BISHOP HEBER COLLEGE (AUTONOMOUS)
TIRUCHIRAPPALLI – 620017
TAMILNADU, INDIA

COURSE OUTCOMES

DEPARTMENT OF BIOINFORMATICS (Integrated)

STRUCTURE OF THE SYLLABUS

Programme: M.Sc., BIOINFORMATICS (INTEGRATED) (2021-2022)

Program Name	Course	Course Code	Course Title
M.Sc. Bioinformatics	Core I	I20BI101	Introduction to Computer and Bioinformatics
M.Sc. Bioinformatics	Core Prac. I	I18BI1P1	Introduction to Computer and Bioinformatics Lab
M.Sc. Bioinformatics	Allied I	I16BI1Y1	Cell Biology
M.Sc. Bioinformatics	Allied Prac. I	I16BIYP1	Cell Biology and Biochemistry Lab
M.Sc. Bioinformatics	Core II	I16BI202	Computational Biology and Sequence Analysis
M.Sc. Bioinformatics	Core Prac. II	I18BI2P2	Computational Biology and Sequence Analysis Lab
M.Sc. Bioinformatics	Allied II	I18BI2Y2	Biochemistry
M.Sc. Bioinformatics	Allied Prac. I	I16BIYP1	Cell Biology and Biochemistry Lab
M.Sc. Bioinformatics	Core III	I20BI303	Programming in C and C++
M.Sc. Bioinformatics	Core Prac. III	I20BI3P3	Programming in C and C++ Lab
M.Sc. Bioinformatics	Allied III	I18BI3Y3	Microbiology
M.Sc. Bioinformatics	Allied Prac. II	I16BIYP2	Microbiology and Genetic Engineering Lab
M.Sc. Bioinformatics	Core IV	I18BI404	Basic Mathematics
M.Sc. Bioinformatics	Core Prac. IV	I20BI4P4	Octave Programming for Bioinformatics
M.Sc. Bioinformatics	Allied IV	I16BI4Y4	Molecular Biology and Genetic Engineering
M.Sc. Bioinformatics	Allied Prac. II	I16BIYP2	Microbiology and Genetic Engineering Lab
M.Sc. Bioinformatics	Core V	I16BI505	Structural Bioinformatics and Medicinal Chemistry
M.Sc. Bioinformatics	Core VI	I16BI506	Programming in PERL and BioPERL
M.Sc. Bioinformatics	Core Prac. V	I16BI5P5	Advanced Bioinformatics Lab - I
M.Sc. Bioinformatics	Core Prac. VI	I16BI5P6	Programming in PERL and BioPERL Lab
M.Sc. Bioinformatics	Elective I	I13BI5:1/ I13BI5:2	Biophysics / Database and Tools for bioinformatics
M.Sc. Bioinformatics	Elective II	I13BI5:3/ I13BI5:4	Biostatistics and Numerical Methods/Research Methodology
M.Sc. Bioinformatics	Core VII	I20BI607	Database Management System and SQL
M.Sc. Bioinformatics	Core VIII	I20BI608	Molecular Modeling and Drug Design
M.Sc. Bioinformatics	Core Prac. VII	I18BI6P7	Database Management System and SQL Lab
M.Sc. Bioinformatics	Core Prac. VIII	I18BI6P8	Advanced Bioinformatics Lab - II
M.Sc. Bioinformatics	Elective III	I20BI6:1/ I20BI6:2	Biodiversity Informatics / Immunoinformatics
M.Sc. Bioinformatics	Core Project - I	I18BI6PJ	Project

Program Name	**Course**	**Course Code**	**Course Title**
M.Sc. Bioinformatics	Core IX	I20BI709	Algorithm for Computational Biology
M.Sc. Bioinformatics	Core X	I21BI710	Programming in JAVA
M.Sc. Bioinformatics	Core XI	I20BI711	Bioinformatics Database and Tools
M.Sc. Bioinformatics	Core Prac. IX	I20BI7P9	Programming in Java Lab
M.Sc. Bioinformatics	Core Prac. X	I20BIP10	Bioinformatics Database and Tools Lab
M.Sc. Bioinformatics	Elective IV	I20BI7:4/ I20BI7:A	Protein Structure and functions / Molecular Interactions
M.Sc. Bioinformatics	Core XII	I20BI812	R Programming in Bioinformatics
M.Sc. Bioinformatics	Core XIII	I20BI813	Probability and Biomathematics
M.Sc. Bioinformatics	Core XIV	I20BI814	Principles of Drug design and Development
M.Sc. Bioinformatics	Core Prac. XI	I20BIP11	Computational Biology, Statistics using R and Drug Designing Lab
M.Sc. Bioinformatics	Elective V	I20BI8:5/ I20BI8:A	Basics of Next Generation Sequencing / Herbal Medicine
M.Sc. Bioinformatics	Elective VI	I20BI8:6/ I20BI8:B	Systems Biology/ Research Methodology, Bioethics, Biosafety and IPR
M.Sc. Bioinformatics	Core XV	I20BI915	Genomics and Proteomics
M.Sc. Bioinformatics	Core XVI	I20BI916	Advance in Structural Bioinformatics
M.Sc. Bioinformatics	Core XVII	I20BI917	Programming in Python
M.Sc. Bioinformatics	Core Prac. XII	I20BIP12	Advances in Structural Bioinformatics Lab
M.Sc. Bioinformatics	Core Prac. XIII	I20BIP13	Programming in Python Lab
M.Sc. Bioinformatics	Elective VII	I20BI9:7/ I20BI9:A	Cheminformatics / Biodiversity, Bioethics and IPR
M.Sc. Bioinformatics	Core XVIII	I20BIX18	Pharmacoinformatics
M.Sc. Bioinformatics	Elective VIII	I120BIX:8 / I20BIX:A	Big Data Analytics for Bioinformatics/ Application of Bioinformatics in Biodiversity, Agriculture medicine and Environment
M.Sc. Bioinformatics	Core Project- II	I20BIXPJ	Project

CORE I : INTRODUCTION TO COMPUTER AND BIOINFORMATICS

SEMESTER : I **COURSE CODE : I20BI101**
CREDITS : 4 **HOURS/ WEEK: 4**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the basics of computer	K1	I
CO2	Discuss the components of input, memory and output devices of computers	K2	I
CO3	Demonstrate the mechanism of working of software and hardware	K3	II
CO4	Describe the basics of bioinformatics, scope and its applications	K1	III
CO5	Summarize the details about biological databases	K2	IV
CO6	Classify Secondary Databases	K2	V

CORE PRAC I : INTRODUCTION TO COMPUTER AND BIOINFORMATICS LAB

SEMESTER : I **COURSE CODE: I18BI1P1**
CREDITS : 2 **HOURS/ WEEK : 3**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Demonstrate the document in proper format, border and word count	K3	1
CO2	Employ worksheet using formulas and functions	K3	2
CO3	Create a power point presentation with animation, audio and video.	K5	3
CO4	Practice the retrieval of Protein and nucleotide sequence using NCBI, EMBL, DDBJ and UniProt	K3	4,5,6
CO5	Differentiate between SCOP and CATH	K4	7
CO6	Analyse the profiles and patterns of the protein sequence	K4	8

ALLIED I : CELL BIOLOGY

SEMESTER : I **COURSE CODE : I16BI1Y1**
CREDITS : 4 **HOURS/ WEEK : 4**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Differentiate the organization of prokaryotic and eukaryotic cells	K3	I
CO2	Relate the role of biomolecules in maintaining the plasma membrane stability /function	K2	II
CO3	Analyze and compare the different transport mechanisms available to: transfer the solutes through plasma membrane	K4	III
CO4	Illustrate the structure and organization of various cell organelles	K3	IV
CO5	Describe the various stages of cell cycle and its regulation	K2	V
CO6	Explain the working principle of microscope	K2	I

CORE II : COMPUTATIONAL BIOLOGY AND SEQUENCE ANALYSIS

SEMESTER : II **COURSE CODE: I16BI202**
CREDITS : 6 **HOURS/ WEEK : 6**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the principal of sequence alignment	K2	I
CO2	Analyze the pair wise Sequence alignment methods	K4	II
CO3	Categorize the types of Basic Local Alignment Search Tool	K4	III
CO4	Explain the Motif and Domain Database	K2	IV
CO5	Gene prediction using various probabilistic approaches	K3	V
CO6	Summarize the programmes available for gene finding	K4	V

CORE PRAC II: COMPUTATIONAL BIOLOGY AND SEQUENCE ANALYSIS LAB
SEMESTER : II **COURSE CODE : I18BI2P2**
CREDITS : 2 **HOURS/ WEEK : 3**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Demonstrate pair wise global and local alignment using Dotplot, Emboss Needle and Emboss Water	K3	1, 2
CO2	Analyze Nucleotide and Protein sequence using BLAST and FASTA Programs	K4	2, 3
CO3	Practice the steps used for Multiple Sequence alignment of the given protein and nucleotide sequence using Clustal Omega	K3	4
CO4	Use Expasy for structure analysis through SOPMA	K3	5, 6
CO5	Employ GenMark and GeneScan for gene finding.	K3	7, 8
CO6	Summarize the various literature databases and be aware of the importance of Pubmed and OMIM	K2	9, 10

ALLIED II : BIOCHEMISTRY
SEMESTER : II **COURSE CODE : I18BI2Y2**
CREDITS : 4 **HOURS/ WEEK : 4**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Recall the basic chemistry of elements & molecules learnt in high school and describe the structure-function aspects of biomolecules	K1	I
CO2	Illustrate the influence of chemical bonding through intra and intermolecular forces in assemblage of higher order structures	K3	II
CO3	Identify the methods of analysis of various biomolecules	K3	III
CO4	Analyze the structure and function of biomolecules and survey their commercial uses.	K4	IV
CO5	Critically appraise theories pertaining to mechanisms of biomolecular action and physiological correlations thereof.	K4	V
CO6	Develop keen understanding to identify, represent and study biological macromolecules and apply knowledge gained in in silico applications	K5	I

ALLIED PRAC I: CELL BIOLOGY AND BIOCHEMISTRY LAB

SEMESTER : I/II **COURSE CODE : I16BIYP1**
CREDITS : 3 **HOURS/ WEEK : 3**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Identify the mitosis from onion roots	K2	a1
CO2	Interpret the results of barr body staining	K6	a2
CO3	Demonstrate the isolation of DNA from Buccal cells	K3	a3 & a4
CO4	Prepare stock standard and working standard solution	K5	b1, b3, b4
CO5	Perform estimations for protein and glucose	K3	b2,b3, b4
CO6	Analyse the results of basic chromatographic techniques	K4	b5

SBEC –I: GENERAL CHEMISTRY

SEMESTER : II **COURSE CODE : I16BI2S1**
CREDITS : 2 **HOURS/ WEEK : 2**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Repeat the basics of atomic and molecular orbital	K1	I
CO2	List the different types of bonded and non-bonded interactions	K1	II
CO3	Describe the principles of bioenergetics	K2	III
CO4	Define the basics of chemical kinetics	K2	IV
CO5	List the forces involved in drug receptor complex	K1	V
CO6	Explain the factors that are affecting the chemical reactions	K2	I

CORE III : PROGRAMMING IN C and C++

SEMESTER : III **COURSE CODE : I20BI303**
CREDITS : 6 **HOURS/ WEEK : 6**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Practice the basics structure and operations in C and C++ programming languages	K3	I
CO2	Differentiate the various looping and branching techniques in C	K4	II
CO3	Integrate the concepts of user defined datatypes in C	K5	III
CO4	Analyze the advantages of object oriented C++ programming over C	K4	IV
CO5	Assess the input and output operations in C++	K6	IV
CO6	Build the concepts of classes and objects, constructors and inheritance operations in C++	K5	V

CORE PRAC: III. PROGRAMMING IN C and C++ LAB

SEMESTER : III **COURSE CODE :I20BI3P3**
CREDITS : 2 **HOURS/ WEEK : 3**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	State the basics of programming	K1	1,2,4
CO2	Discuss the need for programming in Biology	K2	3,5
CO3	Apply programming concepts to analyze molecular sequences	K3	6,7,9
CO4	Relate object oriented programming with Bioinformatics and its role in handling complex data	K4	8,11,12,17
CO5	Develop efficient skills in file managing operations	K5	7,10,13,16
CO6	Create various operations on classes and objects in C++	K5	14,15

ALLIED III: MICROBIOLOGY

SEMESTER : III **COURSE CODE : I18BI3Y3**
CREDITS : 4 **HOURS/ WEEK: 4**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the history, classification and scope of microbiology	K1	I
CO2	List out the types of culture media and factors affecting the growth of microbes	K1	II
CO3	Discuss the methods used for controlling the growth of microorganisms	K2	III
CO4	Inspect the applications of microbes in day today life	K4	IV
CO 5	Use microorganisms to produce useful products	K4	IV
CO 6	Explain the types of microbial diseases	K2	V

CORE IV: BASIC MATHEMATICS

SEMESTER : IV **COURSE CODE : I18BI404**
CREDITS : 5 **HOURS/ WEEK: 6**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Recall the basics of linear algebra involving the definition of matrices and determinants	K1	I
CO2	Explain Cramer's rule- matrix method to solve linear system of equations	K2	I
CO3	Analyse the difference between scalar and vector quantities, types of vectors the basics and applications of vector algebra in solving problems	K4	II
CO4	Determine the fundamentals of differential calculus including functions and limits	K3	III
CO5	Solve problems using the rules of differentiation	K6	IV
CO6	Evaluate problems involving various methods of integration	K5	V

CORE PRAC IV: OCTAVE PROGRAMMING FOR BIOINFORMATICS
SEMESTER : IV **COURSE CODE: I20BI4P4**
CREDITS : 2 **HOURS/ WEEK : 3**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Analyze the program for correctness and determine/ estimate/ predict the output	K4	1, 4
CO2	Write programs using statistical methods	K1	2, 3, 4, 5
CO3	Sketch the usage of equation solving functions	K3	2, 3, 5
CO4	Demonstrate the applications of 2D and 3D graphs	K3	7
CO5	Quantify the outputs under simulation environment using Octave tools	K4	6, 7
CO6	Formulate the applications of plots in Biological problems	K5	5, 8

ALLIED IV: MOLECULAR BIOLOGY & GENETIC ENGINEERING
SEMESTER : IV **COURSE CODE : I16BI4Y4**
CREDITS : 4 **HOURS/ WEEK: 4**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Illustrate DNA replication mechanism in prokaryotes and Eukaryotes	K2	I
CO2	Analyze the functions of the proteins involved in eukaryotic and prokaryotic transcription	K4	II
CO3	Interpret the genetic code	K2	III
CO4	Employ DNA modifying enzymes in gene cloning	K3	IV
CO5	Categorize vectors based on their features	K4	V
CO6	Report on gene libraries and its construction	K6	V

ALLIED PRAC II: MICROBIOLOGY AND GENETIC ENGINEERING LAB
SEMESTER : III/IV **COURSE CODE : I16BIYP2**
CREDITS : 3 **HOURS/ WEEK: 3**

At the end of this course, the students will be able to

CO	Course Outcomes	Level	Experiment
CO1	Identify the microbes under the microscope	K2	a1
CO2	Differentiate gram positive bacteria from gram negative bacteria	K4	a2
CO3	Categorize microbes using plating techniques	K4	a3
CO4	Analyze the isolated DNA from buccal and bacterial cell	K3	b1&b2
CO5	Demonstrate agarose gel electrophoresis	K3	b3
CO6	Illustrate the mechanism of Restriction digestion of DNA and southern blot hybridization	K2	b4&b5

CORE V: STRUCTURAL BIOINFORMATICS AND MEDICINAL CHEMISTRY
SEMESTER : V **COURSE CODE : I16BI505**
CREDITS : 5 **HOURS/ WEEK: 6**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Recall the different Level and organization of protein structure	K1	I
CO2	Explain basic principles of experimental methods for the determination of the structure of Macromolecules	K2	I
CO3	Discuss some of the relevant protein, DNA and RNA databases including PDB and associated file formats, data representation and file viewers	K2	II
CO4	Analyze the appropriate tools to predict the secondary and tertiary structure of a protein Sequence of interest	K4	III
CO5	Relate the four key components of ADME properties	K4	IV
CO6	Assess the cell signaling receptors and its role in drug designing.	K6	V

CORE VI: PROGRAMMING IN PERL AND BIOPERL

SEMESTER : V **COURSE CODE : I16BI506**
CREDITS : 5 **HOURS/ WEEK : 6**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Reiterate the concepts of programming language	K2	I
CO2	Experiment with file handling and directory handling	K4	II
CO3	Test loops and control structures	K4	III
CO4	Prepare PERL scripts to use regular expressions and subroutines	K5	IV
CO5	Design applications with string handling functions	K5	IV
CO6	Create applications in BioPerl	K5	V

CORE PRAC VI: PROGRAMMING IN PERL AND BIOPERL LAB

SEMESTER : V **COURSE CODE : I16BI5P6**
CREDITS : 2 **HOURS/ WEEK: 3**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Develop scripts using arrays	K4	A1, A2, A3, A4, A5, A6, A7, A8
CO2	Compose applications with file handling with string handling functions	K5	A9, A10, A11
CO3	Construct Bioperl scripts using built-in functions	K5	B1,B2, B3, B4, B5, B6, B7, B8
CO4	Integrate scripts with external databases	K5	B9, B10
CO5	Apply math functions	K3	B11, B12
CO6	Design applications with subroutines	K5	B13, B14

CORE PRAC V: ADVANCED BIOINFORMATICS LAB-I

SEMESTER : V **COURSE CODE: I16BI5P5**
CREDITS : 2 **HOURS/ WEEK : 3**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Interpret the outputs from basic structure prediction tools	K3	2
CO2	Generate the required information from structural database	K2	1
CO3	Examine various protein visualizing software	K4	5
CO4	Compare the various gene manipulation tools	K5	4
CO5	List the various secondary structure prediction and validating servers	K2	2
CO6	Evaluate the phylogeny of the given sequences	K6	3

ELECTIVE I : BIOPHYSICS

SEMESTER : V **COURSE CODE: I13BI5:1**
CREDITS : 5 **HOURS/ WEEK :5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Underline the basics of physiochemical properties of atoms and bonds	K1	I
CO2	Employ the separation techniques for biomolecule purification	K3	II
CO3	Describe the basics of crystal system and bravis lattice	K2	III
CO4	Illustrate the methodology of X-ray diffraction	K2	IV
CO5	Theorize the steps involved in NMR spectroscopy	K4	IV
CO6	Propose the importance of optimization of biomolecule	K5	V

ELECTIVE I : DATABASE AND TOOLS FOR BIOINFORMATICS

SEMESTER : V **COURSE CODE : I13BI5:2**
CREDITS : 5 **HOURS/ WEEK: 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Discuss the genome sequences repositories and derived databases	K2	I
CO2	Explain the structural database and its classification	K2	II
CO3	Classify various visualization tools and its usage	K2	III
CO4	Use the docking software to design drug and predict active site	K3	IV
CO5	Describe how bioinformatics data is store and organized	K2	V
CO6	Categorize the applications Genomic database in various fields	K4	I

ELECTIVE II : BIOSTATISTICS AND NUMERICAL METHODS

SEMESTER : V **COURSE CODE : I13BI5:3**
CREDITS : 5 **HOURS/ WEEK: 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Explain the basics concept of numerical measures	K2	I
CO2	Construct the correlation and regression coefficient for bivariate data	K3	II
CO3	Knows the application of Baye's theorem	K3	III
CO4	Quantify the different types of rule in numerical integration	K4	IV
CO5	Catalogue different methodologies for solving ordinary differential equations	K4	V
CO6	Apply the concepts of Euler's Methods in differential equations to execute biological algorithms	K3	V

ELECTIVE II: RESEARCH METHODOLOGY

SEMESTER : V **COURSE CODE : I13BI5:4**
CREDITS : 5 **HOURS/ WEEK: 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the research and its types.	K1	I
CO2	List the factors are used in research formulation	K1	II
CO3	Sketch the research plan - Exploration, Description, Diagnosis, Experimentation	K3	III
CO4	Extrapolate Structure and components of scientific reports	K4	IV
CO5	Illustrate the different steps in the preparation, Layout, structure and Language of typical reports	K2	IV
CO6	Critique the environmental impacts, Ethical issues, ethical committees, Commercialization	K4	V
CO7	Analyze the reproduction of published material, Plagiarism, Citation and acknowledgement, Reproducibility and accountability	K4	V

SBEC II: APPLIED BIOINFORMATICS

SEMESTER : V **COURSE CODE : I14BI5S2**
CREDITS : 2 **HOURS/ WEEK : 2**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Explain the Microarray, Functional Genomics and Computational Tools useful for Bioinformatics Research	K2	I
CO2	Use the In silico prediction of SSR and SNP. Chromosomes and nuclear DNA amount to deduce Evolutionary Relationship of the species.	K3	II
CO3	Identify the Molecular Evolution and Phylogenetic analysis and plant DNA Barcoding	K2	III
CO4	Apply Quantum Mechanical Methods to accurate in silico Drug designing	K3	IV
CO5	Analyse the Computational Toxicology	K4	IV
CO6	Discuss the Computational statistics and computational Biology in Bioinformatics	K2	V

CORE VII : DATABASE MANAGEMENT SYSTEM & SQL

SEMESTER : VI **COURSE CODE : I20BI607**
CREDITS : 5 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Classify the use of various types of Database.	K2	I & II
CO2	Create databases using DDL commands	K5	III
CO3	Use DML commands for manipulating databases and tables	K3	III
CO4	Apply PL/SQL programs to work with databases	K3	III
CO5	Distinguish the application areas for RDBMS and NoSQL databases	K4	IV
CO6	Apply data integration	K3	V

CORE VIII: MOLECULAR MODELING AND DRUG DESIGN

SEMESTER : VI **COURSE CODE : I20BI608**
CREDITS : 5 **HOURS/ WEEK: 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the concept of molecular modeling	K1	I
CO2	Identify the force field involved inbonded and nonbonded interaction	K2	II
CO3	Dramatize the interaction of molecular modeling simulation	K3	III
CO4	Apply different algorithms for energy minimization	K3	III
CO5	Analyze molecular dynamics simulation methods for monitoring molecular interaction	K4	IV
CO6	Assess the various structure prediction methods used in drug designing	K6	V

CORE PRAC VII : DATABASE MANAGEMENT SYSTEM & SQL LAB
SEMESTER : VI **COURSE CODE : I18BI6P7**
CREDITS : 2 **HOURS/ WEEK : 3**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Create databases and tables	K5	1,2
CO2	Apply relational and mathematical operators	K3	3,4,5
CO3	Use different data types based on requirements	K3	6,7
CO4	Experiment joining tables	K4	8,9
CO5	Practicevarious operations on fields	K3	10
CO6	Test the usage of backend when developing applications	K4	11,12

CORE PRAC VIII: ADVANCED BIOINFORMATICS LAB-II
SEMESTER : VI **COURSE CODE : I18BI6P8**
CREDITS : 2 **HOURS/ WEEK: 3**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiments Covered
CO1	Create the small molecules and prepare them in proper file format	K5	1
CO2	Interpret the post-docking results and analyze their interactions	K2	6
CO3	Analyze the biological properties of small molecules	K4	2
CO4	Perform the simple docking process for the given compounds	K3	5
CO5	Demonstrate the optimization steps for small molecules	K3	3
CO6	Critique the binding site information of the given protein	K4	4

ELECTIVE III : BIODIVERSITY INFORMATICS

SEMESTER : VI **COURSE CODE : I20BI6:1**
CREDITS : 5 **HOURS/ WEEK : 6**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Explain the basic concept of biodiversity	K2	I
CO2	Describe the importance of biodiversity	K2	II
CO3	Analyze the consequences of the loss of biodiversity	K4	III
CO4	Debatethe need for biodiversity conservation	K4	IV
CO5	Use of bioinformatics database in monitoring endangered species	K3	V
CO6	State the role of IPR in global biodiversity	K1	V

ELECTIVE III : IMMUNOINFORMATICS

SEMESTER : VI **COURSE CODE : I20BI6:2**
CREDITS : 5 **HOURS/ WEEK: 6**

At the end of this course, the students will be able to

CO. No	Course outcomes	Level	Unit
CO1	Describe the antigen processing mechanism	K2	I
CO2	Discuss the different types of immune cells and its functions	K2	II
CO3	Explain the production of antibodies	K2	III
CO4	Describe the membrane receptors for antigen	K2	IV
CO5	Analyse the merits and demerits of vaccine designing	K4	IV
CO6	Discuss the basics of immunological databases	K2	V

SBEC III: COMPREHENSIVE PRACTICE FOR BIOINFORMATICS COMPETITIVE EXAMINATION

SEMESTER : VI **COURSE CODE : I16BI6S3**
CREDITS : 2 **HOURS/ WEEK : 2**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the basics of computer	K2	I
CO2	Categorize the types of Basic Local Alignment Search Tool	K4	II
CO3	Explain the Motif and Domain Database	K2	I1
CO4	Analyze the different transport mechanisms available to: transfer the solutes through plasma membrane	K4	III
CO5	Employ mathematical concepts in analyzing biological data	K4	IV
CO6	Assess the various molecular modeling methods used for drug designing	K6	V

NMEC-I : BASIC BIOINFORMATICS

SEMESTER : III **COURSE CODE : I13BI3E1**
CREDITS : 2 **HOURS/ WEEK : 2**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the basics of bioinformatics, scope and its applications	K1	I
CO2	Discuss the important properties of the bioinformatics databases	K2	II
CO3	Summarize the details about nucleotide sequence databases	K2	III
CO4	Explain the steps involved in pairwise and multiple sequence alignment	K2	IV
CO5	Tell the importance ofMetabolic Pathway Databases	K2	IV
CO6	Demonstrate the steps involved in phylogenetic analysis	K3	V

NMEC II: BASIC STRUCTURAL BIOINFORMATICS

SEMESTER : IV **COURSE CODE : I13BI4E2**
CREDITS : 2 **HOURS/ WEEK : 2**

At the end of this course, the students will be able to

CO. No	Course outcomes	Level	Unit
CO1	Explain the structure of DNA, RNA and proteins	K2	I
CO2	List the biological databases and visualization tools	K1	II
CO3	Describe the steps involved in structure alignment	K2	III
CO4	Categorize the types of protein structure prediction	K4	IV
CO5	Discuss the applications of structural bioinformatics	K2	IV
CO6	Analyse the ADME properties of small molecules	K4	V

CORE IX: ALGORITHM FOR COMPUTATIONAL BIOLOGY

SEMESTER : VII **COURSE CODE : I20BI709**
CREDITS : 5 **HOURS/ WEEK 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Explain the various algorithms used for pairwise sequence analysis	K2	I
CO2	Discuss the concepts and algorithms in multiple sequence alignment	K2	II
CO3	Analyze the methods used for phylogenetic tree construction	K4	II
CO4	Relate the role of the various tools used in genome comparison	K4	III
CO5	Employ various structure determination technique to study macromolecules	K3	IV
CO6	Design the computational methods used for Protein structure prediction	K5	V

CORE X: PROGRAMMING IN JAVA

SEMESTER : VII **COURSE CODE : I21BI710**
CREDITS : 5 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Apply the concepts of Object Oriented Programming	K3	I
CO2	Develop Console applications in Text editor	K6	II
CO3	Adapt multithreading in real time console applications	K6	III
CO4	Design windows application in java and explain the use of Exception handling	K6	IV
CO5	Develop applications using files in console application and windows application	K6	IV
CO6	Construct applications with string handling in real-time applications	K6	V

CORE XI: BIOINFORMATICS DATABASE & TOOLS

SEMESTER : VII **COURSE CODE : I20BI711**
CREDITS : 5 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Discuss the storage and organization of biological data	K2	I
CO2	Classify the different types of mapping Databases	K2	II
CO3	Use Genomic databases for various research in life sciences	K3	III
CO4	Use the appropriate tools to predict the secondary structure of a protein sequence of interest	K3	IV
CO5	Distinguish between good, medium and poor quality of a protein structure	K4	V
CO6	Create the 3D structure of a protein using various protein structure prediction methods	K5	V

CORE PRAC IX : PROGRAMMING IN JAVA LAB

SEMESTER : VII **COURSECODE: I20BI7P9**
CREDITS : 3 **HOURS/ WEEK 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Apply string handling in java	K3	1, 2
CO2	Experiment loops, conditions and operators	K4	3,4,5,6,7
CO3	Practice with arrays	K3	8,9
CO4	Construct applications with built-in functions	K5	10,11,12,13
CO5	Analyze sequences in applications	K4	14,15,16
CO6	Execute applications by dealing with memory addresses	K3	17,18

CORE PRAC X : BIOINFORMATICS DATABASE AND TOOLS LAB

SEMESTER : VII **COURSE CODE I20BIP10**
CREDITS : 3 **HOURS/ WEEK 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Use NCBI, EBI,DDBJ and UniProt for sequence analysis	K3	1
CO2	Analyze data retrieved from Genome Data Viewer using accessions numbers, gene names	K4	2
CO3	Demonstrate data retrieval from genome browser using Ensembl's	K3	3
CO4	Demonstrate various genome databases	K3	3
CO5	Use appropriate tools to predict the secondary structure of a protein sequence of interest	K3	5,6, 7
CO6	Appraise the quality of protein structure	K4	8

ELEC IV: PROTEIN: STRUCTURE AND FUNCTIONS

SEMESTER : VII **COURSE CODE I20BI7:4**

CREDITS : 4 **HOURS/ WEEK 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	State the classifications of proteins based on their structure	K1	I
CO2	Discuss the interactions of the macromolecules	K2	II
CO3	Predict the protein structure using various tools	K3	III
CO4	Inspect the protein function prediction algorithms	K4	IV
CO5	Analyze the methodology of protein function prediction	K4	IV
CO6	Design novel strategy for predicting protein function	K5	V

ELEC IV: MOLECULAR INTERACTIONS

SEMESTER : VII **COURSE CODE I20BI7:A**

CREDITS : 4 **HOURS/ WEEK 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the fundamentals of atomic and molecular orbitals	K2	I
CO2	Classify the different types of bonded and non-bonded interactions	K2	II
CO3	Discuss the principles of protein folding and secondary structures	K2	III
CO4	Summarize the various molecular interactions in macromolecules	K2	IV
CO5	Analyze the principles of molecular interactions	K2	IV
CO6	Critique the principles and applications of spectroscopy in predicting the macromolecules structure	K4	V

CORE XII : R PROGRAMMING IN BIOINFORMATICS

SEMESTER : VIII **COURSE CODE : I20BI812**
CREDITS : 5 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Summarize the features R packages in Bioinformatics	K2	I
CO2	Describe the operations involved in R packages	K2	II
CO3	Use file handling operations to retrieve biological data	K3	III
CO4	Inspect the wide array of Built-in functions available in R packages	K4	IV
CO5	Employ various R functions to align biological sequences	K3	IV
CO6	Develop programs to carry out exception handling in R	K5	V

CORE XIII: PROBABILITY AND BIOMATHEMATICS

SEMESTER : VIII **COURSE CODE : 20BI813**
CREDITS : 5 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Apply the concept of Chi Square Test in Biological problems	K3	I
CO2	Identify the relationship between Binomial, Poisson, Normal distribution by Studying their properties	K3	II
CO3	Apply the concepts Inference and hypothesis testing in sampling distribution	K3	III
CO4	Analyze biological problems with statistical data	K4	IV
CO5	Formulate the applications of differentiation in Biological problems.	K5	V
CO6	Build the concepts of various differential calculus theorems in Bio programming	K5	V

CORE XIV : PRINCIPLES OF DRUG DESIGN AND DEVELOPMENT
SEMESTER : VIII **COURSE CODE : I20BI814**
CREDITS : 5 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Explain the concepts of drug action and discovery	K2	I
CO2	Demonstrate the steps such as lead discovery, modification and optimization	K3	II
CO3	Relate the quantitative structure with activity for lead discovery	K4	II
CO4	Revise the interaction of drug with receptors	K5	III
CO5	Assess the factors affecting the interaction of lead and target	K6	IV
CO6	Analyze the stereochemistry of drug metabolism	K5	V

CORE PRAC XI : COMPUTATIONAL BIOLOGY, STATISTICS USING R AND DRUG DESIGNING LAB
Semester : VIII **Course code : I20BIP11**
Credits : 3 **Hours : 5**

At the end of this course, the students will be able to

S.No	Course Outcomes	Blooms Taxonomic levels of Transaction	Ex. Covered
CO1	Design the small molecules and prepare them in proper file format	K5	I
CO2	Perform molecular docking using advance docking tools and interpret the post-docking results	K3	II
CO3	Analyze the patterns of the given through specialized sequence alignment	K4	III
CO4	Compare the given protein sequences using R programming	K6	IV
CO5	Quantify the different distributions for the given sequences	K4	IV
CO6	Develop shell scripts to retrieve the protein sequences	K5	V

ELEC V: BASICS OF NEXT GENERATION SEQUENCING

Semester : VIII **Course Code :I20BI8:5**
Credits : 4 **Hours : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Recall the history of DNA sequencing	K1	I
CO2	Describe the basic principles and applications of NGS	K2	II
CO3	Discuss the different methodologies for DNA sequence analysis	K2	III
CO4	Employ bioinformatics skills and tools for NGS data analysis	K3	IV
CO5	Discuss the methodologies of RNA-Seq data analysis	K2	IV
CO6	Inspect histone modification sites from ChIP-seq data	K4	V

ELEC V: HERBAL MEDICINE

SEMESTER : VIII **COURSE CODE I20BI8:A**
CREDITS : 4 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Tell the history of herbal medicine and its evolution	K1	I
CO2	Discuss about the common medicinal systems that are practiced in ancient India	K2	II
CO3	Discuss about the different systems of medicine that are practiced throughout the world	K2	III
CO4	Explain the concept of holistic medicine	K2	IV
CO5	Describe the global impact of herbal medicine	K2	V
CO6	Summarize the databases on herbals and herbal drugs	K2	V

ELEC VI: SYSTEMS BIOLOGY

SEMESTER : VIII **COURSE CODE : I20BI8:6**
CREDITS : 4 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Discuss the concepts in Biological Systems and analyze its network construction	K4	I
CO2	Employ enzyme kinetics and thermodynamics	K3	II
CO3	Categorize the algorithms involved in metabolic regulation	K4	III
CO4	Differentiate the metabolic pathways within living organisms using systems biology databases	K4	IV
CO5	Device modeling tools for constructing gene and protein network	K5	IV
CO6	Apply the concepts of synthetic biology in various fields and investigate its real time application in computational Biology	K6	V

ELEC VI: RESEARCH METHODOLOGY, BIOETHICS, BIOSAFETY AND IPR

SEMESTER : VIII **COURSE CODE : I20BI8:B**
CREDITS : 4 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	List the research approaches	K1	I
CO2	Practice thesis and research report writing.	K3	II
CO3	Discuss the significance of Bioethics	K2	III
CO4	Summarize the biosafety guidelines	K2	IV
CO5	Analyze the importance of IPR	K4	V
CO6	Justify the importance of patent filing	K6	V

CORE XV : GENOMICS AND PROTEOMICS

SEMESTER : IX **COURSE CODE: I20BI915**

CREDITS : 5 **HOURS/ WEEK: 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the genome sequencing methods and explain the sequence assembly	K2	I
CO2	Discuss how the location of genes is identified with the help of HGP	K2	I
CO3	Summarize the methods and markers involved in genome mapping	K2	II
CO4	Relate the microarray technology in predicting gene expression	K4	III
CO5	Analyze the tools and techniques involved in protein and peptide analysis	K4	IV
CO6	Review the databases and tools that are used for proteomic study	K6	V

CORE XVI : ADVANCE IN STRUCTURAL BIOINFORMATICS

SEMESTER : IX **COURSE CODE I20BI916**

CREDITS : 5 **HOURS/ WEEK 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Recall the structure prediction and assessment methods	K1	I
CO2	Employ scoring functions to predict protein structure	K4	II
CO3	Summarize various binding site predicting servers	K2	III
CO4	Demonstrate the mechanism of ion channels using computational servers	K3	IV
CO5	Design an antibody with high affinity using computational methods	K5	IV
CO6	Analyze the structure based computational approaches in pharmacology	K4	V

CORE XVII : PROGRAMMING IN PYTHON

SEMESTER : IX **COURSE CODE I20BI917**
CREDITS : 5 **HOURS/ WEEK 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Analyse the basic concepts of Python Programming	K4	I
CO2	Create functions and understand its characteristics	K6	II
CO3	Construct Tuples, Dictionaries and Lists.	K6	III
CO4	Test the operations of Exception Handling mechanisms	K6	IV
CO5	Compile programs using Object Oriented Programming concepts	K6	V
CO6	Build the biological sequences with biopython module	K6	V

CORE PRAC IX : ADVANCES IN STRUCTURAL BIOINFORMATICS LAB

SEMESTER : IX **COURSE CODE I20BIP12**
CREDITS : 3 **HOURS/ WEEK 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Design small molecules and prepare them in proper file format	K5	6, 8
CO2	Perform docking in advance docking tools and Interpret the post-docking results	K3	11, 12
CO3	Analyse the biological properties of small molecules	K4	4, 5, 9
CO4	Build and measure the energy of macromolecules using quantum mechanics	K5	7, 9
CO5	Justify the pharmacophore models developed by small molecules	K6	10
CO6	Classify the given proteins through sequence and structure comparison	K5	1, 2, 3

CORE PRAC XIII : PROGRAMMING IN PYTHON LAB

SEMESTER : IX **COURSE CODE: I20BIP13**

CREDITS : 3 **HOURS/ WEEK: 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Experiment
CO1	Create simple programs in Python for real world problems	K5	1, 2,3,4,5,6,9
CO2	Apply string handling functions	K3	7,8,10
CO3	Evaluate programs using classes and objects	K6	15,16
CO4	Construct Programs using Tuples, Lists and Dictionaries	K5	11,12
CO5	Compose Programs and apply exception handling mechanisms	K5	13,14
CO6	Analyze biological sequences with biopython modules.	K4	17, 18,19,20

ELECTIVE VII: CHEMINFORMATICS

SEMESTER : IX **COURSE CODE :I20BI9:7**

CREDITS : 4 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Practice the skills to analyse the properties of small molecules and explain the manipulation of 2D molecular structures	K3	I
CO2	Design the different formats and methods of chemical compound representation	K5	II
CO3	Demonstrate the various molecular notations to represent the chemical structure	K3	II
CO4	Analyze the various cheminformatics databases	K4	III
CO5	Assess the structure similarity search of chemical structures	K6	IV
CO6	Build the knowledge of High-Throughput Screening by using the concepts of QSAR to create novel leads	K5	V

ELEC VII : BIODIVERSITY, BIOETHICS AND IPR

SEMESTER : IX **COURSE CODE I19BI9:A**

CREDITS : 4 **HOURS/WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Units Covered
CO1	State the biodiversity values and its management	K1	I
CO2	Discuss the biodiversity application software's and virtual libraries	K2	II
CO3	Explain about gene therapy and drug targets	K2	III
CO4	Analyze biotechnological application of microbes	K4	IV
CO5	Inspect the alternative energy sources	K4	IV
CO6	Review the importance of Microbial Engineering	K6	V

CORE XVIII :PHARMACOINFORMATICS

SEMESTER : X **COURSE CODE: I20BIX18**

CREDITS : 4 **HOURS/ WEEK : 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the principles of pharmacodynamics and pharmacokinetics	K1	I
CO2	Use the combinatorial chemistry strategies to solve the problems in drug development	K3	II
CO3	Classify the different pathways of drug metabolism	K2	III
CO4	Analyse the genetic differences between individuals and relating the pros and cons of drug therapy	K4	IV
CO5	Plan innovative strategies for the potential drug discovery	K5	IV
CO6	Evaluate the significance of pharmacovigilance and ADRS strategies in pharmacoinformatics	K6	V

ELEC VIII: BIG DATA ANALYTICS FOR BIOINFORMATICS

SEMESTER : X **COURSE CODE I20BIX:8**
CREDITS : 4 **HOURS/ WEEK 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	Describe the background and Origin of Big Data	K1	I
CO2	List the terminologies related to Big Data Processing Frame	K1	II
CO3	Inspect the concepts of Deep Learning and Its Parallelization	K4	III
CO4	Apply the Statistical Methods for Genome wide Association Studies	K3	IV
CO5	Integrate statistical methods for automatic Disease Diagnosis and Disease Marker Detection	K5	IV
CO6	Evaluate the applications of big data analytics for proteome	K6	V

ELEC VIII: APPLICATION OF BIOINFORMATICS IN BIODIVERSITY,AGRICULTURE MEDICINE AND ENVIRONMENT

SEMESTER : X **COURSE CODE: I20BIX:A**
CREDITS : 4 **HOURS/ WEEK: 5**

At the end of this course, the students will be able to

CO. No	Course Outcomes	Level	Unit
CO1	State the biodiversity values and its management	K1	I
CO2	Discuss the biodiversity application software's and virtual libraries	K2	II
CO3	Explain about gene therapy and drug targets	K2	III
CO4	Analyze biotechnological application of microbes	K4	IV
CO5	Inspect the alternative energy sources	K4	IV
CO6	Review the importance of Microbial Engineering	K6	V