KANNUR UNIVERSITY

(Abstract)

B.Sc.Bioinformatics Programme -Scheme, Syllabus and Pattern of Question Papers of Core and Generic Elective Course under Choice Based Credit and Semester System (Outcome Based Education System-OBE) in Affiliated colleges with effect from 2019 Admission-Implemented-Orders issued.

Academic Branch

No.Acad.C2/13051/2019/i Civil Station P.O Dated 21/06/2019

Read:- 1. U.O.No.Acad.C2/429/2017 dated 10-10-2017
2. The Minutes of the Meeting of the Curriculum Restructuring Committee held on 28-12-2018.
3. U.O No. Acad.C2/429/2017 Vol.II dated 03-06-2019
4. The Minutes of the Meeting of the Board of Studies in Biotechnology (Cd) held on 07/06/2019
5. Syllabus of B.Sc. Bioinformatics Programme Submitted by the Chairperson, Board of Studies in Biotechnology(Cd) dated 20/06/2019

ORDER

1. A Curriculum Restructuring Committee was constituted in the University vide the paper read (1) above to co-ordinate the activities of the Syllabus Revision of UG programmes in Affiliated colleges of the University.

2. The meeting of the Members of the Curriculum Restructuring Committee and the Chairpersons of different Boards of Studies held, vide the paper read (2) above, proposed the different phases of Syllabus Revision processes such as conducting the meeting of various Boards of Studies , Workshops and discussion.

3. The Revised Regulation for UG programmes in Affiliated colleges under Choice Based Credit and Semester System (in OBE-Outcome Based Education System) was implemented with effect from 2019 Admission as per paper read (3) above.

4. Subsequently, as per paper read (4) above, the Board of Studies in Biotechnology (Cd) finalized the Scheme, Syllabus & Pattern of Question Paper for Core & Generic Elective Course of B.Sc. Bioinformatics Programme to be implemented with effect from 2019 Admission.

5. As per paper read (5) above, the Chairperson, Board of Studies in Biotechnology (Cd) submitted the finalized copy of the Scheme, Syllabus & Pattern of Question Papers of B.Sc. Bioinformatics Programme for implementation with effect from 2019 Admission.

6. The Vice Chancellor after considering the matter in detail and in exercise of the powers of the Academic Council conferred under Section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with accorded sanction to implement the Scheme, Syllabus & Pattern of Question Paper(Core/ Generic Elective Course) of B.Sc. Bioinformatics programme under Choice Based Credit and Semester System(in OBE-Outcome Based Education System) in the Affiliated colleges under the University with effect from 2019 Admission, subject to reporting before the Academic Council.

7. The Scheme, Syllabus & Pattern of Question Paper of B.Sc. Bioinformatics Programme are uploaded in the University website (www.kannuruniversity.ac.in)

Orders are issued accordingly.

Sd/-
DEPUTY REGISTRAR (ACADEMIC)
For REGISTRAR

To

The Principals of Colleges offering B.Sc. Bioinformatics programme

Copy to: -

1. The Examination Branch (through PA to CE)
2. The Chairperson, Board of Studies in Biotechnology (Cd)
3. PS to VC/PA to PVC/PA to Registrar
4. DR/AR-I, Academic
5. The Computer Programmer (for uploading in the website)
6. SF/DF/FC

KANNUR UNIVERSITY CIVIL STATION P.O. KANNUR Pin-670 002 THAVAKKARA

Forwarded/By Order

SECTION OFFICER

KANNUR UNIVERSITY

BOARD OF STUDIES, BIOTECHNOLOGY (Cd)

SYLLABUS

FOR CORE COURSES OF

B.Sc. BIOINFORMATICS PROGRAMME

AND GENERIC ELECTIVE COURSES OFFERED BY THE DEPARTMENT

CHOICE BASED CREDIT AND SEMESTER SYSTEM

(2019 ADMISSION ONWARDS)

KANNUR UNIVERSITY

VISION AND MISSION STATEMENTS

Vision: To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasargode and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission:

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher education and to cater to the modern notions of equity, social justice and merit in all educational endeavors.
- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.
- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as non-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

KANNUR UNIVERSITY

PROGRAMME OUTCOMES (PO)

PO 1. Critical Thinking:

1.1. Acquire the ability to apply the basic tenets of logic and science to thoughts, actions and interventions.
1.2. Develop the ability to chart out a progressive direction for actions and interventions by learning to recognize the presence of hegemonic ideology within certain dominant notions.
1.3 Develop self-critical abilities and also the ability to view positions, problems and social issues from plural perspectives.

PO 2. Effective Citizenship:

2.1. Learn to participate in nation building by adhering to the principles of sovereignty of the nation, socialism, secularism, democracy and the values that guide a republic.
2.2. Develop and practice gender sensitive attitudes, environmental awareness, empathetic social awareness about various kinds of marginalisation and the ability to understand and resist various kinds of discriminations.
2.3. Internalise certain highlights of the nation's and region's history. Especially of the freedom movement, the renaissance within native societies and the project of modernisation of the post-colonial society.

PO 3. Effective Communication:

3.1. Acquire the ability to speak, write, read and listen clearly in person and through electronic media in both English and in one Modern Indian Language
3.2. Learn to articulate, analyse, synthesise, and evaluate ideas and situations in a well-informed manner.
3.3. Generate hypotheses and articulate assent or dissent by employing both reason and creative thinking.

PO 4. Interdisciplinarity:

4.1. Perceive knowledge as an organic, comprehensive, interrelated and integrated faculty of the human mind.
4.2. Understand the issues of environmental contexts and sustainable development as a basic interdisciplinary concern of all disciplines.
4.3. Develop aesthetic, social, humanistic and artistic sensibilities for problem solving and evolving a comprehensive perspective.

PREFACE

Bachelor of Science in Bioinformatics is a three-year undergraduate program offered under the choice-based credit semester system. The whole program is divided into six semesters, with about five month's duration for each semester. The curriculum has been revised in tune with the concept of 'Outcome Based Education'. Outcome Based Education is an approach, in which decisions about the curriculum and instruction are driven by the learning outcome. 'Learning outcome' is the ability the students are expected to acquire at the end of a program or a course. The syllabus of the B.Sc. Bioinformatics program has been designed to give a basic understanding of Bioinformatics, a fast-developing interdisciplinary area in Science. It is revised after evaluating the existing syllabus and in consultation with teachers who are experts and well experienced in the subject.

A number of courses are offered within the B.Sc. Bioinformatics program. The syllabus of each course has been divided into a number of instructional units. The program specific outcome and course outcomes are explicitly stated in the syllabus. There are four types of courses offered: common courses, core courses, complementary elective courses and generic elective courses. Details such as the semester in which the course is offered, credit for the course, books for study/reference and the pattern of evaluation are also given in the syllabus.

Chairperson
Board of Studies, Biotechnology (Cd)
Kannur University

Kannur University

Programme Specific Outcome of B.Sc. Bioinformatics Programme

PSO 1:

Understand the fundamentals of computers and accessories, programming, internet, data transfer and computational tools used in bioinformatics.

PSO 2:

Understand the basics of living cells, cell organelles, biological macromolecules, regulatory mechanisms, genes, flow of genetic information and inheritance.

PSO 3:

Understand the methods and applications of biological databases, DNA and protein sequence analysis, basics of genomics and proteomics, macromolecular structure and functions and computer aided drug discovery.

PSO 4:

Apply different bioinformatics tools, retrieve data from biological databases and to write computer programmes to solve simple problems.

INDEX

KANNUR UNIVERSITY

B. Sc. BIOINFORMATICS PROGRAMME

WORK AND CREDIT DISTRIBUTION STATEMENT

	Courses	credit	Total
Common (including General Awareness Courses)	English	4+3+4+3+4+4	22
	Additional language	4+4+4+4	16
Core	Bioinformatics		56
Complementary Elective courses	Physics Chemistry	2+2+2+2+4 2+2+2+2+4	24
Generic Elective courses		2	2
Total			120

Semester	Course Title	Credits	Marks	Hours per week	Total Credits	Total Hours
I	COMMON: ENGLISH COURSE I	4	50	5	18	25
	COMMON: ENGLISH COURSE II	3	50	4		
	COMMON: ADDITIONAL LANGUAGE COURSE I	4	50	4		
	COMPLEMENTARY ELECTIVE: PHYSICS COURSE I	2	50	4		
	COMPLEMENTARY ELECTIVE: CHEMISTRY COURSE I	2	50	4		
	CORE COURSE I	3	50	4		
II	COMMON: ENGLISH COURSE III	4	50	5	18	25
	COMMON: ENGLISH COURSE IV	3	50	4		
	COMMON: ADDITIONAL LANGUAGE COURSE II	4	50	4		
	COMPLEMENTARY ELECTIVE: PHYSICS COURSE II	2	50	4		
	COMPLEMENTARY ELECTIVE: CHEMISTRY COURSE II	2	50	4		
	CORE COURSE II	3	50	4		
III	COMMON: ENGLISH COURSE V	4	50	5	15	25
	COMMON: ADDITIONAL LANGUAGE COURSE III	4	50	5		
	COMPLEMENTARY ELECTIVE: PHYSICS COURSE III	2	50	3		
	COMPLEMENTARY ELECTIVE: PHYSICS PRACTICAL	-	**	2		
	COMPLEMENTARY ELECTIVE: CHEMISTRY COURSE III	2	50	3		
	COMPLEMENTARY ELECTIVE: CHEMISTRY PRACTICAL	-	**	2		
	CORE COURSE III	3	50	3		
	CORE COURSE (PRACTICAL I)	-	**	2		
IV	COMMON: ENGLISH COURSE VI	4	50	5		
	COMMON: ADDITIONAL LANGUAGE COURSE IV	4	50	5		

	COMPLEMENTARY ELECTIVE: PHYSICS COURSE IV	2	50	3	27	25
	COMPLEMENTARY ELECTIVE: PHYSICS PRACTICAL	4	50	2		
	COMPLEMENTARY ELECTIVE: CHEMISTRY COURSE IV	2	50	3		
	COMPLEMENTARY ELECTIVE: CHEMISTRY PRACTICAL	4	50	2		
	CORE COURSE IV	3	50	3		
	CORE COURSE V (PRACTICAL I)	4	50	2		
V	CORE COURSE VI	3	50	3	21	25
	CORE COURSE VII	3	50	4		
	CORE COURSE VIII	3	50	4		
	CORE COURSE IX	3	50	4		
	CORE COURSE X	3	50	4		
	CORE COURSE XI (PRACTICAL II)	4	50	4		
	GENERIC ELECTIVE COURSE	2	25	2		
VI	CORE COURSE XII	3	50	3	21	25
	CORE COURSE XIII	3	50	4		
	CORE COURSE XIV	3	50	4		
	CORE COURSE XV	3	50	4		
	CORE COURSE XVI	3	50	4		
	CORE COURSE XVII (PRACTICAL III)	4	50	4		
	CORE COURSE XVIII (PROJECT)	2	50	2		
	Total				120	150

**End semester examinations for Core course (Practical 1) and Complementary elective courses shall be conducted at the end of 4th semester

First Complementary Elective: PHYSICS

Second Complementary Elective: CHEMISTRY

PART A:

CORE COURSES WORK AND CREDIT DISTRIBUTION

(2019 ADMISSION ONWARDS)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HRS	MARKS
1B01BIF	INTRODUCTION TO INFORMATION TECHNOLOGY & BIOINFORMATICS	I	4	3	3	50
2B02BIF	COMPUTER FUNDAMENTALS	II	4	3	3	50
3B03BIF	PROGRAMMING CONCEPTS AND C LANGUAGE	III	3	3	3	50
4B05BIF	BIOINFORMATICS PRACTICAL I	III	2	-	**	
4B04BIF	BIOLOGICAL DATABASES	IV	3	3	3	50
4B05BIF	BIOINFORMATICS PRACTICAL I	IV	2	4	3	50
5B06BIF	INTRODUCTORY STATISTICS	V	3	3	3	50
5B07BIF	CELL BIOLOGY	V	4	3	3	50
5B08BIF	BIOCHEMISTRY	V	4	3	3	50
5B09BIF	STRUCTURAL BIOINFORMATICS	V	4	3	3	50
5B10BIF	ADVANCED BIOINFORMATICS	V	4	3	3	50
5B11BIF	BIOINFORMATICS PRACTICAL II	V	4	4	3	50
6B12BIF	MOLECULAR BIOLOGY	VI	3	3	3	50
6B13BIF	GENETICS	VI	4	3	3	50
6B14BIF	SEQUENCE ANALYSIS	VI	4	3	3	50
6B15BIF	GENOMICS AND PROTEOMICS	VI	4	3	3	50
6B16BIF	BIOINFORMATICS TECHNIQUES & DRUG DISCOVERY	VI	4	3	3	50
6B17BIF	BIOINFORMATICS PRACTICAL III	VI	4	4	3	50
6B18BIF	PROJECT WORK	VI	2	2	3	50

** Examination for the Bioinformatics Practical 1 shall be conducted at the end of 4th semester

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

CONTINUOUS INTERNAL ASSESSMENT (FOR THEORY)

COMPONENT	WEIGHTAGE	REMARKS
PERIODIC CLASS TESTS	60%	MINIMUM TWO CLASS TESTS AND AVERAGE OF THE BEST TWO
ASSIGNEMENT /SEMINAR	40%	ASSIGNEMENT OR SEMINAR (SAME CRITERIA SHOULD BE APPLIED UNIFORMLY TO ALL STUDENTS IN THE CLASS)

(FOR PRACTICAL)

COMPONENT	WEIGHTAGE	REMARKS
LAB INVOLVEMENT	50%	
INTERNAL TESTS	50%	

CORE COURSE I : INTRODUCTION TO INFORMATION TECHNOLOGY & BIOINFORMATICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
I	1B01BIF	4	3	3

COURSE OUTCOME

CO1	Understand about internet, types, access methods and its services.
CO2	Understand the concept of webserver and basics of PERL programming language.
CO3	Understand the tags and syntaxes of HTML
CO4	Understand the development and importance of Bioinformatics.
CO5	Understand the major classes of databases in bioinformatics.
CO6	Understand the concepts of genes, genomes and Human Genome Project.

Unit I

Introduction to Internet: services of internet - TCP/IP, WWW, FTP, registration with ISP. Internet access methods - Dial-up, DSL, cable, ISDN, WLAN, Wi-Fi. Internet connection wizard, URL, http, PPP, data transmission modes, topology network, types of network, internet and intranet. (12 hrs)

Unit II

Web server: Role of web server, a brief introduction to Apache. Introduction to PSW, role of CGI program, introduction to PERL – history of PERL, application of PERL, PERL basics, basic data types and variables - scalar, list, hashes. (12 hrs)

Unit III

HTML: Introduction, common tags, creation of hyper link, incorporation of images, Tables, Frames, list- ordered, unordered, definition, nested. formatting text with font, creating web pages from information contained in a database, creation of internet database connection file. Introduction to XML and its differences with HTML. (18 hrs)

Unit IV

Introduction to Bioinformatics**:** Bioinformatics - History, definition, importance and uses of Bioinformatics, databases, Biological database, protein and nucleic acid sequence database, protein structure database, protein function database, Genome database, NCBI, Bioinformatics and Biotechnology opportunities in India. (18 hrs)

Unit V

Human Genome Project: genes and genomes, Need of Human Genome Project, contribution of various countries, Rough and Final Draft of Human Genome Project, goals of HGP, uses and application. (12 hrs)

Books for study:

1. Introduction to Bioinformatics By TK Attwood,DJ Parry-Smith and S Phukan
2. Internet and World Wide Web- how to program - H. M. Dietel, P. J. Dietel.

Books for References:

1. Internet and World Wide Web- how to program - H. M. Dietel, P. J. Dietel and T. R. Nieto,
2. Pearson Education India
3. Introduction to Bioinformatics By TK Attwood, DJ Parry-Smith and S Phukan
4. Bioinformatics : Sequence and Genome Analysis by David W Mount
5. Bioinformatics: Genes, Proteins,and Computers by CA Orengo,DT Jones and JM Thornton.
6. Introduction to Bioinformatics By TK Attwood,DJ Parry-Smith and S Phukan
7. Pearson WR, Lipman DJ. Improved tools for biological sequence comparison. Proc Natl Acad Sci USA
8. Essential Bioinformatics-Jin Xiong, Cambridge University Press.

Marks including choice:

Unit	Marks
I	10
II	8
III	14
IV	14
V	14

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)

- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)

- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)

- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)

- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE II : COMPUTER FUNDAMENTALS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
II	2B02BIF	4	3	3

COURSE OUTCOME

CO1	Understand the basic concepts, characteristics, limitations, different generation and applications of computer.
CO2	Understand the hardware organization of computer
CO3	Understand the numbering system of computer and conversions.
CO4	Understand the concept of Logic gates.
CO5	Understand the basics of operating system.

Unit I

Introduction to computer : Definition of computer, characteristics, limitations, capabilities of computers, evaluation, generation , classification based on size and purpose, applications of computers in various fields(12 hrs)

Unit II

Structure of computer: Block diagram and functions of units, Input Unit – ALU, Memory Unit, Control Unit, motherboard, SMPS, Expansion Slots, Serial and Parallel ports, USB. Concept of Memory: Primary Memory – RAM, ROM, EPROM, PROM. Secondary Storage devices: - Magnetic disk, Magnetic tape Pendrive, DVD/CD ROM, Cache memory. (14 hrs)

Unit III

Input and Output Devices: Keyboard, Mouse, Light pen, Joystick, Touch screen, Digitizer, Scanner, MICR, OMR, Barcode reader and Mike. VDU, Printers – Dot-matrix, Inkjet, Laser, Line, Plotters. (10 hrs)

Unit IV

Numbering System and Boolean Algebra: BCD, EBCDIC, ASCII, Gray Code, Excess 3- code, Bit, Byte, Word. Number System – Binary, Octal, Decimal, Hexadecimal Conversion of Number, System, Binary Arithmetic – addition, subtraction, multiplication, division, ones and two's nine's and ten's compliment. Boolean Algebra: Postulates of Boolean algebra (16 hrs)

Unit V

Logic Gates: AND, OR, NOR, NAND, NOT, EX- OR, Universal gates. (10 hrs)

Unit VI

Introduction to Operating Systems: Definition and Functions of O.S. Types of O.S. – Single user, Multi-user, Graphical User interface. (10 hrs)

Books for study:

1. Computer Fundaments - P.K. Sinha.

2. Digital Fundamentals - Floyd.

Books for References:

1. Computer Today --Basundra
2. Fundamentals of computers --V. Rajaraman.
3. Computer Fundaments -- P.K. Sinha.
4. Computer Fundamentals (Architecture and Organization)– B. Ram
5. Microsoft Office 2000 – Vipra Computers
6. Computers Today – S. Basandra (Galgotia Pub)
7. Digital Fundamentals - Floyd.
8. Digital Principles and Applications - A. P. Malvino & D.P.Leach (TMH).
9. Modern digital Electronics (2nd Edn.) R. P. Jain.

Marks including choice:

Unit	Marks
I	8
II	12
III	10
IV	14
V	6
VI	10

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)
- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)
- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)
- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE III: PROGRAMMING CONCEPTS AND C LANGUAGE

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
III	3B03BIF	3	3	3

COURSE OUTCOME

CO1	Understand the steps involved in problem solving, algorithm and computer languages.
CO2	Understand the basic concept of C language.
CO3	Understand the basic operators in C.
CO4	Understand the concept of array and types of arrays in C language.
CO5	Understand the basic pointers, strings and functions of C language
CO6	Perform the various C programs in the computer lab.

Unit I: Introduction to programming

Steps involving in problem solving, problem definition ,algorithm, charts, definition, symbol, running and debugging ,computer languages-low , assembly,, high level, compiler and interpreter(10 hrs)

Unit II: Introduction to C language:

History, character set, C tokens, constants, variables, keywords and comments, instruction: type declaration instruction, arithmetic instruction, integer and float conversion, hierarchy of operation, control instructions in C. (12 hrs)

Unit III: Operators

Arithmetic, logical, relational, bitwise, increment, decrement, conditional operators, special operators, decision control structure –If statement-types of If statements, loop control structures : the while loop, for loop, do while loop, break,continue, go to label statements, switch statement, case control structure. (16 hrs)

Unit IV: Arrays, Strings and Function & Pointers

Arrays, array initialization, types of array, strings, strlen(), strcmpy(), strcmp(), strcat(),function definition,declaration,passing values, scopes, call by values, call by reference,pointers,pointer notation,recursion,back to function call, pointers and array, array of pointers to strings(examples) (16 hrs)

Books for study:

1. Let Us C (English) 13th Edition (Paperback) by Yashavant Kanetkar.

2. C programming by Balaguruswamy.

Books for references:

1. The C Programming Language (Ansi C Version) (English) 2nd Edition (Paperback) by Brian W. Kernighan, Dennis M. Ritchie

2. Data Structures Through C In Depth 2 Edition (English) 2nd Edition by SRIVASTAVA

3. Let Us C (English) 13th Edition (Paperback) by Yashavant Kanetkar.

Marks including choice:

Unit	Marks
I	10
II	13
III	22
IV	15

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)
- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)
- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)
- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE IV: BIOLOGICAL DATABASES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B04BIF	3	3	3

COURSE OUTCOME

CO1	Understand the basic concept of bibliographic databases related to life science.
CO2	Understand the formats, contents and retrieval of databases using text based search.
CO3	Understand the protein and nucleic acid sequence database, genome database.
CO4	Understand the basic characters of viral, archeal and bacterial genomes.
CO5	Understand the characteristics of eukaryotic genomes .
CO6	Understand the various primary, secondary and other databases used in bioinformatics.

Unit I

Basic concept of open access bibliographic resources related to life sciences, the significances and the need for such resources , the major content of the databases, how to search and use these resources/databases with special references to Pub Med. (12 hrs)

Unit II

Contents and formats of databases entries, retrieval of data using text based search using ENTREZ, sources of data, method for deposition of data to databases. (10 hrs)

Unit III

Nucleic acid sequence databases, GenBank, EMBL, DDBJ. Protein Sequence Databases: SWISSPROT, Tr-EMBL, PIR-PSD, Genome Databases at NCBI, EBI , TIGR, SANGER. (10 hrs)

Unit IV

Viral genome, Archeal and Bacterial Genomes, Eukaryotic genome with special references to model organism (Yeast, Drosophilla, C.elegans, Mouse), human, plants such as Arabidopsis thaliana. (12 hrs)

Unit V

PDB, NDB, PROSITE, PRINTS, BLOCKS, CDD, PRODOM, Pfam, CATH, SCOP, DSSP, DALI, VAST, Profiles, Metabolic pathway - KEGG. (10 hrs)

Books for Study:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education.
2. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P

Books for Reference:

3. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
4. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
5. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
6. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
7. Essential Bioinformatics-Jin Xiong, Cambridge University Press
8. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
9. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.

Marks including choice:

Unit	Marks
I	12
II	10
III	15
IV	8
V	15

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)

- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)

- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)

- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)

- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE V : BIOINFORMATICS PRACTICAL I

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
IV	4B05BIF	4	4	3

COURSE OUTCOME

CO1	Understand the basic concept of "C" language and carry out basic arithmetic operations.
CO2	Perform certain C programs to check whether the number is prime, palindrome, Armstrong or not.
CO3	Perform certain C programs to find the factorial of a number using recursion.
CO4	Perform certain C programs to calculate the matrix addition and multiplication.
CO5	Perform certain C programs to copy the string and concatenate the string.
CO6	Perform certain C programs to reverse a DNA sequence and to perform bubble sorting.

1. Program to carry out all basic arithmetic operations
2. Program to find whether the entered numbers are prime or not
3. Program to check whether the entered number is palindrome
4. Program to check whether the entered number is Armstrong or not
5. Program to check whether the entered string is palindrome
6. Program to find factorial of the number
7. Program for performing bubble sorting(ascending & descending) for numbers & strings
8. Program to find factorial of an integer using recursion
9. Program for matrix addition
10. Program for matrix multiplication
11. Program for string copying
12. Program for string concatenation
13. Program for reversing a DNA sequence.

About the Pattern of Questions:

1 question (12 marks)

1 question (10 marks))

1 question (8 marks)

Viva voce (5 mark)

Record (5 mark)

Maximum marks = 40

CORE COURSE VI : INTRODUCTORY STATISTICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B06BIF	3	3	3

COURSE OUTCOME

CO1	Understand the basics of statistics.
CO2	Understand the data collection methods and different types of data.
CO3	Understand the graphical and diagrammatic representation of statistical data.
CO4	Understand the Measures of central tendency and dispersion.
CO5	Understand the concept of correlation and its types.
CO6	Understand the concept of probability, addition and multiplication laws of probability.

Unit I

Data collection: Scope of statistics in Biological and Medical sciences. Definition of population and sample, Collection of data: primary and secondary data, attributes and variables, qualitative and quantitative data. Types of data: ungrouped data, grouped data, discrete data and continuous data. (10 hrs)

Unit II

Graphical and diagrammatic representation of statistical data: frequency distribution curve, cumulative frequency distribution, ogives, histogram, bar diagrams, Pi chart. (10 hrs)

Unit III

Measures of central tendency and dispersion: arithmetic mean, median, mode, (formulae, demerits, merits), Absolute and relative measures of dispersion: range, quartile deviation, variance, standard deviation. Coefficient of variation (examples) (12 hrs)

Unit IV

Correlation - Definition, types of correlation between two variables, scatter diagrams, Karl Pearson's coefficient of correlation and Spearman's rank correlation (with examples) (10 hrs)

Unit V

Probability - Random Experiments, sample space, event, elementary event, compound event, impossible events, certain events, equally likely events, mutually exclusive events, and exhaustive events, dependent and independent events, Probability: definition, addition and multiplication laws of probability with illustration, definition

of conditional probability. (12 hrs).

Books for Study:

1. Gupta S. C. and V. K. Kapoor Fundamentals of Mathematical Statistics.

2. Marcello Pagano and Kimberlee Gauvreau, Principles of Biostatistics

Books for References:

1. Marcello Pagano and Kimberlee Gauvreau, Principles of Biostatistics
2. Methi J. ,Statistical Methods An Introductory Text. New Age international (p) Ltd.
3. Bhat. B. R. ,Srivenkatramana T. & Madhav Rao K. S. (1996) Statistics. A Beginners Text. Vol . I New Age International (p) Ltd.
4. Ithal U. B. And Naik B. U., Statistical MethodS I, Phadake Prakashan, Kolhapur.
5. Gupta S. C. And V. K. Kapoor Fundamentals of Mathematical Statistics.
6. P.N. Arora and P.K. Malhan,Biostatistics, Himalaya Publishing House
7. RSN Pillai and V. Bagavathi, Statistics, S. Chand and Co Ltd

Marks including choice:

Unit	Marks
I	10
II	10
III	22
IV	8
V	10

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)
- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)
- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)
- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE VII: CELL BIOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B07BIF	4	3	3

COURSE OUTCOME

CO1	Understand how cell originate and organisation of cells.
CO2	Understand the biochemical composition of cell.
CO3	Understand the ultra-structure of cell and different functions.
CO4	Understand the structure of chromosome.
CO5	Understand the concept of cell cycle and cell division

Unit I

CELL, classification of cell types - Cell, cell theory, pre-cellular evolution artificial creation of cell, classification of cell, bacteria, PPLO, plant cell and animal cell ,tissue, organ and organism . (18 hrs)

Unit II

Biochemical Composition of Cells, Proteins, lipids, carbohydrates, nucleic acid (18 hrs)

Unit III

Organelles and function - Ultra structure of cell, cell membranes, cytosol, golgi bodies, mitochondria, endoplasmic reticulum (RER,SER), ribosomes, cytoskeleton structure actin, myosin, microtubules, microfilaments, chloroplast, lysosome, peroxysomes, nucleus. (18 hrs)

Unit IV

Chromosome structure - Chromatin reticulum, chromosome morphology, fine structure, chemical composition, nucleoproteins-histones, non-histones, giant chromosomes-salivary gland chromosome, lamp brush chromosome, mitosis, meiosis, significance of mitosis and meiosis, cell division, cell cycle. (18 hrs)

Books for study:

1. De Robertis, E.D.P. and Robertis, E.M.F.(1991). Cell and Molecular biology
2. J Roy, S.C. and Kalyan Kumar De (1997). Cell Biology

Books for References:

1. Cohn, N.S. (1964). Elements of Cytology Brace and World Inc., New Delhi.
2. Darington, C.D.(1965). Cytology, Churchill, London.
3. Darnell, J., Lodish, KL and Baltimore, D (1991). Molecular Cell biology, Scientific American books.
4. De Robertis, E.D.P. and Robertis, E.M.F.(1991). Cell and Molecular biology. Lea
5. and Febiger, Washington.
6. Dobzhansky, B (1961).Genetks¡and The origin of species, Columbia University press,New York.
7. J Roy, S.C. and Kalyan Kumar De (1997). Cell Biology. New Central Book Agency,Calcutta

Marks including choice:

Unit	Marks
I	10
II	20
III	18
IV	12

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)

- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)

- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)

- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)

- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE VIII : BIOCHEMISTRY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B08BIF	4	3	3

COURSE OUTCOME

CO1	Understand the role of thermodynamics.
CO2	Understand the concept of chemical reactions needed for a living system.
CO3	Understand the structure and classification of proteins.
CO4	Understand the structure and properties of nucleic acids.
CO5	Understand the role of lipids.

Unit I

Origin of life. Prokaryotes, Eukaryotes. Chemical bonds, van der Waal's forces, Properties of water. Acids, bases and buffers, pH and its measurement, making of buffer solutions, laws of thermodynamics. Their significance to 'living'. (14 hrs)

Unit II

Chemical Reactions: Redox reactions, redox potentials and their role in living system, molarity, molality and normality of solutions and their measurement, expressions for concentrations. (10 hrs)

Unit III

Structure of proteins: Amino acids and their classification, primary, Secondary, tertiary and quaternary structure of proteins, Fibrous proteins, globular proteins, Conjugate proteins. (16 hrs)

Unit IV

Structure of nucleic acids: Nucleosides, nucleotides and their constituents. Chemical properties of nucleotides, Oligo and poly nucleotides. Watson - Crick base pairing, Double helical structure in nucleic acids. Structure and function of different RNAs. (14 hrs)

Unit V

Monosaccharides, oligosaccharides and poly saccharides, molecular conjugates with oligo and poly saccharides. (8 hrs)

Unit VI

Fats and fatty acids, Lipid classification properties of lipid aggregates, Biological membranes. Conjugate forms of lipids. Lipid nutrition. Lipid digestion and absorption. Fatty acid oxidation. Fatty acid biosynthesis. (10 hrs)

Books for study:

1. Principles of Biochemistry -Lehninger
2. Textbook of Biochemistry-J L Jain.

Books for References:

1. Principles of Biochemistry -Lehninger
2. Outlines of Biochemistry - Conn & Stumpf
3. Text book of Biochemistry -West, Todd et al.
4. Biochemistry - Voet and Voet
5. Textbook of Biochemistry-J L Jain.

Marks including choice:

Unit	Marks
I	10
II	10
III	13
IV	10
V	7
VI	10

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)
- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)
- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)
- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE IX : STRUCTURAL BIOINFORMATICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B09BIF	4	3	3

COURSE OUTCOME

CO1	Understand the importance of proteins.
CO2	Understand the importance of nucleic acids.
CO6	Understand the role of molecular interactions.
CO7	Understand the protein structure prediction methods.
CO8	Understand the basics of x-ray crystallography.

Unit I

Principles of protein structure – amino acid group, structure, one-letter code, triplet code, classification of proteins – structure, composition, functions. Dihedral angle, Ramachandran plot, structural organization of protein - primary, secondary, tertiary and quaternary structures, motifs and domains. (16 hrs)

Unit II

DNA and RNA, types of base pairing - Watson-Crick and Hoogstein, different structural forms of DNA - A,B,Z and their geometrical as well as structural features, types of RNA - structural, geometrical parameters of each and their comparison. Denaturation and renaturation of DNA. (16 hrs)

Unit III

Molecular interactions: Protein – protein interaction, protein-DNA interaction, DNA binding proteins, types of interaction of DNA with protein and small molecule, different forces involved in the interactions. (12 hrs)

Unit IV

Basic principles of protein structure prediction - Chou-fasman method, GOR method, Nearest Neighbour method, Ab initio method, homology modeling - different steps in homology modeling. (14 hrs)

Unit V

Introduction to X-ray crystallography - x-rays, crystal systems, Braggs law, diffraction of crystals, structure factor, atomic scattering factor, crystallization, data collection, structure solution and refinement, structure validation (14 hrs)

Books for study:

1. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P
2. Essential Bioinformatics-Jin Xiong, Cambridge University Press

Books for References:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Introduction to protein structure - Brandel C and Tooze J.

Marks including choice:

Unit	Marks
I	14
II	12
III	8
IV	16
V	10

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)
- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)
- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)
- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE X : ADVANCED BIOINFORMATICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B10BIF	4	3	3

COURSE OUTCOME

CO1	Understand the role of genetic engineering in bioinformatics.
CO2	Understand the basics of cloning
CO3	Understand the vector biology of cloning
CO4	Understand the development of nanotechnology
CO5	Understand the Nano carriers for drug delivery.

Unit I

Introduction to Genetic Engineering: Basics of cloning: restriction enzymes – types, mechanism of DNA modification and functions. Cutting and Joining DNA molecules, DNA ligase. Bacterial transformation – chemical transformation, electroporation, gene gun. (18 hrs)

Unit II

Cloning vectors:Vector biology **-** salient features, basic characteristics of vectors and applications of plasmids, cosmids, phagemids, YAC and BAC. DNA cloning using plasmid DNA as vector, DNA cloning using a plasmid vector, Few applications of gene cloning. (18 hrs)

Unit III

Nanotechnology: Introduction to Nanotechnology, history and development of science, fabrication of nanomaterials - Bottom up (building from molecular level) and top down (breakdown of microcrystalline materials) approaches. (18 hrs)

Unit IV

Nano carriers for drug delivery, Nanoparticles for cancer drug delivery: cancer and current approaches to its cure through nanoparticles. application of nanotechnology in agriculture, medicine and biotechnology & bioinformatics. possible military applications, ethical issues and challenges. (18 hrs)

Books for study;

1. Genetic engineering, by Nicholl.
2. Introduction to Nanotechnology by Charles P.Poole, Frank J, Owens

Books for References:

1. Principles of genetic manipulation; Ed. Old and Primrose, 6th Edition. Blackwell Science.
2. Gene Cloning, an introduction – T. A. Brown, Chapman and Hall, 3rd Edition, 1995.
3. Genetic engineering, by Nicholl.
4. Principles of Gene manipulations, 1994 by old and primrose, Blackwell scientific publications.
5. Genes IX - Lewin B, 2008, Jones & Bartlett publiations.
6. Nanotechnolgy: basic science and emerging technologies – mick Wilson, Geoff smith, Michelle Simmoms, Burkhard Raguse, Overseas press (2005).
7. Introduction to Nanotechnology by Charles P.Poole, Frank J, Owens, Wiley Interscience (2003).
8. Nano Medicines- Dr,parag Diwan and Ashish Bhardwaj, Pentagon press (2006).

Marks including choice:

Unit	Marks
I	16
II	14
III	14
IV	16

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)
- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)
- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)
- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE XI : BIOINFORMATICS PRACTICAL II

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5B11BIF	4	4	3

COURSE OUTCOME

CO1	Understand the working of some online tools used in Bioinformatics.
CO2	Perform the bibliographic databases in bioinformatics.
CO3	Perform the metabolic pathway database in bioinformatics.
CO4	Perform the sequence similarity tools in bioinformatics
CO5	Perform the multiple sequence similarity in bioinformatics.

1. Literature mining using pubmed central
2. Literature mining using Medline/pubmed
3. Browse the ExPASY sites and write information received in your record
4. To retrieve metabolic pathways using KEGG PATHWAY Database
5. To retrieve metabolic pathway using REACTOM
6. Retrieving protein and DNA sequences using Entrez at NCBI
7. Retrieving protein and DNA sequences using SRS at EBI
8. Web browsing at PIR PSD
9. Web browsing at UNIPROT
10. Nucleotide BLAST - BLASTN programs search nucleotide databases using a nucleotide query.
11. Protein BLAST - BLASTP programs search protein databases using a protein query.
12. BLAST-X - BLASTX programs search protein databases using a translated nucleotide query
13. FASTA – To provides sequence similarity searching against protein databases using the FASTA suite of programs
14. Multiple sequence Alignment-CLUSTAL W
15. Multiple sequence Alignment- T-COFFEE
16. Details of PDB files.

About the Pattern of Questions:

1 question (12 marks)

1 question (10 marks))

1 question (8 marks)

Viva voce (5 mark)

Record (5 mark)

Maximum marks = 40

CORE COURSE XII : MOLECULAR BIOLOGY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B12BIF	3	3	3

COURSE OUTCOME

CO1	Understand the concepts of molecular biology.
CO2	Understand DNA replication mechanisms.
CO3	Understand the mechanism of transcription.
CO4	Understand the mechanism of translation.
CO5	Understand the Regulation of gene expression

Unit I

History and development of Molecular biology- Nucleic acids - DNA and RNA as genetic materials. Nature of genetic code- deciphering genetic code- wobbles hypothesis. (08 hrs)

Unit II

DNA replication in prokaryotes, DNA replication in eukaryotes, types of replication, Unit of replication, enzymes involved, replication origin and replication fork, DNA damage and repair mechanisms- photo activation - excision repair- recombination repair, gene mutations- point, frame shift- physical and chemical mutagens, hotspot, oncogenes. (12 hrs)

Unit III

Transcription in prokaryotes and eukaryotes - transcription unit, promoter, terminator sequence- RNA polymerases, RNA processing - capping, splicing, polyadenylation, structure and functions of different types of RNA. (12 hrs)

Unit IV

Translation in prokaryotes and eukaryotes- aminoacylation of tRNA. Formation of initiation complex, elongation and elongation factors, termination, gene, cistron, muton, polysome, one gene one polypeptide hypothesis. (12 hrs)

Unit V

Regulation of gene expression in prokaryotes- operons - negative and positive control - lac and trp operon, catabolic repression, chromatin activity and gene regulation in eukaryotes (10 hrs)

Books for study:

1. Molecular biology of the Gene. James D Watson, Tania A Baker
2. Genes IX. Benjamin Lewin

Books for References:

1. Cell and molecular biology- Concepts and experiments. Gerald Karp. John Wiley and sons.Inc.
2. Molecular biology of the Gene. James D Watson, Tania A Baker, Stephen P Bell, Alexander Gann, Michael Levine, Richard Losick. Pearson Education.
3. Genes IX. Benjamin Lewin. Jones and Bartlett Publishers.
4. Molecular cell biology. Lodish, Berk, Matsudara, Kaiser, Krieger, Scott, Zipursky, Darnell. W H Freeman& Co. New York.

Marks including choice:

Unit	Marks
I	8
II	16
III	12
IV	12
V	12

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)
- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)
- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)
- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE XIII: GENETICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B13BIF	4	3	3

COURSE OUTCOME

CO1	Understand the basics of genetics.
CO2	Understand the Mendel's law of inheritance.
CO3	Understand the allelic and non-allelic gene interactions.
CO4	Understand the characters and features of multiple alleles.
CO5	Understand the concepts linkage and crossing over of genes.
CO6	Understand the sex linked inheritance.
CO7	Understand the concept of chromosomal abnormalities, population genetics.

Unit I

Introduction to Genetics – gene, allele, homozygote, heterozygote, hybrid, heredity, genotype, phenotype. Mendel's work – selection of experimental plant, procedure, experimental observations and results, monohybrid and di-hybrid crosses, law of dominance, law of segregation, law of independent assortment, back cross, test cross. Allelic gene interactions: Complete dominance, incomplete dominance, co-dominance, penetrance, expressivity, pleiotropism, multiple genes/polygenes. (14 hrs).

Unit II

Genic interactions: Non-allelic gene interactions – Complementary genes/duplicative recessive genes, supplementary genes/non-epistatic interactions, duplicate genes/ duplicative dominant genes, duplicate genes with cumulative effect, Epistasis – dominant epistasis, recessive epistasis, Lethal genes – in man, mice and plants, atavism or reversion. (14 hrs).

Unit III

Multiple alleles – coat colour in rabbits, blood group inheritance in man (ABO and Rh-antigen) and applications. Linkage - Types of linkage : complete and incomplete linkage - theories and factors affecting linkage. Linkage groups, importance of linkage. Crossing over - types of crossing over, mechanism and theories of crossing over, factors affecting crossing over, significance of crossing over, two point cross, three point cross, linkage map. (16 hrs).

Unit IV

Sex linked genes and its inheritance, inheritance of X linked genes: colour blindness, haemophilia, of Y- linked genes, of XY- linked genes, sex limited genes, sex influenced genes, holandric genes, criss-cross inheritance, sex linked lethal genes. (14 hrs).

Unit V

Numerical and structural chromosomal aberrations – Euploidy, Aneuploidy, Non-disjunction in autosomes and sex chromosomes (example from human), different types of gene mutations - mutagens, Population genetics – Hardy-Weinberg equilibrium, gene pool, gene frequencies and genotype frequencies. (14 hrs).

Books for study:

1. Principles of Genetics, Gardner, E.J. and Snustad,
2. Genetics – from genes to genomes, Leland H. Hartwell

Books for Reference:

1. Genetics – from genes to genomes, Leland H. Hartwell et al., McGrawHill
2. Genetics, Monroe W. Strickberger, Prentice Hall of India
3. Principles of Genetics, Sinnot, E.W., Dunn, LC and Dobzhansky, T,
4. Principles of Genetics, Gardner, E.J. and Snustad, D.P. John Wiley
5. Genetics, P.S.verma and V.K.Agarwal, S.Chand publishers
6. Principles of Genetics, Peter Snustad &Simmons (8th edition), John WILEY & Sons.
7. Genetics, Monroe w. stickberger, (3rd edition), Prentice- Hall of India Pvt. –Ltd.

Marks including choice:

Unit	Marks
I	14
II	14
III	14
IV	6
V	12

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)
- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)
- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)
- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE XIV : SEQUENCE ANALYSIS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B14BIF	4	3	3

COURSE OUTCOME

CO1	Understand the various sequence file formats in Bioinformatics
CO3	Understand the basic concept of scoring matrix.
CO4	Understand the sequence based database search.
CO5	Understand the pairwise and multiple sequence alignment.
CO6	Understand the concept of Dynamic programming
CO7	Understand the taxonomy, phylogeny and evolutionary analysis of the sequences.

Unit I

various file format for Bio-molecular Sequences: GenBank, FASTA, GCG, GCG-MSF, PIR, Clustal, Swiss-prot. Basic concept of sequence similarity, identity and homology, Definition of homologous, orthologous, paralogous, analogous, xenologous. (14 hrs)

Unit II

Scoring matrices: Basic concept of scoring matrix, matrices for nucleic acid and protein sequences, PAM and BLOSOM series, principles based on which these matrices are derived. Differences between distance & similarity matrix. (14 hrs)

Unit III

Sequence based database search: What are Sequence based database search, BLAST, FASTA Algorithm, various version of BLAST and FASTA, use of these methods for sequence analysis including the online use of the tools and interpretation of results. (12 hrs)

Unit IV

Pairwise and multiple sequence alignments: Basic concept of sequence alignment, Needleman & Wunch , Smith waterman algorithm, use of pairwise alignment or the analysis of Nucleic acid and Protein sequences and interpretation of the results, need of MSA, basic concept of various approaches for MSA – progressive and hierarchical, algorithm of CLUSTALW & Pileup and their application for sequence analysis, dendogram. (16 hrs)

Unit V

Taxonomy and Phylogeny, sequence patterns and profiles: Basic concept in Taxonomy and Phylogeny, molecular evolution, nature of data used in Taxonomy and Phylogeny.

Evolutionary analysis: phylogenetic trees and terms used in it. Methods of phylogenetic analysis: distance, character based (MP,ML), other methods. Tools for phylogenetic analysis. concept of sequence patterns, motifs, profiles, profile based searches using PSI-BLAST. (16 hrs)

Books for study

1. Introduction to Bioinformatics – Attwood & Parry-Smith
2. Essential Bioinformatics-Jin Xiong

Books for References:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
7. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.

Marks including choice:

Unit	Marks
I	10
II	12
III	14
IV	14
V	10

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)
- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)
- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)
- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE XV : GENOMICS AND PROTEOMICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B15BIF	4	3	3

COURSE OUTCOME

CO1	Understand the basic concepts of genomics and proteomics.
CO2	Understand the concepts of genetic mapping.
CO3	Understand the role cytogenetics.
CO4	Understand the methods of DNA sequencing .
CO5	Understand the methods, tools and application of proteomics.
CO6	Understand the basics of pharmacogenomics

Unit I

Introduction to genomics, genetic mapping, types of genetic mapping, genetic markers, application of genetic markers, application of gene mapping, DNA polymorphism, SNP, DNA typing. (14 hrs)

Unit II

Cytogenetics, chromosome painting, FISH, isolation of genes from genomic DNA-cDNA, exon trapping, chromosome walking, gene prediction, transgenes, DGGE in mutation detection(14 hrs)

Unit III

DNA sequencing, sequencing strategies, Sanger method, in situ hybridization, Southern blotting, Northern blotting, short gun method, DNA micro array, working of micro array, applications. (14 hrs)

Unit IV

Proteomics: definition, types of proteomics, method for the analysis of proteomes, 2D gel electrophoresis, MALDI TOF MS. Tools for the analysis, application of proteomics. (16 hrs)

Unit V

Introduction to pharmacogenomics – definition, challenges, applications and benefits. Pharmacodynamics and pharmacokinetics in relation to pharmacogenomics – similarities and differences. (14 hrs)

Books for study:

1. Structural Bioinformatics by Philip E. Bourne
2. Bioinformatics - BaxevanisAD

Books for References:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
7. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.
8. Structure and mechanism in protein science – Alan Fershit, W.H. Freeman & company.
9. Protein engineering – Stefan Lutz.
10. Introduction to protein science – Arthur M Lusk, Oxford University Press.

Marks including choice:

Unit	Marks
I	12
II	12
III	14
IV	12
V	10

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)

- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)

- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)

- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)

- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE XVI :

BIOINFORMATICS TECHNIQUES & DRUG DISCOVERY

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B16BIF	4	3	3

COURSE OUTCOME

CO1	Understand the role of spectroscopic methods.
CO2	Understand about structure visualization tools.
CO3	Understand the concept of drug action.
CO4	Understand the drug discovery methods.
CO5	Understand the concept of Next Generation Sequencing.

Unit I

Spectroscopic methods for structure determination: NMR spectroscopy: shielding constant, chemical shift, application of NMR in protein structure determination. Structural information from UV-visible and IR spectroscopy. (14 hrs)

Unit II

Structure visualization tools: Rasmol, SPDBV, WEBMOL, Cn3D, VMD, molmol, chime. Cheminformatics tools- chemical database-PUBCHEM, SMILES, ACD, Chembank. (14 hrs)

Unit III

Introduction to drugs, classification of drugs, characteristics of a drug, drug dosage and drug efficiency, rule of five. Drug action: pharmaco-kinetics, pharmaco-dynamics, pharmacophore identification, structure and action of anti-cancer drugs, anti-diabetic drugs, anti-inflammatory drugs and antibiotics. (14 hrs)

Unit IV

Drug Discovery: Drug, target, ligand, substrate, drug discovery pipeline, HTS, mass screening, combinatorial chemistry, combinatorial library, CADD, QSAR, SBDD, In-vitro, in- silico methods, pharmacophore modeling, docking, De NOVO, ADME property prediction. (16 hrs)

Unit V

Next Generation Sequencing (NGS): Introduction to NGS, basics of NGS chemistry, methods and application areas of NGS - whole genome sequencing, exome sequencing, De Novo sequencing, ChIP sequencing, RNA sequencing, NGS vs Sanger sequencing. (14 hrs)

Books for study:

1. Introduction to Bioinformatics – Attwood & Parry-Smith
2. Structural Bioinformatics by Philip E. Bourne

Books for References:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York
7. Bioinformatics - BaxevanisAD & Quellette BFF, John Wiley & Sons Inc.
8. Evolutionary computations in Bioinformatics – Fogel & Corne, Morgan Kafman publishers
9. Introduction to Protein structure by Brandel C. and Tooze, J.
10. Structure and Mechanism in Protein science – Fersht WH freeman & Co
11. Protein folding – Creighton TE (ed) WH Freeman & Co.
12. www.illumina.com/documents/products/illuminasequencing_introductio n.pdf.
13. https://arxiv.org/ftp/arxiv/papers/1606/1606.05254.pdf

Marks including choice:

Unit	Marks
I	8
II	10
III	12
IV	16
V	14

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (8 questions x 2 marks each = 16 marks)
- Answer any 6 questions (6 questions x 2 marks each = 12 marks)

Part C - Short Essay (6 questions x 3 marks each = 18 marks)
- Answer any 4 questions (4 questions x 3 marks each = 12 marks)

Part D - Essay (4 questions x 5 marks each = 20 marks)
- Answer any 2 questions (2 questions x 5 marks each = 10 marks)

Total marks including choice = 60

Maximum marks = 40

CORE COURSE XVII : BIOINFORMATICS PRACTICAL III

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B17BIF	4	4	3

COURSE OUTCOME

CO1	Understand the working of some online tools used in Bioinformatics.
CO2	Perform the physico-chemical property, pI,Mw of the sequence.
CO3	Perform the secondary structure prediction of the sequence.
CO4	Perform the local and global alignment algorithms in bioinformatics.
CO5	Perform the 3D structure of the sequence using different visualization tools.

1. Protparam: Physico – chemical parameters of a protein sequence.

2. Compute pI/Mw;compute the theoretical isoelectric point and molecular weight from Uniprot knowledge base entry or for a user sequence

3. ScanSite pI/Mw-compute the theoretical pI/Mw and multiple phosphorylation states

4. Helix wheel/Helix draw: representation of a protein fragment as a helical wheel

5. APSSP - Advanced Protein Secondary Structure Prediction server

6. GOR/SOPMA – Protein secondary structure prediction

7. HOMOLOGY MODELLING—SWISS MODEL-An automated knowledge based protein modeling server

8. Threading –Phyre-the Phyre automatic fold recognition server for predicting the structure and/function of your protein

9. Ab initio- HMMSTR-prediction of the protein structure from sequence assessing tertiary structure prediction

10. EMBOSS Needle - To Create an optimal global alignment of two sequences using the Needleman-Wunsch algorithm

11. EMBOSS Water – To Use the Smith-Waterman algorithm to calculate the local alignment of two sequences.

12. EMBOSS pepinfo-pepstats-pepwindow - create amino acid properties such

as charged residues, position, calculate Mw and draw hydropathy plots of protein sequences.

13. Peptide Cutter - predicts potential cleavage sites cleaved by proteases or chemicals in a protein sequence

14.Use visualization tools like RasMol, Swiss Pdb viewer, Jmol, VMD, Mol Mol

15. Download protein and DNA from PDB and display using above program and analyze the structural features.

16. Use any one Docking software.

About the Pattern of Questions:

1 question (12 marks)

1 question (10 marks))

1 question (8 marks)

Viva voce (5 mark)

Record (5 mark)

Maximum marks = 40

CORE COURSE XVIII: PROJECT WORK

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
VI	6B18BIF	2	2	

Carry out a small research project on any topic related to BIOINFORMATICS and submit a brief dissertation at the end of 6th Semester.

Evaluation of the Project

(Maximum marks 50)

Continuous Evaluation of the Project (20% of Total) (Maximum marks 10)

COMPONENT	WEIGHTAGE
ORGANIZATION OF WORK	30%
USE OF DATA	20%
PUNCTUALITY	20%
VIVA VOCE	30%

End Semester Evaluation of the Project (80% of Total) (Maximum marks 40)

COMPONENT	WEIGHTAGE
RELEVANCE OF TOPIC/ METHODOLOGY	20%
PRESENTATION/ ANALYSIS/FINDINGS	30%
VIVA VOCE	50%

PART C:

BIOINFORMATICS GENERIC ELECTIVE COURSES
WORK AND CREDIT DISTRIBUTION
(2019 ADMISSION ONWARDS)

EACH DEPARTMENT SHALL OFFER A POOL OF FIVE GENERIC ELECTIVE COURSES **AT A TIME, TRANSACTION THROUGH GUIDANCE MODE**. STUDENTS OF OTHER DEPARTMENTS CAN CHOOSE **ANY ONE OF THE GENERIC ELECTIVE COURSES FROM THE POOL OF FIVE COURSES.** ALL DEPARTMENTS (WHETHER IT IS A CORE DEPARTMENT OR COMPLEMENTARY DEPARTMENT CAN OFFER THE COURSE IN SEMESTER V)

COURSE CODE	COURSE TITLE	SEMESTER	HOURS PER WEEK	CREDIT	EXAM HOURS
5D 01 BIF	MOLECULAR MODELLING & DRUG DESIGNING	V	2	2	2
5D 02 BIF	PERL PROGRAMMING	V	2	2	2
5D 03 BIF	INTRODUCTION TO BIOINFORMATICS	V	2	2	2
5D 04 BIF	BIOLOGICAL DATABASES	V	2	2	2
5D 05 BIF	BIOMOLECULES	V	2	2	2

EVALUATION

ASSESSMENT	WEIGHTAGE
EXTERNAL	4
INTERNAL	1

CONTINUOUS INTERNAL ASSESSMENT

COMPONENT	WEIGHTAGE	REMARKS
PERIODIC CLASS TESTS	60%	MINIMUM TWO CLASS TESTS AND AVERAGE OF THE BEST TWO
ASSIGNEMENT /SEMINAR	40%	ASSIGNEMENT OR SEMINAR (SAME CRITERIA SHOULD BE APPLIED UNIFORMLY TO ALL STUDENTS IN THE CLASS)

GENERIC ELECTIVE COURSE I:

MOLECULAR MODELLING & DRUG DESIGNING

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5D 01 BIF	2	2	2

COURSE OUTCOME

CO1	Understand the concept and application of molecular modelling.
CO2	Understand the basic principles of structure prediction methods.
CO3	Defining the terms of ADMET property and their drug targets.
CO4	Understand how to design a drug using bioinformatics tools and software.

Unit I

Introduction to the concept of molecular modelling: Molecular structure and internal energy, application of molecular graphics, energy minimization of small molecules, empirical representation of molecular energies, uses of force field, the molecular mechanics method, local and global energy minima. (10 hrs)

Unit II

Macromolecular modelling: Homology modelling, Basic principles for fold recognition, 1D profiles and threading approaches, secondary structure prediction, basic principles of ab initio structure prediction. (8 hrs)

Unit III

Introduction to Drugs: Definition of drugs, Absorption, Distribution, Metabolism and excretion of drugs. Drug targets : Receptors, enzymes, structural proteins and nucleic acids as the drug targets. (8 hrs)

Unit IV

Drug design using bioinformatics: Design of ligands for known macromolecular target sites, drug-receptor interactions, Classical SAR/QSAR studies and their implications to the 3D modeller, pharmacophore identification and novel drug design, High through put combinatorial approaches, structure based drug design. (10 hrs)

Books for Study:

1. Protein folding – Creighton TE
2. Principles of Medicinal chemistry – William O & Foye BI

Books for References:

1. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
2. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi

3. Principles of Medicinal chemistry – William O & Foye BI , Waverks Pvt. Ltd
4. Medicinal Chemistry – Patrick G, Viva Books Pvt Ltd.
5. Structure and Mechanism in Protein science – Fersht WH freeman & Co
6. Protein folding – Creighton TE (ed) WH Freeman & Co.

Marks including choice:

Unit	Marks
I	5
II	10
III	10
IV	5

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (6 questions x 2 marks each = 12 marks)
- Answer any 4 questions (4 questions x 2 marks each = 8 marks)

Part C - Essay (2 questions x 6 marks each = 12 marks)
- Answer any 1 question (1 question x 6 marks each = 6 marks)

Total marks including choice = 30

Maximum marks = 20

GENERIC ELECTIVE COURSE II:

PERL PROGRAMMING

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5D 02 BIF	2	2	2

COURSE OUTCOME

CO1	Understand the perl program and how to install and use it in a computer.
CO2	Understand the basic data types and variables in perl program.
CO3	Perform the perl program to store a DNA sequence and to concatenate that sequence.
CO4	Understand the strings and arrays used in perl program.
CO5	Perform various perl program to be used in bioinformatics.

Unit I

Getting started with perl: Allow and long learning curve, perl's benefits, installing perl on your computer, how to run perl programs, text editors, finding help, Individual approaches to programming, edit-run-revise (and save), an environment of programs, programming strategies, the programming process. (8 hrs)

Unit II

Sequences and strings: Representing sequence data, a program to store a dna sequence, concatenating DNA fragments, transcription: DNA to RNA using the perl, documentation, calculating the reverse complement in proteins, files and arrays, reading proteins in files, arrays, scalar and list context. (10 hrs)

Unit III

Motifs and loops: Flow control code layout finding motifs counting nucleotides exploding strings into arrays, operating on strings, writing to files. (6 hrs)

Unit IV

Subroutines and bugs: Subroutines, scoping and subroutines command-line arguments and arrays passing data to subroutines, modules and libraries of subroutines, fixing bugs. (6 hrs)

Unit V

The genetic code: Hashes data structures and algorithms for biology the genetic code, translating DNA into proteins reading dna from files in FASTA format reading frames. (6 hrs)

Books for Study:

1. James Tisdall, 200I "Beginning Perl for Bioinformatics", O'Reilly & Associates, (2001) Learning Perl

Books for References:

1. James Tisdall, 200I "Beginning Perl for Bioinformatics", O'Reilly & Associates, (2001) Learning Perl, 3rd Edition.

Marks including choice:

Unit	Marks
I	4
II	4
III	10
IV	8
V	4

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)

- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (6 questions x 2 marks each = 12 marks)

- Answer any 4 questions (4 questions x 2 marks each = 8 marks)

Part C - Essay (2 questions x 6 marks each = 12 marks)

- Answer any 1 question (1 question x 6 marks each = 6 marks)

Total marks including choice = 30

Maximum marks = 20

GENERIC ELECTIVE COURSE III:

INTRODUCTION TO BIOINFORMATICS

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5D 03 BIF	2	2	2

COURSE OUTCOME

CO1	Understand about internet, types, access methods and its services.
CO2	Understand the concept of webserver and basics of PERL programming language.
CO3	Understand the tags and syntaxes of HTML.
CO4	Understand the development and importance of Bioinformatics.
CO5	Understand the major classes of databases in bioinformatics.

Unit I

Introduction to Internet: services of internet - TCP/IP, WWW, FTP, registration with ISP. Internet access methods - Dial-up, DSL, cable, ISDN, WLAN, Wi-Fi. Internet connection wizard, URL, http, PPP, data transmission modes, topology network, types of network, internet and intranet. (8 hrs)

Unit II

Web server: Role of web server, a brief introduction to Apache. Introduction to PSW, role of CGI program, introduction to PERL – history of PERL, application of PERL, PERL basics, basic data types and variables - scalar, list, hashes. (8 hrs)

Unit III

HTML: Introduction, common tags, creation of hyper link, incorporation of images, Tables, Frames, list- ordered, unordered, definition, nested. formatting text with font, creating web pages from information contained in a database, creation of internet database connection file. (10 hrs)

Unit IV

Bioinformatics - History, definition, importance and uses of Bioinformatics, databases, Biological database, protein and nucleic acid sequence database, protein structure database, protein function database, Genome database, NCBI. (10 hrs)

Books for Study:

1. Introduction to Bioinformatics By TK Attwood
2. Internet and World Wide Web- how to program - H. M. Dietel

Books for References:

1. Internet and World Wide Web- how to program - H. M. Dietel, P. J. Dietel and T. R. Nieto,Pearson Education India
2. Introduction to Bioinformatics By TK Attwood, DJ Parry-Smith and S Phukan
3. Bioinformatics : Sequence and Genome Analysis by David W Mount
4. Bioinformatics: Genes, Proteins, and Computers by CA Orengo, DT Jones and JM Thornton.
5. Introduction to Bioinformatics By TK Attwood, DJ Parry-Smith and S Phukan

Marks including choice:

Unit	Marks
I	6
II	8
III	8
IV	8

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)

- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (6 questions x 2 marks each = 12 marks)

- Answer any 4 questions (4 questions x 2 marks each = 8 marks)

Part C - Essay (2 questions x 6 marks each = 12 marks)

- Answer any 1 question (1 question x 6 marks each = 6 marks)

Total marks including choice = 30

Maximum marks = 20

GENERIC ELECTIVE COURSE IV:

BIOLOGICAL DATABASES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5D 04 BIF	2	2	2

COURSE OUTCOME

CO1	Understand the basic concept of bibliographic databases related to life science.
CO2	Understand the formats, contents and retrieval of databases using text based search.
CO3	Understand the protein and nucleic acid sequence database, genome database.
CO4	Understand the basic characters of viral, archeal, bacterial and eukaryotic genomes.
CO5	Understand the primary, secondary and metabolic pathways in bioinformatics.

Unit I

Basic concept of open access bibliographic resources related to life sciences, the significances and the need for such resources , the major content of the databases, how to search and use these resources/databases with special references to Pub Med. (12 hrs)

Unit II

Contents and formats of databases entries, retrieval of data using text based search using ENTREZ, sources of data, method for deposition of data to databases (8 hrs)

Unit III

Nucleic acid sequence databases, GenBank, EMBL, DDBJ. Protein Sequence Databases: SWISSPROT, Tr-EMBL, PIR-PSD, Genome Databases at NCBI, EBI , TIGR, SANGER. (8 hrs)

Unit IV

PDB, NDB, PROSITE, PRINTS, CDD, PRODOM, Pfam, CATH, SCOP, DALI, Profiles, Metabolic pathway - KEGG. (8 hrs)

Books for Study:

1. Introduction to Bioinformatics – Attwood & Parry-Smith
2. Bioinformatics-Methods and applications, Rastogi,S.C

Books for References:

1. Introduction to Bioinformatics – Attwood & Parry-Smith, Pearson

Education
2. Bioinformatics- A beginner's guide by Jean-Michel Claverie, John Wiley & Sons.
3. Structural Bioinformatics by Philip E. Bourne and Helge Weissing, Wiley
4. Bioinformatics-Methods and applications, Rastogi,S.C. Mendiratta, N. and Rastogi P, Prentice-Hall of IndiaPvt. Ltd, New Delhi
5. Essential Bioinformatics-Jin Xiong, Cambridge University Press
6. Bioinformatics – Sequence and Genome anlysis, Mount DW, Cold Spring Harbour Laboratory Press, New York.

Marks including choice:

Unit	Marks
I	6
II	6
III	10
IV	8

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)
- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (6 questions x 2 marks each = 12 marks)
- Answer any 4 questions (4 questions x 2 marks each = 8 marks)

Part C - Essay (2 questions x 6 marks each = 12 marks)
- Answer any 1 question (1 question x 6 marks each = 6 marks)

Total marks including choice = 30

Maximum marks = 20

GENERIC ELECTIVE COURSE V: BIOMOLECULES

SEMESTER	COURSE CODE	HOURS PER WEEK	CREDIT	EXAM HRS
V	5D 05 BIF	2	2	2

COURSE OUTCOME

CO1	Understand the role of thermodynamics.
CO3	Understand the structure and classification of proteins.
CO4	Understand the structure and properties of nucleic acids.
CO5	Understand the role of lipids.

Unit I

Origin of life. Prokaryotes, Eukaryotes. Chemical bonds, van der Waal's forces, Properties of water. Acids, bases and buffers, pH and its measurement, making of buffer solutions, laws of thermodynamics. Their significance to 'living' (10 hrs)

Unit II

Structure of proteins: Amino acids and their classification, primary, Secondary, tertiary and quaternary structure of proteins, Fibrous proteins, globular proteins, Conjugate proteins. (8 hrs)

Unit III

Structure of nucleic acids: Nucleosides, nucleotides and their constituents. Chemical properties of nucleotides, Oligo and poly nucleotides. Watson - Crick base pairing, Double helical structure in nucleic acids. Structure and function of different RNAs. (10 hrs)

Unit IV

Fats and fatty acids, Lipid classification properties of lipid aggregates, Biological membranes. Conjugate forms of lipids. Lipid nutrition. Lipid digestion and absorption. Fatty acid oxidation. Fatty acid biosynthesis. (8 hrs)

Books for Study:

1. Text book of Biochemistry -West, Todd
2. Principles of Biochemistry -Lehninger

Books for References:

1. Principles of Biochemistry -Lehninger
2. Outlines of Biochemistry - Conn & Stump
3. Text book of Biochemistry -West, Todd et al.
4. Biochemistry - Voet and Voet

Marks including choice:

Unit	Marks
I	5
II	7
III	10
IV	8

About the Pattern of Questions:

Part A - Short notes (6 questions x 1 mark each = 6 marks)

- Answer all questions (6 questions x 1 mark each = 6 marks)

Part B - Notes (6 questions x 2 marks each = 12 marks)

- Answer any 4 questions (4 questions x 2 marks each = 8 marks)

Part C - Essay (2 questions x 6 marks each = 12 marks)

- Answer any 1 question (1 question x 6 marks each = 6 marks)

Total marks including choice = 30

Maximum marks = 20

KANNUR UNIVERSITY

B.Sc. DEGREE EXAMINATION

MODEL QUESTION PAPERS

FOR

BIOINFORMATICS

CORE COURSES

I SEMESTER B.Sc. DEGREE EXAMINATION
BIOINFORMATICS (CORE COURSE)

1B01BIF: INTRODUCTION TO INFORMATION TECHNOLOGY & BIOINFORMATICS

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. FTP
2. APACHE
3. URL
4. PERL
5. HTML
6. HTTP

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. Hyperlink
8. Web server
9. Application of internet
10. Bus topology
11. LAN
12. WWW
13. Genome database
14. ISDN

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Write some common tags in HTML
16. Difference between html & xml
17. Protein sequence database
18. What are the services of internet?
19. Nucleic acid sequence database
20. Application and history of PERL.

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Discuss HTML and different types of list in HTML.
22. Explain in detail about internet access methods.
23. Discuss HGP. What are the goals and application of HGP.
24. Explain the importance of Bioinformatics and mention different databases in detail.

II SEMESTER B.Sc. DEGREE EXAMINATION
BIOINFORMATICS (CORE COURSE)
2B02BIF: COMPUTER FUNDAMENTALS

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Control unit
2. Expansion of ASCII
3. ALU
4. 9'scomplement of 23 & 100
5. MICR
6. RAM

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. What is BCD?
8. Difference between RAM & ROM
9. What is SMPS?
10. Discuss internal commands in DOS
11. What is parallel and serial port?
12. Convert AIO into decimal number
13. List out most popular Microsoft operating system
14. What is USB?

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Explain application of computer's
16. Explain CPU and its different parts
17. What are optical device? Give an example
18. Excess 3-code. How it differ from grey code
19. Write a note on Universal Gates
20. Mention and write a note on Printers

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Explain generation and classification of computer
22. What are logic gates? Sketch NOR, NAND, EX-OR gates. What is Universal gate?
23. Explain Operating system in detail.
24. Convert the following.
    i. 16 decimal to octal
    ii. 1209 decimal to hexadecimal
    iii. 145 hexadecimal to decimal
    iv. 75 decimal to octal
    v. 525 decimal to hexadecimal

III SEMESTER B.Sc. DEGREE EXAMINATION
BIOINFORMATICS (CORE COURSE)

3B03BIF: PROGRAMMING CONCEPTS AND C LANGUAGE

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Compiler
2. Algorithm
3. Interpreter
4. C token
5. Character set
6. Pointers

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. Discuss the data types in C?
8. What are the applications of computers in different fields.
9. Explain "break…continue" statement
10. What are arrays? How it is arranged in C language?
11. What are flowcharts?
12. What do you mean by a scope of a variable?
13. What are keywords? Give examples.
14. Difference between compiler and interpreter.

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. What are high level languages? Differentiate between high level and low level languages.
16. Discuss the methods of debugging.
17. Explain switch statement with example.
18. Write a C program to print first 20 Fibonacci numbers.
19. Explain various loop control structures in C language.
20. Write a C program to check whether a given number is prime or not.

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Discuss all the data types used in C language. List out with examples.
22. What do you mean by hierarchy of operators? Explain the hierarchy of operators in C language with examples.
23. Write a C program which print the product of two matrices A x B, also Write a C program which print the addition of two matrices A + B.
24. What are recursions? List out the structure of recursive functions. Write a C program of recursion which identify the factorial of a given number.

IV SEMESTER B.Sc. DEGREE EXAMINATION
BIOINFORMATICS (CORE COURSE)

4B04BIF: BIOLOGICAL DATABASES

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. NCBI
2. Pfam
3. Profiles
4. NDB
5. Arabidopsis Thaliana
6. C.elegans

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. What is bibliography?
8. What is PIR?
9. Describe Entrez and SRS
10. Scop
11. PDB
12. Cath
13. Prosite
14. What is a model organism?

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Describe TIGR & SANGER
16. What are biological databases?
17. How will you search and retrieve in pubmed.
18. Give an account on modal organisms
19. What is the need for bibliographic resources.
20. Difference between Genbank and NCBI.

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Explain the protein and nucleic acid databases.
22. Discuss about content and formats in database with Pubmed
23. Discuss various primary and secondary databases.
24. Explain Genome databases.

IV SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

4B05BIF: BIOINFORMATICS PRACTICAL I

Time: 3 Hrs **Maximum marks: 40**

1. Write a C program for multiplying a matrix (12 marks)
2. Write a program to find the factorial of an integer using recursion (10 marks)
3. Write a program to perform bubble sorting of numbers in descending order (8 marks)
4. Viva voce (5 marks)
5. Record (5 marks)

V SEMESTER B.Sc. DEGREE EXAMINATION
BIOINFORMATICS (CORE COURSE)
5B06BIF: INTRODUCTORY STATISTICS

Time: 3 hours **Maximum marks: 40**

Part A

Answer each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Define Sample.
2. What is range?
3. What is coefficient of variation?
4. Define Median.
5. What is Spearman's rank correlation?
6. Define Mode,

Part B

Answer any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. What is Histogram?
8. What is pi chart?
9. Define probability with examples.
10. What is primary & secondary data?
11. What is a scatter diagram?
12. What are mutually exclusive events? Give example.
13. What is quartile deviation? Explain with example.
14. Define standard deviation.

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Write on frequency distribution table.
16. What are ogives?
17. Discuss on types of events.
18. Give difference between absolute and relative dispersion.
19. What is Karl Pearson correlation coefficient.
20. Explain addition and multiplication theorems of probability.

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Discuss merits and demerits of different measures of central tendency.
22. Compute Arithmetic Mean and Standard Deviation for the data given below

Class Interval	5-15	15-25	25-35	35-45	45-55
Frequency	8	12	15	9	6

23. A bag contains 12 balls numbered from 1 to 12. If a ball is taken at random, What is the probability of having a ball with a number which is a multiple of either 2 or 3?

24.Explain the different methods of data collection.

V SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

5B07BIF: CELL BIOLOGY

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Cell
2. SER
3. Actin
4. Organ
5. Expansion of PPLO
6. Nucleic acid

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. Define Cell Division
8. What is Histones?
9. What is Heterochromatin?
10. Define Lysosomes
11. Define Microtubles
12. Define RER
13. Explain PPLO.
14. Draw the Structure of a cell.

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Discuss about tissues and its various types.
16. Write a note on nucleus.
17. Write a note on lamp brush chromosome.
18. Explain tRNA and its structure
19. Write a note on mitochondria.
20. Explain structure of plasma membrane.

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Explain chromosome, its fine structure and briefly describe about giant chromosome
22. Explain cell cycle and discuss the significance of mitosis and meiosis
23. Explain protein and its structural organization in detail
24. Explain nucleic acids and different types of nucleic acids.

V SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

5B08BIF: BIOCHEMISTRY

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. pH
2. conjugate protein
3. Poly nucleotide
4. Amino acid
5. Molarity
6. Acids & bases

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. What is a buffer?
8. What are charged amino acids?
9. What are fatty acids?
10. Discuss Morality.
11. What are the classifications of amino acids.
12. What do you mean by redox potential?
13. What are polynucleotides?
14. What are oligosaccharides?

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Discuss the laws of thermodynamics
16. Discuss significance of pH in living system?
17. What are the classifications of lipids?
18. Explain structure biological membranes.
19. Explain the structures of nucleic acids
20. Discuss the secondary structure of proteins.

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Discuss various chemical properties of nucleotides.
22. Differentiate prokaryotes and eukaryotes
23. How do you prepare buffer in a solution? Explain
24. Explain the process of fatty acid biosynthesis

V SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

5B09BIF: STRUCTURAL BIOINFORMATICS

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Define amino acid
2. Define protein
3. Uniqueness of glycine.
4. Triplet codes of amino acids
5. Structure of alanine
6. Define motif and domain

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. Dihedral angle
8. Discuss secondary structure of protein
9. Difference between DNA & RNA
10. What is Braggs law?
11. B form DNA
12. Structure of amino acid
13. Protein – protein interactions
14. Use of crystallography

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Write on types of amino acids
16. What is Ramachandran plot?
17. What are DNA binding proteins?
18. Describe the structure validation.
19. Explain GOR method.
20. Explain Chou-Fasman method

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Explain in detail about Structural organization of protein.
22. Define Homology modeling. Mention different steps in homology modeling.
23. Discuss protein structure prediction methods.
24. Discuss on different forms and types of DNA & RNA.

V SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

5B10BIF: ADVANCED BIOINFORMATICS

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Vector
2. BAC
3. Ligase
4. Nanomaterial
5. Host
6. Drug

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. Give few applications of nanotechnology
8. What is cloning vectors?
9. List out commonly used vectors used in genetic engineering.
10. Discuss bottom up approaches.
11. Discuss the differences of DNase and RNase
12. Discuss on genetic engineering
13. Mention the types of restriction endonucleases.
14. Define nanotechnology.

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. How will you create rDNA molecules?
16. Discuss the ethical issues of nanotechnology.
17. Explain DNA modifying enzymes.
18. What is recombinant DNA.
19. What are the approaches to cure diseases?
20. What are restriction enzymes?

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Discuss on applications of genetic engineering. How will you create a rDNA by ligation?
22. Discuss nanotechnology. What are the properties of nanomaterials?
23. Explain about the enzymes used in genetic engineering.
24. Give some applications of nanotechnology in bioinformatics and biotechnology.

V SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

5B11BIF: BIOINFORMATICS PRACTICAL II

Time: 3 Hrs **Maximum marks: 40**

1. Perform the multiple sequence alignment and note down the details (12 arks)
2. Perform the protein-protein query of a sequence and note it down. (10 arks)
3. Retrieve the details from PDB and download a structure (8 marks)
4. Viva voce (5 marks)
5. Record (5 marks)

VI SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

6B12BIF: MOLECULAR BIOLOGY

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Nucleic acid
2. Amino acid
3. DNA
4. RNA
5. Lac operon
6. Point mutation

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. What is wobble hypothesis?
8. What is RNA polymerase?
9. What is terminator genes?
10. What are photo activation?
11. DEfine a gene?
12. Explain hotspot
13. What is catabolic repression?
14. What are operons?

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Write a note on lac and trp operon
16. Explain the role of chromatin in a cell
17. What do you mean by gene expression?
18. What are miRNAs?
19. What do you mean by point mutation?
20. Explain elongation and elongation factors.

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. With neat sketches explain central dogma of molecular biology.
22. What is DNA replication? Discuss the different DNA replication in eukaryotes
23. Explain DNA damage and repair mechanism.
24. Explain the regulation of gene expression in prokaryotes.

VI SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

6B13BIF: GENETICS

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Gene
2. Allele
3. Di-hybrid cross
4. Penetrance
5. Lethal gene
6. Pleiotropism

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. Define Genetics
8. Explain Genotype & phenotype
9. What is a Test cross?
10. What do you mean by epistasis
11. Explain Sex linked genes.
12. Discuss the law of segregation
13. What is a Back Cross?
14. What is Gene pool?

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Explain Linkage and its types
16. Discuss Population genetics
17. What are Sex limited genes?
18. Law of independent assortment
19. Discuss Complementary genes
20. Explain blood group inheritance in man.

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Explain Mendels work in detail. How they are distinguished?
22. What are linkages? Explain complete & incomplete linkage with an example. What are the importance and factors affecting linkage. Discuss linkage map.
23. Explain in detail about any 4 types of epistasis
24. What are Chromosomal aberrations? Discuss about the numerical and structural chromosomal aberrations.

VI SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

6B14BIF: SEQUENCE ANALYSIS

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Homologs
2. Paralogs
3. FASTA?
4. ClustalW?
5. PIR
6. Pileup

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. Taxonomy & phylogeny
8. Versions of BLAST
9. Write any four applications of sequence analysis
10. Pairwise Sequence alignment
11. FASTA format
12. What are the tools for phylogenetics analysis?
13. Explain character based methods in .
14. What are dendrograms?

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Define sequence analysis and sequence assembly
16. What are the difference between BLAST and FASTA?
17. What are the difference between PAM & BLOSUM?
18. What is MSA?
19. Write on different types phylogenetic trees.
20. Write differences in the analysis of protein & nucleic acid sequences.

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. What are scoring matrices? Elaborate PAM or BLOSUM in detail.
22. Discuss about Needleman-Wunch algorithm
23. Discuss various file formats of bio-molecular sequences
24. What do you mean by sequence based database search?

VI SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

6B15BIF: GENOMICS AND PROTEOMICS

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. FISH
2. SNP
3. Proteomics
4. Genomics
5. Pharmacokinetics
6. Micro array

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. What is DNA typing?
8. Explain chromosome walking
9. Write a note on tools in proteomics
10. Explain DNA polymorphism
11. What do you mean by genetic mapping?
12. Definition of pharmacogenomics.
13. Explain cytogenetics.
14. What are the application of microarray?

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Discuss genetic markers. What are its applications?
16. Discuss Shot gun method.
17. Explain the use of 2D gel Electrophoresis.
18. What is FISH? How it works.
19. Discuss the challenges and applications of pharmacodynamics.
20. Explain gene prediction methods

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Explain gene prediction. Discuss the algorithms used for gene prediction
22. What are genetic markers? How will you identify genetic markers? Discuss the application of genetic markers.
23. Explain pharmacodynamics and pharmacokinetics in relation to pharmacogenomics. Discuss its similarities and differences.
24. What are hybridization techniques? Discuss southern and northern blotting.

VI SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

6B16BIF: BIOINFORMATICS TECHNIQUES & DRUG DISCOVERY

Time: 3 hours **Maximum marks: 40**

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Absorption spectrum.
2. Chemical shift.
3. Database.
4. SMILES.
5. Drug.
6. ADME

Part B

Write notes on any six of the following. Each question carries 2 marks.

(6 x 2 = 12 marks)

7. What is Pharmacophore?
8. Features of Rasmol.
9. What is Cheminformatics?
10. Explain the Lipinski's rule of five.
11. What is a lead compound?
12. What is QSAR?
13. What is meant by drug dosage and drug efficiency?
14. Write briefly on drug targets.

Part C

Write short essay on any four of the following. Each question carries 3 marks.

(4 x 3 = 12 marks)

15. Discuss RNA sequencing
16. Write on docking?
17. Discuss about whole genome sequencing
18. Discuss SBDD
19. Write briefly on drug discovery pipeline.
20. What is combinatorial chemistry?

Part D

Write essay on any two of the following. Each question carries 5 marks.

(2 x 5 =10 marks)

21. Explain NMR spectroscopy. Give its applications.
22. What is CADD? Give the advantages and disadvantages of CADD.
23. Discuss on pharmaco-kinetics and pharmaco-dynamics
24. Explain the methods of NGS.

VI SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (CORE COURSE)

6B17BIF: BIOINFORMATICS PRACTICAL III

Time: 3 Hrs **Maximum marks: 40**

1. Perform the 3D visualization of a protein using Rasmol software.	(12 marks)
2. Predict the secondary structure of a protein.	(10 marks)
3. Find the physico - chemical parameters of a protein/NA sequence	(8 marks)
4. Viva voce	(5 marks)
5. Record	(5 marks)

KANNUR UNIVERSITY

B.Sc. DEGREE EXAMINATION

MODEL QUESTION PAPERS

FOR

BIOINFORMATICS

GENERIC ELECTIVE COURSES

V SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (GENERIC ELECTIVE COURSE)

5D01BIF: MOLECULAR MODELLING & DRUG DESIGNING

Time: 2 hours Maximum Marks: 20

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Protein fold
2. Drug
3. Enzymes
4. QSAR
5. Ligand
6. ADME

Part B

Write notes on any four of the following. Each question carries 2 marks.

(4 x 2 = 8 marks)

7. What is force field?
8. What is global energy minimum?
9. What is 1D profiles?
10. What is a Drug target?
11. What is SBDD.
12. What is HTS?

Part C

Write essay on any one of the following. Each question carries 6 marks.

(1 x 6 = 6 marks)

13. Discuss the various approaches in drug design.
14. Explain different structure prediction methods.

V SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (GENERIC ELECTIVE COURSE)

5D02BIF: PERL PROGRAMMING

Time: 2 hours Maximum Marks: 20

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Programming language
2. Motif
3. Array
4. Bugs
5. Flow chart
6. Subroutines

Part B

Write notes on any four of the following. Each question carries 2 marks.

(4 x 2 = 8 marks)

7. Approaches in perl programing.
8. Application of PERL
9. Fixing bugs in perl.
10. Write a program to calculate the reverse compliment of protein.
11. What are the files and arrays in perl.
12. How will you concatenate two strings.

Part C

Write essay on any one of the following. Each question carries 6 marks.

(1 x 6 = 6 marks)

13. Discuss the command-line arguments and libraries of perl.
14. Explain the data types and variables in PERL

V SEMESTER B.Sc. DEGREE EXAMINATION, 2019

BIOINFORMATICS (GENERIC ELECTIVE COURSE)

5D03BIF: INTRODUCTION TO BIOINFORMATICS

Time: 2 hours Maximum Marks: 20

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. URL
2. HTTP
3. Web server
4. Hyperlink
5. Database
6. NCBI

Part B

Write notes on any four of the following. Each question carries 2 marks.

(4 x 2 = 8 marks)

7. What is Apache?
8. Difference between internet and intranet.
9. How will you insert an image in html?
10. Write on DNA sequence database.
11. What do you mean by frames?
12. Write a note on PERL.

Part C

Write essay on any one of the following. Each question carries 6 marks.

(1 x 6 = 6 marks)

13. Discuss different types of list in html with examples.
14. Explain biological database. Discuss the protein and nucleic acid database.

V SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (GENERIC ELECTIVE COURSE)

5D04BIF: BIOLOGICAL DATABASES

Time: 2 hours Maximum Marks: 20

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. Database
2. NCBI
3. DALI
4. VAST
5. CATH
6. SCOP

Part B

Write notes on any four of the following. Each question carries 2 marks.

(4 x 2 = 8 marks)

7. ENTREZ
8. PROSITE
9. KEGG
10. PDB
11. DDBJ
12. Data retrieval

Part C

Write essay on any one of the following. Each question carries 6 marks.

(1 x 6 = 6 marks)

13. What is biological database? What do you know about genome databases?
14. Explain the protein and nucleic acid sequence database.

V SEMESTER B.Sc. DEGREE EXAMINATION

BIOINFORMATICS (GENERIC ELECTIVE COURSE)

5D05BIF: BIOMOLECULES

Time: 2 hours Maximum Marks: 20

Part A

Write short notes on each of the following. Each question carries 1 mark.

(6 x 1 = 6 marks)

1. pH
2. Amino acid
3. Protein
4. T-RNA
5. DNA
6. Lipid

Part B

Write notes on any four of the following. Each question carries 2 marks.

(4 x 2 = 8 marks)

7. Write second law of thermodynamics.
8. Properties of water.
9. Define nucleotide.
10. What are fatty acids?
11. What is base pairing?
12. Secondary structure of protein

Part C

Write essay on any one of the following. Each question carries 6 marks.

(1 x 6 = 6 marks)

14. Explain the structural organization of protein
15. Discuss the classification of lipids and its conjugate forms.