoretical concepts in Computer Aided Drug Design and molecular Modeling
3. To apply the role of computational drug discovery methods using various tools in Bioinformatics.

PAPER-3 DATABASE CONCEPTS & BIOLOGICAL DATABASES

Course Outcomes:

On completion of the course the students are able

1. To learn the concepts in developing & creating databases
2. To learn programming languages which are applied to create databases.
3. To comprehensively understand biological databases.

PAPER4-ADVANCED BIOINFORMATICS & LINUX OPERATING SYSTEM

Course Outcomes:

On completion of the course the students are able

1. To learn advanced topics in Bioinformatics
2. To learn Free Software; Linux Operation System and working in a command line environment.
3. To understand the basic concepts of Machine learning and their application in Bioinformatics.

LABORATORY COURSE III

Course Outcomes:

On completion of the course the students are able

1. To learn some practical immunological tests which include
 - a. Agglutination Reactions-ABO Blood Grouping and Rh TypingImmuno Diffusion Assays-Single radial Immuno Diffusion assay (Mancini Technique)Double diffusion Immuno assay (Ouchterlony Technique);ELISA TestsVIDAL and VDRL slide tests for Diagnosis of Typhoid and syphilis respectively.
2. Linux & Shell Programming
3. SQL Commands & PL/SQL Programming
4. Database creation using PHP-MySQL
5. Proteomics Tools

SEMESTER IV

ELECTIVE PAPER-1 GENETIC ENGINEERING & IPR

Course Outcomes:

On completion of the course the students are able

1. To learn Genetic Engineering Techniques.
2. To learn concepts in IPR and bioethics.
3. To effectively contribute in the relevance of applying Genetic Engineering in today's industry (Commercial and Research)

ELECTIVE PAPER-2 BIO PROGRAMMING

Course Outcomes:

On completion of the course the students are able

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

ELECTIVE PAPER-3 DATA MINING IN BIOINFORMATICS

Course Outcomes:

On completion of the course the students are able

1. To learn the concepts of Data Mining
2. To utilize data mining techniques and enhance its application in acquiring Biological Data
3. To learn large scale biological data analysis using Bioinformatics Softwares.

LABORATORY COURSE IV

Course Outcomes:

On completion of the course the students are able

1. Possess working knowledge and understanding of basic molecular techniques in Biotechnology which include
 - a. DNA isolation, RNA isolation, Conjugation, cDNA preparation, Competent cell preparation, Transformation, Plasmid isolation, Restriction enzyme digestion, Ligation, RFLP, Amplification of selective gene by PCR
2. R programming
3. Python & Biopython Programming
4. Drug Design & Docking using HEX
5. Molecular Visualization Softwares – RasMol, SPDBV etc. & Homology Modeling