

Name of the Department : **DEPARTMENT OF BIOINFORMATICS**

Academic Year : 2018-19

A. Program Outcome and Program Specific Outcomes

Name of the programme (UG/PG/M.Phil./ Diploma etc.)	Programme Outcomes	Program Specific Outcomes
PG M.Sc. (Integrated Bioinformatics)	1. To equip the students to meet the requirement of corporate world and industrial standard.	1. Students will gain knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics
	2. To engage in professional development and to pursue higher education and research in the fields of Bioinformatics	2. Students will be able to use existing software effectively to extract information from large databases and to use this information in computer modeling
	3. To provide in depth knowledge about Bioinformatics and expertise in application of softwares, and in creation of tools and databases	3. Students will acquire problem-solving skills, including the ability to develop new algorithms and analysis methods
	4. Develop an insight into scientific methodology, advances in bioinformatics research and related ethical issues	4. Students will have an understanding of the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries
	5. To involve in the analysis of the human genome, identification of targets for drug discovery, development of new algorithms and analysis methods, the study of structural and functional relationships, and molecular evolution.	5. Students will be able to develop computational techniques and diversified bioinformatics tools for processing data, including statistical, machine Comprehending and data mining techniques
		6. Students will be able to design and implement efficient and reliable bioinformatics solutions by optimizing the usage of existing tools and developing new ones

Name of the programme (UG/PG/M.Phil./ Diploma etc.)	Programme Outcomes	Program Specific Outcomes
Diploma / PG Diploma	1. To applicability of this discipline is maximum in the fields of medicine and biology	1. Students will gain knowledge of genomes, the programming codes used in the study, its fundamental usage involved in medical sequencing of proteomics and much more
	2. To provides the students with a platform to imbibe in them the intricacies and in-depth aspects related to the subject	2. Students will acquire knowledge in the streams of Biomedical Research, Pharmaceutical Company, Data Base Programming and Agriculture
	3. The course opens up a wide arena of opportunity for students to explore after the completion of the program	

B1. Course Outcomes of all Programmes Offered by the Department

Name of the Programme : M.Sc. Integrated Bioinformatics

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
1.	Introduction to Computer and Bioinformatics (Core I)	I18BI101	1 Explain the basics of computer
			2 Recall the concept of input, memory and output devices of computers
			3 List the software and hardware used in computer
			4 Interpret the concepts of browser and internet
			5 Design and develop web pages.
			6 Exemplify the scope and applications of bioinformatics
			7 Describe the important bioinformatics databases
2	Introduction to Computer and Bioinformatics Lab (Core Prac I)	I18BI1P1	1 Compute various DOS commands
			2 Create document in proper format, border and word count
			3 Develop worksheet using formulas and functions
			4 Design a power point presentation with animation, audio and word art
			5 Characterize various biological databases and their data retrieval
3	Cell Biology (Allied I)	I16BI1Y1	1 Explain the basic structure and function of the cell
			2 Describe the classification of cell type
			3 Exemplify the biological significance of a cell
			4 List the organelles of a cell
			5 Discuss the regulation of cell cycle and cell division

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
4	Computational Biology and Sequence Analysis (Core II)	I16BI202	1 Explain the applications of bioinformatics in sequence alignment analysis
			2 Discuss various algorithms used for sequence alignment
			3 List out the servers used for sequence and structure alignment
			4 Predict the secondary and tertiary structures of protein
			5 Distinguish probabilistic approaches from gene finding methods
			6 After completing this course, the students will be able to
5	Computational Biology and Sequence Analysis Lab (Core Prac II)	I18BI2P2	1 Select various bioinformatics tools for sequence alignment
			2 Characterize various biological databases and their data retrieval
			3 Perform secondary structure prediction and molecular graphics tools
6	Biochemistry (Allied II)	I18BI2Y2	1 Define the basics of chemistry, structure and function of biological molecules.
			2 Explain the classification and functions of carbohydrates
			3 Discuss the physiochemical and structural properties of protein
			4 Exemplify the properties and importance of lipids
			5 List the types of nucleic acids and vitamins

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
7	Cell Biology and Biochemistry Lab (Allied Prac I)	I16BIYP1	1 Identify the mitosis from onion roots
			2 Interpret the results of barr body staining and DNA from buccal cells
			3 Perform estimations for protein and glucose
			4 Analyse the results of basic chromatographic techniques
8	SBEC-I General Chemistry (SBEC-I)	I16BI2S1	1 Recall the basics of atomic and molecular orbitals
			2 List the different types of bonded and non-bonded interactions
			3 Describe the principles of bioenergetics
			4 Define the basics of chemical kinetics
			5 List the forces involved in drug receptor complex
9	Programming In C (Core III)	I18BI303	1 Define the keywords, identifiers, variables and data types
			2 Develop program using control structures
			3 Classify the category of functions
			4 Define the structures and unions
			5 Construct file operations and allocate memory using pointers
10	Programming In C Lab (Core Prac: III)	I18BI3P3	1 Create biological programming using C
			2 Apply the loops and decision making statements on biological programming
			3 Implement different operations on arrays.
			4 Apply functions, pointers, structures and unions to solve the problem
			5 Compute file operations in C programming for a given application

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
11	Microbiology (Allied III)	I18BI3Y3	1 Describe the scope, history and classification of microbiology
			2 List the types of culture media and factors affecting the growth
			3 Discuss the types of control for microorganisms
			4 Exemplify the applications of microbes in day today life
			5 Explain the types of microbial diseases
12	Basic Mathematics (Core IV)	I18BI404	1 Define the basics of matrices and determinants
			2 Describe the basics and applications of vector algebra
			3 Explain the basics of differential calculus
			4 Discuss the applications of differential and vector calculus
13	Programming In Sci Lab (Core Prac IV)	I18BI4P4	1 Analyze the program for correctness and determine/estimate/predict the output
			2 Examine the outputs under simulation environment using SCILAB tools
14	Molecular Biology & Genetic Engineering (Allied IV)	I16BI4Y4	1 Define the basics of molecular biology
			2 Explain the steps and molecular composition involved in transcription and translation
			3 Describe the history and scope of rDNA technology
			4 List the different types of vectors

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
15	Microbiology and Genetic Engineering Lab (Allied Prac II)	I16BIYP2	1 Identify the microbes under the microscope
			2 Differentiate gram positive and gram negative bacteria
			3 Separate microbes using plating techniques
			4 Separate the DNA using agarose gel electrophoresis
			5 Isolate the DNA from bacteria and buccal cells
16	Structural Bioinformatics and Medicinal Chemistry (Core V)	I16BI505	1 Explain the basics of macromolecular and small molecule structures
			2 List the different file formats, retrieval and visualization of each biomolecule
			3 Exemplify various structure prediction techniques for proteins
			4 Predict the physiochemical and biological properties of small molecules
			5 Discuss various drug target principles
17	Programming in Perl and Bioperl (Core VI)	I16BI506	1 Describe the usage of scalar, arrays and hashes in perl
			2 Define handle expressions, arguments, statements and operators
			3 Develop algorithms through the process of top-down, stepwise refinement and implement them in Perl
			4 Explain the concepts of subroutines and acquire knowledge on file handling and file management
			5 Apply theBioPerl modules in Bioinformatics research.
			6 Write scripts and programs to handle various bioinformatics applications

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
18	Advanced Bioinformatics Lab-I (Core Prac V)	I16BI5P5	1 Characterize various tools of sequence alignment
			2 Interpret the outputs from basic structure prediction tools
			3 Generate the required information from structural database
			4 Examine various protein visualizing software
19	Programming In Perl and Bioperl Lab (Core Prac VI)	I16BI5P6	1 Apply theperl programming in solving general and in biological problems
			2 Perform the program for sequence analysis
			3 Apply and analyse the outputs of DNA computing
20	Biophysics (Elective I)	I13BI5:1	1 Discuss the basics of crystal system and bravis lattice
			2 Define how protein crystals are formed
			3 Exemplify the techniques of downstream process for crystal analysis
			4 Examine the <i>in-silico</i> techniques that are used for the prediction of protein structures
21	Database and Tools For Bioinformatics (Elective I)	I13BI5:2	1 Discuss the genome sequences repositories and derived databases
			2 Explain the structural database and its classification
			3 Classify various visualization tools and its usage
			4 Use the docking software to design drug and predict active site

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22	Biostatistics and Numerical Methods (Elective II)	I13BI5:3	1 Define the basics of numerical measures
			2 Explain the correlation and regression
			3 Write and interpret the basics of probability
			4 List the different types of rule in numerical integration
			5 List the different methodology for solving ordinary differential equations
23	Research Methodology (Elective II)	I13BI5:4	1 Interpret the types of research
			2 Identify the importance of literature review
			3 Illustrate the research design
			4 Organize the research report in proper order
			5 Exemplify the importance of IPR, ethics and plagiarism
24	Applied Bioinformatics (SBEC II)	I14BI5S2	1 Design the research work
			2 Apply for patent the novel ideas
			3 Analyse the multiple gene expression using microarray
			4 Plan to commercialize the lead compound discovered in the lab
25	Database Management System & SQL (Core VII)	I18BI607	1 Define the scope and history of database systems
			2 List the different types of data model
			3 Describe the basics of SQL
			4 Organize and analyse scientific data and data integration in bioinformatics
			5 Discuss about the integration platform for databanks in bioinformatics

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
26	Basics of Basics of Molecular Modeling And Drug Design (Core VIII)	I18BI608	1 Discuss the importance of molecular modeling
			2 List the bonded and non-bonded interactions
			3 Classify the different types of energy minimization
			4 Explain the steps involved and software required of molecular dynamics
			5 Examine and relate from structure prediction to drug design
27	Database Management System & Sql Lab (Core Prac VII)	I18BI6P7	1 Create, manage, alter, update, insert and delete the table and files
			2 Organize and work with biological datasets
			3 Analyse the queries and technique to work with different table and datasets
28	Advanced Bioinformatics Lab-II (Core Prac VIII)	I18BI6P8	1 Create the small molecules and prepare them in proper file format
			2 Interpret the post-docking results and analyse their interactions
			3 Analyse the biological properties of small molecules
29	Biodiversity Informatics (Elective III)	I13BI6:1	1 Explain the basics of biodiversity information
			2 Classify and categorize the biodiversity information
			3 Illustrate the design of biodiversity information system
			4 Assess the worldwide biodiversity databases
			5 Exemplify the global biodiversity information system

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30	Immunoinformatics (ELECTIVE III)	I13BI6:2	1 Identify the antigen processing mechanism
			2 List the different types of immune cells and mechanism
			3 Explain about production of antibody
			4 Analyze the Sequence and structure of antibody using Immunoglobulin database
31	Comprehensive Practice For Bioinformatics Competitive Examination (SBEC III)	I16BI5S3	1 Recall the basics of computers and programming
			2 Define the scopes and applications of bioinformatics
			3 Describe the basics of microbiology and cell and molecular biology
			4 Discuss the basics of mathematics
			5 Explain the basics and applications of structural bioinformatics
32	Basic Bioinformatics (NMEC-I)	I13BI3E1	1 Define the basics of bioinformatics scope and applications.
			2 Describe the properties of the most important bioinformatics databases
			3 Explain the major steps in pairwise and multiple sequence alignment,
			4 Write the principle for pairwise sequence alignment by dynamic programming.
33	Basic Structural Bioinformatics (NMEC II)	I13BI4E2	1 Explain the basics of DNA, RNA, protein structure.
			2 List the biological databases and visualization tools
			3 Write the steps involved in structure alignment
			4 Classify the types of protein structure prediction
			5 Discuss the applications of structural bioinformatics

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
34	Cell and Molecular Biology (Core IX)	I13BI709	1 Define the basic concepts of cell organelles and its function
			2 Relate cellular functions with the overall activity of a living organism
			3 Analyse molecular mechanics of gene and its regulation
			4 Predict the role of Si RNA in gene silencing
			5 Comprehend about gene expression analysis
35	Core X: Programming in C++ And Java (Core X)	I17BI710	1 Develop browser based programs using the JavaScript language
			2 Select and use essential components of Internet-based applications with graphical user interface (GUI)
			3 Design interactive web pages and web-based applications
			4 Develop design applications using packages
			5 Apply inheritance features to multiple classes
36	Bioinformatics Databases & Tools (Core XI)	I13BI711	1 Define and analyse the importance of databases with cell and molecular Biological concepts
			2 Comprehend about Genome database, mapping and structure prediction.
			3 Predict the secondary and tertiary structures of protein and its interaction using advanced tools
37	Programming In Java Lab (Core Prac IX)	I13BI7P5	1 Comprehend about the objects and classes in Java
			2 Develop biological application programs using Java
			3 Select and use appropriate functions to implement packages.
			4 Create applets for drawing shapes

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
38	Bioinformatics Databases and Tools Lab (Core Prac X)	I13BI7P6	1 Perform text-based and sequence-based searches, to analyse the concepts of Molecular biology
			2 Comprehend how to map a genome and analyze literature database, structure database, and derived Database.
			3 Predict the secondary and tertiary structures of protein sequences using ExPasy server and EMBOSS.
39	Proteins – Structure And Functions (Elec IV)	I13BI7:1	1 Comprehend the classifications of proteins based on their structural arrangements
			2 Predict the structural and functional modifications attained by the macromolecules
			3 Comprehend about the cofactors and coenzymes in biological systems.
40	Molecular Interactions (Elec IV)	I13BI7:2	1 Comprehend the fundamentals of bonding and non-bonded interactions
			2 Differentiate small molecular and macromolecular structures
			3 Comprehend about the different types of molecular interactions
			4 Analyse and evaluate the macromolecules using biophysical techniques
41	Algorithm for Computational Biology (Core XII)	I13BI812	1 Comprehend the principles of bioinformatics tools
			2 Design Algorithms for mathematical models
			3 Comprehend sequence and structural databases
			4 Analyse the role of different computational methods in solving the biological problems.

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42	Probability and Biomathematics (Core XIII)	I18BI813	1 Compute probabilities and conditional probabilities using laws and theorems
			2 Solve and compare real world problems using combinatorial analysis.
			3 Analyse biological problems with statistical data
43	Molecular Modeling and Drug Design (Core XIV)	I18BI814	1 Comprehend and perform Protein modelling and evaluation
			2 Explain the concepts of molecular modeling, pharmacophore, virtual screening, molecular docking, 3D QSAR etc.,
			3 Comprehend the advantages and limitations of computational tools
			4 Analyse and interpret the problems in designing the drug
44	Computational Biology, Statistics Using R and Drug Designing Lab (Core Prac XI)	I17BI8P7	1 Design the small molecules and prepare them in proper file format
			2 Perform molecular docking using advance docking tools and interpret the post-docking results
45	Basics of Next Generation Sequencing (Elec V)	I18BI8:1	1 Design and analyze large-scale of next-generation sequencing experiments
			2 Define the basics of biological problems informatics theories
			3 Implement different analysis tools (such as alignment, alternative splicing, variant call, ...)
			4 Comprehend the advantages, limitations of standard statistical/bioinformatics methods

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46	Herbal Medicine (Elec V)	I13BI8:2	1 Comprehend the history of herbal medicine and its evolution
			2 Discuss about the common medicinal techniques that are followed in ancient India
			3 Exemplify the standardization and preservation of herbal medicines and the databases for herbal medicines.
47	Genomics and Proteomics (Core XV)	I17BI915	1 Define and discuss the different components in prokaryotic and eukaryotic genomes and proteomes and its sequencing methods.
			2 Analyse molecular mechanisms responsible for diseases.
			3 Comprehend the importance of maps in genome sequencing
			4 Develop protein-protein interactions and its techniques.
			5 Predict the gene expressed in particular disease through microarray analysis.
48	Advances in Structural Bioinformatics (Core XVI)	I13BI916	1 Discuss the topology and arrangements of macromolecular and small molecule structures
			2 Comprehend about the molecular dynamics simulation techniques for macromolecules
			3 Analyse the post docking analysis and the factors involved in protein-ligand interactions
49	Programming in Python (Core XVII)	I17BI917	1 Define and design scripting languages.
			2 Differentiate the object-oriented concepts and built-in objects
			3 Analyse standard python algorithms to solve a given biological problems
			4 Create new Python based software tools for life science research.

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
50	Advances in Structural Bioinformatics Lab (Core Prac XII)	I13BI9P8	1 Design small molecules and prepare them in proper file format
			2 Perform docking in advance docking tools and Interpret the post-docking results
			3 Analyse the biological properties of small molecules
51	Programming in Python Lab (Core Prac XIII)	I17BI9P9	1 Create Syntax and Semantics functions in Python.
			2 Develop strings, Lists, Dictionaries and Files in Python.
			3 Design Object Oriented Programming concepts in Python
52	Cheminformatics (Elec VI)	I13BI9:1	1 Analyse data from various chemical databases
			2 Discuss the chemical properties of the given drug using computational methods
			3 Develop the drugs using computational tools
			4 Exemplify the bioavailability of the drugs
53	Biodiversity, Bioethics and IPR (Elec VI)	I13BI9:2	1 Differentiate and classify biodiversity
			2 Analyse the benefits and ethical issues in genetic engineering
			3 Comprehend the gene therapy and implications of cloning
			4 Analyse the biosafety protocols and risk management
			5 Ascertain the importance intellectual property rights and its implications

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
54	Pharmacoinformatics (Core XVIII)	I17BIX18	1 Comprehend the principles of human genetics and genomics
			2 Analyse the genetic differences between individuals and drug therapy in a positive and negative way.
			3 Understand the basis of variability in drug response and its efficacy and toxicity, adverse drug reactions and drug-drug interactions
			4 Analyse tools for pharmacogenomic analysis. Pharmacokinetics (PK), Pharmacodynamics (PD)
			5 Predict the structural changes among sequences caused by polymorphisms.
55	Advanced Applied Bioinformatics (Elec VII)	I17BIX:1	1 Define the gene expression and monitoring disease
			2 Analyse microbial species and its functional information
			3 Analyse the new drugs and target identification
			4 Comprehend about pharmacogenomics and its applications
56	Bioinformatics In Biodiversity, Agriculture, Medicine And Environment (Elec VII)	I17BIX:2	1 Comprehend the biodiversity values and its management.
			2 Assess the biodiversity application softwares and study about the virtual libraries
			3 Understand gene therapy and drug targets
			4 Predict biotechnological application of microbes and forensic analysis
			5 Generate ideas in synthetic biology which comprises the technology and applications of Directed Evolution and Microbial Engineering

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
57	Databases And Sequence Analysis (NMEC-III)	I13BI8E3	1 Ascertain the sequence alignment and algorithms
			2 Define different methods and analysis and Concepts of Evolutionary analysis
			3 Design and develop web pages
			4 Comprehend the basics of bioinformatics scope and applications
			5 Describe the contents and properties of the most important bioinformatics databases, perform text- and sequence-based searches

B2. Course Outcomes of all Programmes Offered by the Department

Name of the Programme : PG Diploma in Bioinformatics

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
1.	Bioinformatics and Computational Biology (Core I)	PD18BI11	1 Explain the basics of computer
			2 Recall the concept of input, memory and output devices of computers
			3 List out the servers used for sequence and structure alignment
			4 Predict the secondary and tertiary structures of protein
			5 Distinguish probabilistic approaches from gene finding methods
2	Computer Programming (Core II)	PD18BI12	1 Define the keywords, identifiers, variables and data types
			2 Develop program using control structures
			3 Recall the concept of input, memory and output devices of computers
			4 List the software and hardware used in computer
			5 Classify the category of functions
3	Basic Bioinformatics & Programming In C (Core Practical I)	PD18BIP1	1 Create document in proper format, border and word count
			2 Develop worksheet using formulas and functions
			3 Design a power point presentation with animation, audio and word art
			4 Characterize various biological databases and their data retrieval
			5 Create biological programming using C
			6 Compute file operations in C programming for a given application

Sl. No.	Name of the Course	Course Code	Program Specific Outcomes (After completing this course, the students will be able to)
4	Genomics & Proteomics (Core-III)	PD18BI23	1 Define and discuss the different components in prokaryotic and eukaryotic genomes and proteomes and its sequencing methods.
			2 Analyse molecular mechanisms responsible for diseases.
			3 Comprehend the importance of maps in genome sequencing
			4 Develop protein-protein interactions and its techniques.
			5 Predict the gene expressed in particular disease through microarray analysis
5	Applied Bioinformatics (Core IV)	PD18BI24	1 Design the research work
			2 Apply to patent the novel ideas
			3 Analyse the multiple gene expression using microarray
			4 Plan to commercialize the lead compound discovered in the lab
6	Molecular Modeling and Drug Design (Core V)	PD18BI25	1 Discuss the importance of molecular modeling
			2 List the bonded and non-bonded interactions
			3 Classify the different types of energy minimization
			4 Explain the steps involved and software required of molecular dynamics
			5 Examine and relate from structure prediction to drug design
7	Advanced Bioinformatics Lab (Core Practical II)	PD18BIP2	1 Create the small molecules and prepare them in proper file format
			2 Interpret the post-docking results and analyse their interactions
			3 Analyse the biological properties of small molecules