



MAHATMA GANDHI UNIVERSITY
of
MEDICAL SCIENCES & TECHNOLOGY
JAIPUR

Syllabus

B.Sc. Bioinformatics

(6 SEMESTERS U.G. DEGREE PROGRAM)

2023-24

Recommended by Committee of Courses of Health Informatics at its meeting held on 03/03/2023 and approved by Academic Council at its meeting held on 28/04/2023.

NOTICE

- 1. The university reserves the right to make changes in the syllabus /books/ guidelines, fee-structure or any other information at any time without prior notice. The decision of the university shall be binding on all.**
- 2. The jurisdiction of all court cases shall be Jaipur Bench of Hon'ble Rajasthan High Court only.**

**RULES & REGULATIONS OF
B.Sc. Bioinformatics
PROGRAM CODE: - BSC0223**

(6 SEMESTERS U.G. DEGREE PROGRAM)

1. Introduction:

Objectives/aims of the course:

To teach the students about the Basic sequence and structural Bioinformatics as well as introduction to Bioinformatics algorithms. Pairwise and multiple sequence alignment. Methods for phylogenetic analysis and pattern recognition. Bioinformatics databases and servers. Classification and comparison of protein structures. Prediction of secondary and tertiary structure from sequence and homology modelling of the three-dimensional structure of proteins. Molecular dynamics simulations and molecular docking with applications to drug design. Applications of bioinformatic research. Computer exercises in bioinformatic scientific environment. Introduction to basic programming in R. Ethical aspects in education, research and development.

Program Outcome:

1. Students will become familiar with a variety of currently available genomic and proteomic databases. Assessment will be based upon performance on computer assignments and exam questions.
2. Students will be able to search and retrieve information from genomic and proteomic databases (e.g. GenBank, Swiss-Prot), and to analyze their search results using software available on the internet (e.g. BLAST, ClustalW). Assessment will be based upon performance on computer assignments and exam questions.
3. Students will learn how to compare and analyze biological sequences and how to interpret the results of their analyses. Assessment will be based upon performance on computer assignments and exam questions.
4. Students will learn how to construct phylogenetic trees based on biological sequence data. Assessment will be based upon performance on computer assignments and exam questions.
5. Students will be able to locate consensus sequences, genes and open reading frames within biological sequences. Assessment will be based upon performance on computer assignments and exam questions.
6. Students will become familiar with the principles and applications of microarrays. Assessment will be based upon performance on exam questions.
7. Students will be able to perform elementary predictions of protein structure and function. Assessment will be based upon performance on computer assignments and exam questions.
8. Students will be able to perform elementary comparative genomic analysis. Assessment will be based upon performance on computer assignments and exam questions.
9. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.
10. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

2. TITLE OF THE PROGRAM:

B.Sc. Bioinformatics

3. DURATION OF THE COURSE:

Duration of the course: 3 Years (6 Semesters)

4. MEDIUM OF INSTRUCTION:

English shall be the medium of instruction for all the subjects of study and for examination of the course.

5. ELIGIBILITY FOR ADMISSION:

Senior Secondary (10 +2) or equivalent with minimum aggregate of 45% marks for general category students and 40% mark for reserved category students in physics, chemistry and biology provided the candidate has passed in each subject separately.

Candidate should have completed the age of 17 years till 31 Dec. of the respective admission year.

6. PROCESS OF ADMISSION:

Admission to B.Sc. Bioinformatics Program shall be made on the basis of written entrance examination conducted for the purpose.

7. RESERVATION POLICY:

Reservation in admissions shall be applicable as per policy of the State Government.

8. ENROLLMENT:

Every candidate who is admitted to B.Sc. Bioinformatics Degree Program in Mahatma Gandhi Institute of Health Informatics shall be required to get himself/herself enrolled with the Mahatma Gandhi University of Medical Sciences & Technology (MGUMST) after paying the prescribed eligibility and enrolment fees.

A candidate shall deposit enrolment fees along with tuition fees at the time of his/her admission to the course. Such a candidate who fails to submit, to the college Principal, duly filled enrolment form along with original documents including migration certificate required for enrolment within prescribed period then after he/she shall pay late fee applicable at that time. No student will be allowed to appear in the university examination without his/her enrollment.

9. ATTENDANCE:

Minimum 75 % attendance is required in each Semester, both for theory and practical classes separately, student with deficient attendance will not be permitted to appear in university examination.

10. WORKING DAYS:

Each semester shall consist of approximately 120 working days including examination.

11. CONDUCTION OF THE UNIVERSITY EXAMINATION:

University semester examination shall be conducted twice in a year with an interval of six months. Even Semester examination shall be conducted after 6 months of odd semester examination.

12. ELIGIBILITY TO APPEAR FOR UNIVERSITY EXAMINATION

Student is required to have minimum 75% attendance (in theory and practical separately) /to make him/her eligible to Candidates failing in one or more, subject in a semester will be required to appear in their failing subject in the next examination of the same semester next year.

A candidate will have to clear all the subjects of First to Fifth semester before appearing at sixth semester university examination.

13. APPOINTMENT OF EXAMINER & PAPER SETTER

- All the examiners - Paper setters, Theory examination answer books evaluators, External and internal Examiners for Practical examinations shall be appointed by the president of the University from the panel submitted by Principal through concerned dean of faculty.
- Paper setters shall be external, who will assess answer sheets of their respective papers.
- Professor/ Assoc. Professor /Assistant Professor/Lecturer/Allied Health Professional having PG qualification and 03 years' teaching experience after PG in respective field is eligible to act as Internal/External examiner of theory/practical examination.

14. SCHEME OF EXAMINATION

The University Examination (End of Semester Examination or EOSE) for the Course shall be conducted semester wise at the end of every semester.

i. Theory

- (a) There shall be five Theory papers in each semester.
- (b) Each Theory paper examination shall be of 3 hours duration and of maximum 70 marks.
- (c) Internal assessment (Continuous Assessment or CA) shall be of 30 marks for each Theory Paper.
- (d) The Paper Setter shall set the questions within the prescribed course of study of the concerned paper. There will be a set pattern of question papers duly approved by Academic Council.

Pattern of question papers (Attached)

- (g) Passing Marks: A candidate will have to obtain aggregate 50% marks including Continuous Assessment in each theory paper to pass.

II. Practical and Viva-Voce Examination

- (a) At the end of each semester there shall be practical and viva-voce examination of 200 marks. It shall be conducted after the Theory examination is over. A candidate will have to obtain at least 50% marks in practical and viva-voce examination
- (b) practical and viva-voce examination shall be of 140 marks (Practical 100 marks + viva voce 40 marks) and internal assessment of 60 marks.
- (b) The pattern of practical examination shall be as follows –

Semester	Practical Marks			Total Marks	Min. Pass Marks	Practical Examiners
	EOSE (End of Semester Examination)					
	Practical	viva-voce	CA			
I to VI Each	100	40	60	200	100	One Internal & one External Examiner

III. Result

1. Candidate have to obtain at least 50% marks separately in each Theory paper including continuous assessment and a minimum of 50% marks in the practical examination including viva-voce for him to be declared pass.
2. A Candidate who has failed in a Paper (s) will reappear in respective paper(s) in next examination of the same semester next year.
3. Candidate who has failed in Practical examination will reappear in practical examination only in next practical examination of the same semester.

IV. Supplementary Examination.

- (a) There shall be a supplementary examination of only VI semester within two months of the declaration of the result of the main examination of VI Semester.
- (b) Continuous assessment marks obtained in the concerned failed paper(s)/practical shall be carried forward for working out the result of next Theory paper(s) and/or practical examination.
- (c) If A failing candidate, wants to improve his/her Continuous assessment marks shall be allow to do so. In case he does appear for improvement or gets lesser marks in internal assessment, his earlier marks will be considered for working out the result of the failing subject.

V. Promotion to the Next Semester

1. A candidate who has passed or failed in one or more subjects shall be promoted to respective next semester.

2. A candidate will be allowed to appear for the VI semester examination only when the backlog of all papers (theory papers and practical) of I semester to V semester exams including elective papers (if any) is cleared.
3. The student is required to clear all the End of Semester Examination within 6 years from the year of joining of the Program otherwise he/she will have to leave the course.

B.Sc. Bioinformatics Marks Distribution of Semester – I Examination

Course/Paper Name	Course/Paper Code	Credits	Theory/ Practical/Viva			
CORE COURSES			UE	IA	Total	Pass Marks
Basics of Bioinformatics	BSC0223S101T	5	70	30	100	50 % aggregate including continuous assessment marks separately in theory and practical.
Basics of Clinical Sciences	BSC0223S102T	5	70	30	100	
Basics of Computer	BSC0223S103T	5	70	30	100	
ELECTIVE COURSES (ANY TWO)						
Communicative English	BSC0223S104T	4	70	30	100	
Basics of Healthcare Information Technology	BSC0223S105T	4	70	30	100	
Medical Terminology	BSC0223S106T	4	70	30	100	
PRACTICAL/ABILITY ENHANCEMENT COURSE						
Practical & Viva	BSC0223S107P	7	140	60	200	
TOTAL	06 (05 Theory Paper 01 Practical)	30	490	210	700	

B. Sc. in Bioinformatics Marks Distribution of Semester – II Examination

Course/Paper Name	Course/Paper Code	Credits	Theory/ Practical/Viva			
CORE COURSES			UE	IA	Total	Pass Marks
Cell Biology	BSC0223S201T	5	70	30	100	50 % aggregate including continuous assessment marks separately in theory and practical.
Basics of Biostatistics	BSC0223S202T	5	70	30	100	
Basics of Mathematics	BSC0223S203T	5	70	30	100	
ELECTIVE COURSES (ANY TWO)						
Innovation and IPR	BSC0223S204T	4	70	30	100	
Transcription and Telemedicine	BSC0223S205T	4	70	30	100	
Hospital Statistics	BSC0223S206T	4	70	30	100	
PRACTICAL/ABILITY ENHANCEMENT COURSE						
Practical & Viva	BSC0223S207P	7	140	60	200	
TOTAL	06 (05 Theory Paper 01 Practical)	30	490	210	700	

B.Sc. Bioinformatics Marks Distribution of Semester – III Examination

Course/Paper Name	Course/Paper Code	Credits	Theory/ Practical/Viva			
CORE COURSES			UE	IA	Total	Pass Marks
Structural Bioinformatics	BSC0223S301T	5	70	30	100	50 % aggregate including continuous assessment marks separately in theory and practical.
Basic programming in Bio-Perl	BSC0223S302T	5	70	30	100	
Basics of Data Analysis and Visualization	BSC0223S303T	5	70	30	100	
ELECTIVE COURSES (ANY TWO)						
Personality Development	BSC0223S304T	4	70	30	100	
Healthcare Services and its Application	BSC0223S305T	4	70	30	100	
Basic Life Support	BSC0223S306T	4	70	30	100	
PRACTICAL/ABILITY ENHANCEMENT COURSE						
Practical & Viva	BSC0223S307P	7	140	60	200	
TOTAL	06 (05 Theory Paper 01 Practical)	30	490	210	700	

B.Sc. Bioinformatics Marks Distribution of Semester – IV Examination

Course/Paper Name	Course/Paper Code	Credits	Theory/ Practical/Viva			
CORE COURSES			UE	IA	Total	Pass Marks
Basics of Proteomics	BSC0223S401T	5	70	30	100	50 % aggregate including continuous assessment marks separately in theory and practical.
Database Management System	BSC0223S402T	5	70	30	100	
Molecular Biology	BSC0223S403T	5	70	30	100	
ELECTIVE COURSES (ANY TWO)						
Medical Law and Ethics	BSC0223S404T	4	70	30	100	
Disaster Management	BSC0223S405T	4	70	30	100	
Yoga Practices	BSC0223S406T	4	70	30	100	
PRACTICAL/ABILITY ENHANCEMENT COURSE						
Practical & Viva	BSC0223S407P	7	140	60	200	
TOTAL	06 (05 Theory Paper 01 Practical)	30	490	210	700	

B.Sc. Bioinformatics Marks Distribution of Semester – V Examination

Course/Paper Name	Course/Paper Code	Credits	Theory/ Practical/Viva			
CORE COURSES			UE	IA	Total	Pass Marks
Genetic Engineering	BSC0223S501T	5	70	30	100	50 % aggregate including continuous assessment marks separately in theory and practical.
Introduction to Python	BSC0223S502T	5	70	30	100	
Basics of Genomics	BSC0223S503T	5	70	30	100	
ELECTIVE COURSES (ANY TWO)						
Artificial Intelligence in Healthcare	BSC0223S504T	4	70	30	100	
Basics of Computer Graphics	BSC0223S505T	4	70	30	100	
Basics of Machine Learning	BSC0223S506T	4	70	30	100	
PRACTICAL/ABILITY ENHANCEMENT COURSE						
Practical & Viva	BSC0223S507P	7	140	60	200	
TOTAL	06 (05 Theory Paper 01 Practical)	30	490	210	700	

B.Sc. Bioinformatics Marks Distribution of Semester – VI Examination

Course/Paper Name	Course/Paper Code	Credits	Theory/ Practical/Viva			
CORE COURSES			UE	IA	Total	Pass Marks
Introduction to Research	BSC0223S601T	5	70	30	100	50 % aggregate including continuous assessment marks separately in theory and practical.
Project Management	BSC0223S602T	5	70	30	100	
Basics of Chemoinformatics	BSC0223S603T	5	70	30	100	
ELECTIVE COURSES (ANY TWO)						
Biomedical Instrumentation	BSC0223S604T	4	70	30	100	
Information Security	BSC0223S605T	4	70	30	100	
Medical Record Management	BSC0223S606T	4	70	30	100	
PRACTICAL/ABILITY ENHANCEMENT COURSE						
Practical & Viva	BSC0223S607P	7	140	60	200	
TOTAL	06 (05 Theory Paper 01 Practical)	30	490	210	700	

15. REVALUATION / SCRUTINY:

Revaluation of answer book(s) and security of the marks shall be permissible as per the policy of the university.

16. TEACHING HOURS:

Teaching hours shall be approximately 400 hours in every semester.

17. AWARD OF DEGREE:

The degree shall be awarded by the University only after receipt of Course completion certificate and NO dues from the Principal of the college.

18. LETTER GRADES AND GRADE POINTS

LETTER GRADE	GRADE	PERCENTAGE OF MARKS
O (Outstanding)	10	100 %
A+(Excellent)	9	90-99.99 %
A (Very Good)	8	80-89.99 %
B+(Good)	7	70-79.99 %
B (Above Average)	6	60-69.99 %
C(Average)	5	50-59.99 %
F(Fail)	0	0 Less than 50 %
Ab (Absent)	0	0 Absent

19. Grades Qualifying for Pass:

Theory and Practical Examination

1. Minimum 5 Grade in the university examination and **5 Grade** in internal assessment evaluated by the department are required to pass **who fails to obtain 5 Grade shall be declared failed.**

2. A student obtaining **Grade F** shall be considered **failed** and will be required to reappear in the examination.

3. Letter Grade **Ab (Absent)** will be showing the absent of the candidate in examination and will be required to reappear in the examination.

Continuous Assessment:

Continuous Assessment will be conducted two times in a semester. Continuous Assessment marks will consist of departmental examinations, assignments, departmental posting, and evaluations.

End of Semester Examinations:

- a. Each theory paper examination shall be of 3 hours duration.
- b. There will be Five theory papers in Each Semester as following-

20. Weightage Distribution (%)

Item	Credit Weight (%)
1. Continuous Assessment	
Continuous Assessment Examinations	10.00%
Assignment, Class participation/presentation, study records	10.00%
Departmental Postings, case studies, project reports	10.00%
2. University Exam	
70.00%	
Total	100%

21. Authority to issue transcript

The Controller of Examination of the University shall be the authority for issuing transcript after receiving the described fee from the candidate.

22. Working Hours/Days

Duration	3 Years (6 Semesters)
Working Days	6 Days in A Week
Working Hours	36 Hours in A Week

23. Distribution of Courses Semester-Wise

Semester	Core Component (CCC)	Course Elective Component (ECC)	Ability Enhance Component (AEC)/Practical	Total No. Of Courses/Papers
Semester I	3	2	1	6
Semester II	3	2	1	6
Semester III	3	2	1	6
Semester IV	3	2	1	6
Semester V	3	2	1	6
Semester VI	3	2	1	6
Total	18	12	6	36

24. Distribution of Courses in Each Semester

Sr. No.	Type of Course	Numbers
1	Core Course	3
2	Elective Course	2
Total	05 (Five)	

25. Types of Courses in B.Sc. Bioinformatics: -

1. Core Course-course designed under this category aim to cover the basics that a student is expected to imbibe in the discipline of B.Sc. Bioinformatics. A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core Course.

2. Elective Course-it is a course which can be chosen from a pool of courses it is specific or specialized or advanced or supportive to the discipline of B.Sc. Bioinformatics. Students have to **CHOOSE ANY TWO COURSE IN EACH SEMESTER** from the pool of course given to that semester.

3. Ability Enhancement Courses (AEC) /Practical: The Ability Enhancement (AE) Courses or practical are the courses based upon the content that leads to Knowledge enhancement. They are skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

- The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$\text{SGPA (Si)} = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

where C_i is the number of credits of the i th course and G_i is the grade point scored by the student in the i th course.

- The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a program, i.e.

$$\text{CGPA} = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

where S_i is the SGPA of the semester and C_i is the total number of credits in that semester.

- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration of Computation of SGPA and CGPA and Format for Transcripts

- Computation of SGPA and CGPA
Illustration for SGPA

Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 X 8 = 24
Course 2	4	B+	7	4 X 7 = 28
Course 3	3	B	6	3 X 6 = 18
Course 4	3	O	10	3 X 10 = 30
Course 5	3	C	5	3 X 5 = 15
Course 6	4	B	6	4 X 6 = 24
	20			139

Thus, **SGPA = 139/20 = 6.95**

Illustration for CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit : 20 SGPA:6.9	Credit : 22 SGPA:7.8	Credit : 25 SGPA: 5.6	Credit : 26 SGPA:6.0

Semester 5	Semester 6		
Credit : 26 SGPA:6.3	Credit : 25 SGPA: 8.0		

Thus, **CGPA = 20 x 6.9 + 22 x 7.8 + 25 x 5.6 + 26 x 6.0 + 26 x 6.3 + 25 x 8.0**

= 6.73

SEMESTER I

Placement Semester	Semester I
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Bioinformatics
Course Code	BSC0223S101T
Course Type	Core
Credits	5
Hours per Semester	75

Introduction to Bioinformatics, Introduction to bioinformatics and its significance in biological research, Overview of biological databases and data retrieval methods(BLAST,FASTA), Introduction to sequence analysis and alignment techniques,Basics of molecular biology and genetics for bioinformatics, Sequence Analysis,DNA sequencing technologies and data generation, Sequence alignment algorithms (pairwise and multiple sequence alignment),Sequence database search and similarity analysis, Introduction to sequence motifs and pattern recognition, Protein sequence analysis: prediction of secondary structure and functional domains, Applications of Bioinformatics in various fields, Environment, biotechnology, molecular biology, neurobiology, agriculture, drug designing, biomedical genome medicines, medical microbiology.

Placement Semester	Semester I
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Clinical Sciences
Course Code	BSC0223S102T
Course Type	Core
Credits	5
Hours per Semester	75

Human Anatomy and Physiology: - Identify all anatomical structures of the human body • Understand the technical functions of various organs and systems of the body • Acquire knowledge about various body fluids, hormones and enzymes i. Integumentary system • Epithelium – • Cartilage – • Bone • Muscles • Neuron • Blood • Joints • Nasal Cavity, Larynx, Trachea, Thoracic Cage, Diaphragm, pleura, lungs Cardiovascular system • v. Blood and lymphatic system vi. Digestive system • vii. Urogenital viii. Endocrine system • Spinal cord, Brain, ix. Organs of special sense • Gross anatomy of eye; Gross anatomy of external, middle and internal ear; Skin

• **Introduction to Pathology** - Cell Injury, Cell Growth and Differentiation, • Inflammation • Infection, • Degeneration • Neoplasia • Blood groups, cross-matching, transfusions • Tests done on various body fluids and tissues • Infectious Disease • Disease of white cells and lymph nodes

Biochemistry i. Chemistry of the human body fluids in health and diseases ii. Cerebrospinal fluid iii. Clotting mechanism of the blood, iv. Enzymes produced in the G.I.Tract, v. Vitamins, Hormones, Proteins and Non-proteins, vi. Nitrogenous substances, lipids, carbohydrates, vii. Electrolytes viii. Metabolism, acid-base balance, ix. Normal values and ranges of biochemistry investigations

Microbiology i. Introduction to Microbiology, ii. Classification and characteristics of organisms, iii. Cultivation and identification of organisms, bacteria etc.,iv. Disinfection, antiseptics, sanitation, v. Immunity, vi. Allergy vii. Pathogenic organisms, non-pathogenic organisms ,virus and fungus.

Introduction to pharmacology• Route of Drug Administration • Pharmacokinetics and Pharmacodynamics • Drug Toxicity and Safety • Autonomic nervous system, including skeletal muscle relaxants • Introduction to ANS • Cholinergic drugs, Anticholinergic drugs, Neuromuscular blocking drugs and Adrenergic drugs • Adrenergic Receptor Antagonist ii. General and Local anesthetics iii. Hypnotics and Sedatives iv. Narcotic analgesics, narcotic antagonists v. Non-narcotic analgesics, antipyretics vi. Psycho-pharmacological agents vii. Drugs acting on autonomic nervous system viii. Antihistamines ix. Blocking agents x. Respiratory pharmacology, cardiovascular pharmacology, GIT.

Placement Semester	Semester I
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Computer
Course Code	BSC023S103T
Course Type	Core
Credits	5
Hours per Semester	75

Introduction to computers- types of computers-characteristics -Classification of digital computer systems- Microcomputers-minicomputers-supercomputers-functions and components of computers-Central processing unit.

NUMBER SYSTEM 17 Number System-Decimal number system-Binary number system-Complements-Gray code-ASCII code-Bits, Bytes and words-Memory unit-ROM, RAM, PROM, EPROM, EEPROM Auxiliary storage devices-Magnetic tape- hard disk, floppy disk-Input Devices-Output devices.

COMPUTER NETWORKS 13 Computer networks- Overview of a network- Communication Processors- Modems Message Switcher-Communication Media-Types of network-network topology-Introduction to Multimedia-Applications of Multimedia-Multimedia tools.

INTERNET 15 Internet and World wide web-Introduction-Internet access-Internet basics-Internet Protocols- Internet Addressing-WWW-HTML- HTML Tags-Web Browsers-Searching web- 56 Introduction to E-mail – Mailing Basics-E-mail Ethics-Advantages and disadvantages-Useful email services-Mailing list.

Placement Semester	Semester I
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Communicative English
Course Code	BSC0223S104T
Course Type	Elective
Credits	4
Hours per Semester	60

Identifying Common Errors in Writing with Reference to Articles and Prepositions Basic Writing Skills: Sentence Structures -Use of Phrases and Clauses in Sentences- Analysis of sentences- Transformation and Synthesis of sentences- Assertive to Negative and vice versa, Interrogative to Assertive/Negative and vice versa., Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement., Conversion of lexical words into meaningful paragraphs, Articulation according to IPA, Stress and Intonation.

Nature and Style of Sensible Writing- Defining- Describing Objects, Places and Events – Classifying- Providing Examples or Evidence., Writing Practices--Writing Introduction and Conclusion - Essay Writing- Précis Writing, Paragraph writing – Types, Structures and Features of a Paragraph - Creating Coherence- Organizing Principles of Paragraphs in Documents- Format of a Formal Letter-Writing Formal Letters eg., Letter of Complaint, Letter of Requisition, Job Application with Resume., Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Report.

Communication and its Process, Communication in Healthcare, Communication and Patient's Safety, Barriers and Strategies of Communication.

Placement Semester	Semester I
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Healthcare Information Technology
Course Code	BSC0223S105T
Course Type	Elective
Credits	4
Hours per Semester	60

Fundamentals of Health Care Information Technology (HCIT): its applications, challenges, and impact on the healthcare industry, Introduction to Health Care Information Technology, Current trends and challenges in HCIT implementation.

Electronic Health Records (EHRs): Understanding EHR systems and their benefits, EHR adoption and interoperability

Health Information Exchange (HIE): Overview of HIE and its role in healthcare data sharing, Standards and protocols for secure data exchange, Privacy and security concerns in HIE implementation

Health Informatics: Introduction to health informatics and data analytics, Using health data for decision-making and quality improvement, Application of informatics in public health and population management

Health Care Mobile Applications: Overview of health-related mobile apps and wearables

Computer Applications and Technologies in Healthcare

Office Applications

This section focuses on the concepts and operation of the main components of word processor, electronic spreadsheet, database management, and presentation software programs. Students will gain fundamental knowledge of a major software suite and learn skills that have practical application in real world situations.

Placement Semester	Semester I
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Medical Terminology
Course Code	BSC0223S106T
Course Type	Elective
Credits	4
Hours per Semester	60

1. Derivation of medical terms.
2. Define word roots, prefixes, and suffixes.
3. Conventions for combined morphemes and the formation of plurals.
4. Basic medical terms.
5. Form medical terms utilizing roots, suffixes, prefixes, and combining roots.
6. Interpret basic medical abbreviations/symbols.
7. Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system. concepts of body systems, components within individual systems, and relationships between systems, division of the body into body cavities and planes. Disease, disorders and dysfunctions, terminology of body systems to issues of disease, diagnostic and therapeutic tests, and procedures. Common sign and symptoms of disease conditions.

SEMESTER II

Placement Semester	Semester II
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Cell Biology
Course Code	BSC0223S201T
Course Type	Core
Credits	5
Hours per Semester	75

- Cell Biology:
- Cell as a basic unit of life.
- Cell organization of prokaryotic and eukaryotic cells.
- Structural and functional capitalization of cell: – Mitochondria, Chloroplast, Lysosomes, Golgi bodies, Plasma membrane, Cytoskeleton, Cell wall and Nucleus.
- Cell cycle, cell division - mitosis and meiosis.
- Chromosome structure, gene, gene number, gene clusters and Pseudogene.
- Polytene and lamp brush chromosomes.
- Packing of DNA, supercoiled DNA, nucleosome.
- Inverted repeats, repetitive DNA sequence, satellite DNA.
- Cell trafficking

Placement Semester	Semester II
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Biostatistics
Course Code	BSC023S202T
Course Type	Core
Credits	5
Hours per Semester	75

Statistics and Biostatistics

- Definition of Statistics and Biostatistics
- Role of statistics in Health Sciences
 - Variables: Qualitative & Quantitative, Continuous & Discrete, Dependent & Independent
 - Scales of Measurement: Nominal, Ordinal, Interval, Ratio
 - Organization of data
 - Types of class intervals: Inclusive, Exclusive & Open ended
 - Frequency Distribution: Measures of Central Tendency – Arithmetic Mean, Median and Mode for un-grouped and grouped data.
 - Presentation of data: Bar diagram, Pie Diagram, Histogram, Frequency polygon, Frequency curve, and Line diagram.
 - Measures of Variation: (Definition, computation, merits, demerits & application), Range, Inter Quartiles, Mean Deviation, Standard Deviation Co-efficient of Variation.
 - Partition values: Quartiles, Percentiles
 - Probability: Definitions of Classical Probability (Priori) and Frequency, Probability (Posteriori), Addition and Multiplicative Theorems of Probability
 - Normal Distribution: Concept, Normal curve, Properties, Skewness and Kurtosis
 - Probability Distribution: Binomial distribution, Poisson distribution and Normal distribution
 - Sampling- Definition: Population and simple Sampling, Simple Random Sampling, Stratified Random Sampling, Systematic Random Sampling and Cluster Sampling
 - Correlation and Regression: Scatter Diagram, Linear Correlation and Linear Regression Equation Test of Significance – Procedure Test of Significance for large samples and for small samples, Properties of correlation coefficient, Examples
 - Research Process and Research Methodology

- Chi-square Test – Testing for association Misuse of Chi-square Test

Placement Semester	Semester II
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Mathematics
Course Code	BSC0223S203T
Course Type	Core
Credits	5
Hours per Semester	75

I. Bioinformatics and Mathematics

1.1 Introduction 1.2 Genetic Code and Mathematics 1.3 Mathematical Background 1.4 Converting Data to Knowledge
1.5 Challenges and Perspectives

2. Sets: -

- Finite set, infinite set, null or void set, subset, Intervals; closed and open, universal set, operations of set.
- Relations and functions.

3. Matrices: -

- Types of matrices, properties of matrices, addition, subtraction of matrices,
- matrix, multiplication, elementary transformation,
- inverse of matrices.

4. Determinants: -

- Definition,
- properties associated with determinants.

5. Trigonometry and Derivatives.

Placement Semester	Semester II
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Innovation and IPR
Course Code	BSC0223S204T
Course Type	Elective
Credits	4
Hours per Semester	60

Introduction to Innovation: Definition and types of innovation, Importance of innovation in economic development, Innovation ecosystems and drivers.

Overview of Intellectual Property Rights (IPR): Meaning and significance of IPR, Forms of IPR: Patents, trademarks, copyrights, trade secrets, Balancing IPR with public interest and innovation diffusion

Patents and Patenting Process: Understanding patents and patentable subject matter, Criteria for patentability and novelty, Patent application, examination, and grant process, Trademarks and Copyrights, Meaning and purpose of trademarks, Copyrightable works and copyright protection, Fair use and infringement issues

Trade Secrets and Confidentiality: Definition and characteristics of trade secrets, Protecting trade secrets and confidential information, Non-disclosure agreements (NDAs)

IPR Management and Commercialization: Developing an IPR strategy, Licensing, technology transfer, and commercialization, Valuation and monetization of intellectual property

Global IPR Landscape

- International treaties and agreements (e.g., TRIPS, WIPO), Challenges in enforcing IPR internationally, Cultural and ethical aspects of IPR in a global context

Placement Semester	Semester II
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Transcription and Telemedicine
Course Code	BSC0223S205T
Course Type	Elective
Credits	4
Hours per Semester	60

Medical Transcription:

- Basics of Medical Transcription
- Objectives of Medical Transcription
- Rules of Medical Transcription
- Advantages of Medical Transcription
- Division of medical words into their component parts
- Forms, Suffixes, Prefixes and Terminology
- Laboratory tests, Clinical procedures and Abbreviations

Telemedicine:

- Classification of Telemedicine
- Technology of Telemedicine
- Objectives of Telemedicine
- Rules of Telemedicine
- Telemedicine Act
- Merits of Telemedicine
- Future Telemedicine plans
- Research

Placement Semester	Semester II
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Hospital Statistics
Course Code	BSC0223S206T
Course Type	Elective
Credits	4
Hours per Semester	60

Definition of hospital statistics and important Hospital Terms •Sources of Hospital Statistics – Registers, Medical Records and Daily Ward Census •Analysis of Hospital Services and Discharges –Important Rates, Ratio and Percentages with Formula •Uses and Limitations of Hospital Statistics •Hospital Statistics Reporting Crude Rates o Specific Rate o Prevalence, Incidence, Morbidity, fertility rates o Mortality Rates – Crude Death Rate, Specific Death Rates with respect to age , sex etc. Cause-of-death Rates; Infant Mortality Rates; Neonatal Mortality Rates o Post-Neonatal Mortality Rate or Late Infant Mortality Rate Collection of hospital statistical data: Birth, Death, fetal death, live birth and immature infants, reporting, determination of basic data, daily analysis of hospital service, discharge analysis procedure, cumulative method, monthly and annual reports, computation of percentage (ratios) inpatient census and bed occupancy rate (computerized and manual), presentation of hospital data. •Criteria of ill health • Classification of healthy and sick •Measurement of morbidity.

SEMESTER III

Placement Semester	Semester III
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Structural Bioinformatics
Course Code	BSC0223S301T
Course Type	Core
Credits	5
Hours per Semester	75

Nucleic acid structures

- RNA folding, RNA loops
- conformational study.

Protein-protein interactions

- protein ligand interactions, DNA-binding proteins,
- RNA -binding proteins.

Ramachandran plot, Structural databases: -

- Protein Data bank (PDB), Nucleic Acid Data Bank (NDB),
- Molecular modeling Data Bank (MMDB).

Protein identification and characterization: -

- AA Comp Ident, TagIdent, Pep Ident and MultiIdent,
- PROSEARCH, PepSeA, PepMAPPER, FindPept.

Introduction, Structure-based drug designing approaches: -

- Target Identification and Validation, homology modeling and protein folding
- receptor mapping, active site analysis and pharmacophore mapping
- Grid maps.

Placement Semester	Semester III
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basic Programming in Bio-Perl
Course Code	BSC0223S302T
Course Type	Core
Credits	5
Hours per Semester	75

Perl's Benefits, Installing Perl on Your Computer, how to Run Perl Programs, Text Editors and Finding Help. The art of programming: -Individual Approaches to programming, Edit-Run-Revise (and save), An Environment of Programs, Programming Strategies.

The Programming Process, 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 Perl, Proteins, Files, and Arrays, Reading Proteins in Files, Arrays Scalar and List Context. Motifs and Loops: -Flow Control, Code Layout, Finding Motifs, Counting Nucleotides, Exploding Strings into Arrays, operating on Strings Writing to Files.

Subroutines and Bugs: - Subroutines, Scoping and Subroutines, Command-Line Arguments and Arrays, Passing Data to Subroutines, Modules and Libraries of Subroutines, Fixing Bugs in Your Code. Mutations and Randomization: - Random Number Generators, A Program Using Randomization, A Program to Simulate DNA Mutation, Generating Random DNA, Analyzing DNA.

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.

Placement Semester	Semester III
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Data Analysis and Visualization
Course Code	BSC0223S303T
Course Type	Core
Credits	5
Hours per Semester	75

Introduction to Data Analysis and Visualization, Importance and applications of data analysis and visualization, Overview of the data analysis process, Introduction to data visualization tools and software,

Data Types and Data Cleaning, Different types of data (numerical, categorical, etc.),

Data cleaning and preprocessing techniques, Dealing with missing data and outliers,

Exploratory Data Analysis, Summary statistics and measures of central tendency, Data visualization techniques (histograms, box plots, scatter plots, etc.), Principles of effective data visualization, Graphical representations of data (bar charts, line graphs, pie charts, etc.), Visualizing multidimensional data, Data Visualization Tools and Software,

Introduction to popular data visualization tools (e.g., Python, ggplot2, matplotlib).

Placement Semester	Semester III
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Personality Development
Course Code	BSC023S304T
Course Type	Elective
Credits	4
Hours per Semester	60

Definition of

Personality - Determinants of Personality- biological, psychological and socio- cultural factors. - Misconceptions and clarifications - Need for personality development

SELF-AWARENESS AND SELF MOTIVATION Self-analysis through SWOT and Johari window - Elements of motivation - Seven rules of motivation - Techniques and strategies for self-motivation - Motivation checklist and Goal setting based on principle of SMART - Self motivation and life - Importance of self esteem and enhancement of self-esteem.

MEMORY AND STUDY SKILLS Definition and importance of memory - Causes of forgetting - How to forget (thought stopping), how to remember (techniques for improving memory) - The technique of passing exams-management of examination fear.

Placement Semester	Semester III
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Healthcare Services and its Application
Course Code	BSC0223S305T
Course Type	Elective
Credits	4
Hours per Semester	60

Health and Disease Concept,

& Definitions Dimensions of health, Wellbeing, Determinants of health, Evolution of medicine, Public Health, Health indicators, Health service philosophies, Disease & causation, Natural history of disease, Disease control & prevention, Changing patterns of disease.

Medical sociology –Introduction Sociological perspective of health, illness and healing. Institutional perspective and Organizational perspective.

Public and Private Health Care Services in India

Evolution of public health systems in India (ancient, colonial & post-independence), Health Planning in India (Committees, Planning commission, Five year plans, National Health Policies), Public health systems in India (Center, State, District & Village level), Rural development, Corporate philosophy, Evolution and organization of private health systems in India and Current trends in private health care in India.

WHO- Objective, functions, **UNICEF-** objective and functions. Different Model of Healthcare-The Beveridge Model, The Bismarck Model, The National Health Insurance Model, The Out-of-Pocket Model. Brief Introduction of Health System of different countries: USA, UK, Canada, Australia, Sweden, and Germany.

Population Health

Introduction to population studies, Issues of Indian society & culture, Nuptiality & Fertility, Reproductive health, Population and Development (policies, programs & evaluation), introduction to epidemiology (concept, terms, aims & uses), definition of epidemic, endemic, pandemic, sporadic. Prevalence and Incidence. Epidemiological methods- basic idea of Cohort study, Case Control study and RCT. Epidemiology of communicable diseases (TB, STDs, Diarrhea& HIV/AIDS) and Epidemiology of Non communicable diseases(CHD, Cancer, Diabetes, Hypertension &Obesity).

Contemporary Issues in Health Services Management

National Health Policy; Reproductive, Maternal, Newborn, Child, and Adolescent Health(RMNCH+A) ; National Vector Borne Disease Control Program (NVBDCP).

Placement Semester	Semester III
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basic Life Support
Course Code	BSC0223S306T
Course Type	Elective
Credits	4
Hours per Semester	60

Adult BLS, Adult chain of survival Scene safety and assessment adult compressions, AED, and Bag Mask Device

Successful Resuscitation teams

Infant and Child BLS, Pediatric chain of survival, AED for Infants, and children less than 8 years age 6,

Special considerations: Mouth to mouth breaths Breath with an advanced airway Opioid associated life-threatening emergency

Adult, infant and child choking Relief of choking in a responsive adult or child Relief of choking in an unresponsive adult or child

Practical demonstration of CPR, AED in adults and pediatric patients

Placement Semester	Semester IV
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Proteomics
Course Code	BSC0223S401T
Course Type	Core
Credits	5
Hours per Semester	75

SEMESTER IV

- Proteomics classification; Tools and techniques in proteomics; 2-D gel electrophoresis, gel filtration, PAGE, isoelectrick focusing, affinity chromatography, HPLC, ICAT, fixing and spot visualization, Mass spectroscopy for protein analysis, MALDI-TOF, Electrospray ionization (EST), Tandem mass spectroscopy (MS/MS) analysis; tryptic digestion and peptide fingerprinting (PMF).
- Protein Micro array in protein expression, profiling and diagnostics, drug target discovery.
- Database searching, 3-dimensional structure determination by X-ray and NMR.
- Phylogenetic analysis:-Evolution, elements of phylogeny, methods of phylogenetic analysis, Phylogenetic tree of life, comparison of genetic sequence of organisms, phylogenetic analysis tools-Phylip, Clustal W.

Placement Semester	Semester IV
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Database Management System
Course Code	BSC0223S402T
Course Type	Core
Credits	5
Hours per Semester	75

Introduction and Basic Concepts - Structure of DBMS - Advantages & Disadvantages - Relational and their schemes integrity rules - Relational algebra: Basic operations additional operations, relational algebraic operations. Relational Calculus: Tuple Calculus domain calculus - Physical Implementation Issues What is database ,Data base System Applications, Purpose of Database Systems, View of Data – Data Abstraction – Instances and Schema – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base Architecture – Storage Manager – the ,Normalization – Introduction, Non loss decomposition and functional dependencies, First, Second, and third normal forms – dependency preservation, Boyed/Codd normal form. Higher Normal Forms - Introduction, Multi-valued dependencies and Fourth normal form, join dependencies and Fifth normal form, Overview of the SQL Query Language – Basic Structure of SQL Queries, Set Operations, Aggregate Functions – GROUPBY – HAVING, Nested Sub queries, Views, Triggers.

Placement Semester	Semester IV
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Molecular Biology
Course Code	BSC0223S403T
Course Type	Core
Credits	5
Hours per Semester	75

Genome Organization:- Organization of bacterial genome, Structure of eukaryotic chromosomes, Role of nuclear matrix in chromosome organization and function, matrix binding proteins, heterochromatin and euchromatin, molecular components, DNA association kinetics (Cot curve analysis), repetitive and unique sequences, kinetics and sequence complexities, Satellite DNA, DNA melting and buoyant density, packing and organization of chromatin, nucleosome phasing, DNase I hypersensitive regions, DNA methylation & Imprinting.

Mutation: -Nonsense, missense and point mutations, intragenic and intergenic suppression, frameshift mutations, physical, chemical and biological mutagens, Concepts of replication initiation, elongation and termination in prokaryotes and eukaryotes, enzymes and accessory proteins involved in DNA replication, Fidelity in replication, replication of single stranded circular DNA, Gene stability and DNA repair, DNA repair enzymes, photo reactivation, nucleotide excision repair, mismatch correction, SOS repair, Protein synthesis. Transport of proteins and molecular chaperones, Protein stability, protein turnover and degradation.

Placement Semester	Semester IV
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Medical Law and Ethics
Course Code	BSC0223S404T
Course Type	Elective
Credits	4
Hours per Semester	60

Medical ethics - Definition - Goal - Scope , Introduction to Code of conduct , Basic principles of medical ethics – Confidentiality ,Malpractice and negligence - Rational and irrational drug therapy , Autonomy and informed consent - Right of patients ,Care of the terminally ill- Euthanasia , Organ transplantation , Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects, Professional Indemnity insurance policy , Development of standardized protocol to avoid near miss or sentinel events ,Obtaining an informed consent.

Placement Semester	Semester IV
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Disaster Management
Course Code	BSC0223S405T
Course Type	Elective
Credits	4
Hours per Semester	60

Disaster and its type, Flood Draught, Cyclone, Geographical Disaster, Earthquake, Landslide, Avalanches, Volcanic Eruptions, Climatic Disaster-Heat and Cold Wave, Climate Change, Global Warming, Sea level Rise, Ozone Depletion. Disaster Preparedness, Disaster Prevention, Preparation and Mitigation, Disaster Information, System, Megha Satellite, Role of Various Agencies in Disaster Mitigation- National level and State levels, Disaster Response: Disaster Medicine, Rehabilitation, Reconstruction and Recovery. Disaster Response: Disaster Medicine, Rehabilitation, Reconstruction and Recovery.

Placement Semester	Semester IV
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Yoga Practices
Course Code	BSC0223S406T
Course Type	Elective
Credits	4
Hours per Semester	60

FOUNDATIONS OF YOGA: HISTORY

- Origin of Yoga, History and Development of Yoga; Etymology and Definitions, Misconceptions, Aim and Objectives of Yoga, True Nature and Principles of Yoga
- Introduction to Vedas, Upanishads, Prasthanatrayee and Purushartha Chatushtaya
- General introduction to Shad-darshanas with special emphasis on Samkhya and YogaDarshana, Yoga in Vedanta
-

EVOLUTION OF YOGA

Introduction to Epics - (Ramayana, Mahabharata), Yoga in Ramayana, Yoga in Mahabharata

- Introduction to Smritis and Yoga in Smritis; General introduction to Agamas and Tantra, Yoga in Tantra; Concepts of Nadi and Prana in Tantra, Kundalini, Effects of Kundalini Shakti and Shatchakra Sadhana
- Yoga in Medieval Literature, Bhakti Yoga of Medieval Saints, Yoga in Narada Bhakti Sutras.
- Yoga in Modern Times: Yogic Traditions of Ramakrishna and Swami Vivekananda, Shri Aurobindo; Yoga traditions of Maharshi Ramana and Swami Dayanand Saraswati
- Yoga in Contemporary Times: Brief Introduction to important Yoga Paramparas (lineages) Yoga Parampara of Sri T. Krishnamacharya, Yoga Parampara of Swami Shivanada Saraswati, Swami Rama of Himalayas, Maharshi Mahesh Yogi and their contributions for the development and promotion of Yoga.

EVOLUTION SCHOOLS OF YOGA

- Introduction to Schools (Streams) of Yoga: Yoga Schools with Vedanta Tradition (Jnana, Bhakti, Karma and Dhyana), Yoga Schools with Samkhya-Yoga Tradition (Yoga of Patanjali) and Yoga Schools with Tantric Tradition (Hatha Yoga, Swara Yoga and Mantra Yoga)
- Elements of Yoga and Yogic practices in Jainism, Buddhism and Sufism

SEMESTER V

Placement Semester	Semester V
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Genetic Engineering
Course Code	BSC0223S501T
Course Type	Core
Credits	5
Hours per Semester	75

Restriction analysis: Types of restriction enzyme, Type I, II and III, restriction modification systems, type II restriction endonucleases and properties, isoschizomers and neoschizomers, mcr/mrr genotypes, Cohesive and blunt end ligation, linkers, adaptors, homopolymeric tailing. 1.2 Labeling of DNA: Nick translation, random priming, radioactive and non-radioactive probes, use of Klenow enzyme, T4 DNA polymerase, bacterial alkaline phosphatase, polynucleotide kinase.

Gene Cloning Vectors: Plasmids, bacteriophages, Cloning in M13 mp vectors, phagemids, Lambda vectors. Cosmid vectors. Artificial chromosome vectors (YACs, BACs), 2.2 Animal Virus derived vectors- SV-40, vaccinia/baculo & retroviral vectors. 2.3 Hybridization techniques: Northern, Southern and Colony hybridization, Fluorescence in situ hybridization. 2.4 DNA fingerprinting, chromosome walking & chromosome jumping. UNIT – III No.of Hours: 10 3.1 Insertion of Foreign DNA into Host Cells: Transformation, Transfection. 3.2 Chemical and physical methods, liposomes, microinjection, 5.1 PCR - Primer design, Fidelity of thermostable enzymes, DNA polymerases, multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products, T-vectors, proof reading enzymes, PCR in gene recombination, deletion, addition, overlap extension, and SOEing, site specific mutagenesis.

Applications: PCR in molecular diagnostics, viral and bacterial detection, PCR based mutagenesis. Sequencing methods: Enzymatic DNA sequencing, Chemical sequencing of DNA, principle of automated DNA sequencing, RNA sequencing. Applications of recombinant DNA technology in medicine, agriculture, veterinary sciences.

Gene Therapy: Creation of knockout mice, disease model, somatic and germ-line therapy in vivo and ex-vivo, suicide gene therapy, gene replacement, gene targeting. macroinjection, electroporation, biolistics, somatic cell fusion, gene transfer by pronuclear microinjection.

Placement Semester	Semester V
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Introduction to Python
Course Code	BSC0223S502T
Course Type	Core
Credits	5
Hours per Semester	75

Introduction to Python: - What is Python?, History and background of Python, Advantages and applications of Python. Installation and setup

Python Data Types: Numeric data types (integers, floats, complex numbers), Strings and string operations, Lists, tuples, and dictionaries.

Variables and Basic Operations: - Declaring and using variables, Arithmetic operations, Comparison and logical operations.

Control Flow: Conditional statements (if, elif, else), Loops (for loop, while loop) and loop control statements (break, continue), Indentation and its significance.

Functions: - Defining and calling functions, Function parameters and return values, Lambda functions (anonymous functions), Introduction to Libraries

Biological Data Retrieval and Parsing: - Accessing online biological databases,, Parsing file formats like FASTA, GenBank, and PDB Data retrieval from online resources (NCBI, UniProt, etc.), Working with biological sequences (DNA, RNA, and protein),- Sequence objects in Biopython,- Sequence alignment, - Sequence similarity searching (BLAST)

Multiple sequence alignment (ClustalW, MUSCLE)

- Sequence motifs and patterns, Biopython Utilities and Tools
- Bio.SeqIO and Bio.AlignIO for reading/writing sequences and alignments
- BLAST and PSI-BLAST handling

- Entrez and NCBI utilities

Placement Semester	Semester V
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Genomics
Course Code	BSC0223S503T
Course Type	Core
Credits	5
Hours per Semester	75

Genomics: Nucleotide sequence Databases, its Analysis and Identification.

Goals of the Human Genome Project, cloning vectors, concept of maps, physical maps, shotgun libraries, DNA polymorphism, nucleotides, DNA sequences.

Sequence databases: GeneBank, EMBL Nucleotide sequence databank, DNA Data Bank of Japan (DDBJ), database formats.

Recombinant DNA technology, restriction enzymes, resource for restriction enzyme (REBASE), similarity search.

Polymerase chain reaction, primer selection for PCR, BLASTn, application of BioEdit.

Genome information and special features, coding sequences (CDS), untranslated regions (UTR's), cDNA library, expressed sequence tags (EST).

Approach to gene identification; masking repetitive DNA, database search, codon-bias detection, detecting functional sites in the DNA.

Internet resources for gene identification, detection of functional sites, gene expression.

Placement Semester	Semester V
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Artificial Intelligence in Healthcare
Course Code	BSC023S504T
Course Type	Elective
Credits	4
Hours per Semester	60

Artificial Intelligence

What is Artificial Intelligence? ,Philosophy of AI ,Goals of AI , History of AI , Contributes to AI?,

Programming Without and With AI ,What is AI Technique? , Applications of AI ,What is Intelligence ,

Types of Intelligence ,What is AI Technique ?

Intelligence Composition , Difference between Human and Machine Intelligence ,Research Areas of AI ,Search Algorithms ,Logic Systems ,Natural Language Processing ,Robotics ,

Uses of AI in Health Care.

Placement Semester	Semester V
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Computer Graphics
Course Code	BSC0223S505T
Course Type	Elective
Credits	4
Hours per Semester	60

Introduction to Computer Graphics

- Overview of computer graphics
- Applications of computer graphics in various industries
- History and evolution of computer graphics

Image Representation and Manipulation

- 2.1 Introduction to digital images
- 2.2 Image formats and color spaces
- 2.3 Image acquisition and sampling
- 2.4 Basic image manipulation techniques (resizing, cropping, filtering)

2D Graphics, Raster Graphics, 3D Graphics

Introduction to Computer Animation

Graphics Applications and Projects

- Overview of real-world graphics applications (games, simulations, visualizations)
- Final project development (e.g., a simple 2D/3D game, interactive demo)

Placement Semester	Semester V
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Machine Learning
Course Code	BSC0223S506T
Course Type	Elective
Credits	4
Hours per Semester	60

Introduction to Machine Learning

- What is Machine Learning?
- Types of Machine Learning: Supervised, Unsupervised, Reinforcement Learning
- Machine Learning Applications and Real-world Examples
- Data Cleaning and Handling Missing Values
- Feature Scaling
- Data Transformation and Encoding

Introduction to Neural Networks

- Perceptrons and Multilayer Perceptrons (MLPs)
- Activation Functions
- Backpropagation Algorithm

Introduction to Natural Language Processing (NLP)

- Text Preprocessing
- Bag-of-Words and Word Embeddings
- Sentiment Analysis

SEMESTER VI

Placement Semester	Semester VI
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Introduction to Research
Course Code	BSC0223S601T
Course Type	Core
Credits	5
Hours per Semester	75

Introduction to Research: Definition of research, Role of research in various field, Characteristics of good research, Types of research (basic, applied, exploratory, descriptive, etc.)

Research Process: Steps involved in the research process, Developing a research problem and research questions, Literature review: Importance and techniques, Formulating research hypotheses

Research Designs: Experimental, non-experimental, and quasi-experimental designs, Cross-sectional and longitudinal studies, Case studies and survey research, Qualitative research methods and their applications

Data Collection Methods: Surveys: Questionnaire design and administration, Interviews: Types, techniques, and ethical considerations, Observations: Participant and non-participant observations, Secondary data sources and their utilization

Data Analysis and Interpretation: Quantitative data analysis: Descriptive and inferential statistics, Qualitative data analysis: Coding, thematic analysis, and narrative interpretation, Integrating qualitative and quantitative data (mixed methods)

Ethical Considerations in Research: Informed consent and confidentiality, Institutional Review Board (IRB) approval, Addressing bias and ensuring research integrity

Research Communication: Writing a research report: Structure and components, Presenting research findings: Effective visual aids and presentation skills, Disseminating research through conferences and publications

Placement Semester	Semester VI
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Project Management
Course Code	BSC0223S602T
Course Type	Core
Credits	5
Hours per Semester	75

Project Management - Introduction, Meaning & Definition of project. Defining - Project Managers, Functional Managers & Executive's role. Project Manager as a planning agent, Project Driven Vs Non Project Driven organization, marketing in the Project Driven Organization, Programs and Projects, Product Vs Project Management, Project Life Cycles, program evaluation, project analysis & management. Project Planning- Identifying strategic project variables, Project planning, Statement of work, Project specifications, Milestone schedule, Work breakdown structure, Planning cycle, Management Control, categories of project. Project Feasibility - technical feasibility, marketing feasibility, socio-economic feasibility, managerial feasibility, financial feasibility and potential feasibility. UNIT – 4 Project Evaluation and Review techniques - Estimating activity time, Estimating total program time, PERT/CPM planning, Crash time, project sustainability, operations research. Project Management Functions - Controlling, Directing, Project authority, Team building, Leadership, communications, Project review meetings, Management policies and procedures, proposal writing. UNIT – 6 Pricing Estimating & Cost Control - Types of estimates & Pricing process, Labor distributions, Overhead rates, Material/Support costs, Pricing review, Budgeting for projects variance & earned value, Status reporting, project accounting.

Placement Semester	Semester VI
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Basics of Cheminformatics
Course Code	BSC0223S603T
Course Type	Core
Credits	5
Hours per Semester	75

Introduction to Cheminformatics

- Definition and scope of cheminformatics, Role of cheminformatics in drug discovery and materials science, Molecular representations: SMILES, InChI, molecular graphs, etc., Molecular descriptors: 2D and 3D descriptors.

Chemical Databases

- Overview of chemical databases and their importance, Structure databases: PubChem, ChemSpider, ChEMBL, etc., Property databases: NMR, IR, MS databases, Searching and filtering chemical databases.

Molecular Visualization and Modeling

- Molecular visualization software: PyMOL, Jmol, VMD, etc.

-- Protein-ligand interactions and docking studies

Pharmacophore Modeling

Virtual Screening

Molecular docking: Principles and applications

High-throughput screening and compound selection

Cheminformatics in Drug Design

- De novo drug design

- Scaffold hopping and lead optimization

- ADME/T (Absorption, Distribution, Metabolism, Excretion, and Toxicity) prediction

Placement Semester	Semester VI
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Biomedical Instrumentation
Course Code	BSC0223S604T
Course Type	Elective
Credits	4
Hours per Semester	60

1. List of common medical equipment

CT, MRI, X-Ray, USG, ECG, Multi-channel machine, Infusion Pump, Syringe Pump, Anesthesia Machine,

Heart-Lung Machine, IABP, ABG analysis machine, USG Doppler, Echocardiography, PFT machine, Ventilator, Cell saver machine, Diathermy, ACT machine, Defibrillator, Incubator-laboratories & neonate, Sterilizer-Autoclave, ETO, Plasma, Laparoscopic, Colonoscopic.

- Equipment's selection guideline.
- Estimation of cost and planning.
- Purchase, installation, commissioning,
- Replacement and buy back policy.
- International and indigenous standards
- Maintenance Management
- 2. Types of maintenance systems.
- 3. Equipment history and documents.
- 4. Maintenance planning.
- Spares management.
- Replacement policy.
- Depreciation and loss of value.

Placement Semester	Semester VI
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Information Security
Course Code	BSC0223S605T
Course Type	Elective
Credits	4
Hours per Semester	60

Elements of Information Security, Information security supports the mission of the organization, Information security is an integral element of sound management , Information security protections are implemented so as to be commensurate with risk , Information security roles and responsibilities are made explicit, Information security responsibilities for system owners go beyond their own organization , Information security requires a comprehensive and integrated approach , Interdependencies of security controls , Other interdependencies , Information security is assessed and monitored regularly, Information security is constrained by societal and cultural factors,

Threats and Vulnerabilities: A Brief Overview, Examples of Adversarial Threat Sources and Events , Fraud and Theft, Insider Threat , Malicious Hacker , Malicious Code, Examples of Non-Adversarial Threat Sources and Events , Errors and Omissions , Loss of Physical and Infrastructure Support , Impacts to Personal Privacy of Information Sharing, Information Security Policy

Standards, Guidelines, and Procedures, Program Policy, Basic Components of Program Policy , Issue-Specific Policy , Example Topics for Issue-Specific Policy , Basic Components of Issue-Specific Policy, System-Specific Policy, Security Objectives, Operational Security Rules,-Specific Policy Implementation, Interdependencies, Cost Considerations,

Information Security Risk Management, Implement , Assess , Authorize, Monitor, Assurance, Authorization , Authorization and Assurance, Cost Considerations, Security Considerations in System Support and Operations , Support, Software Support , Configuration Management, Backups , Media Controls, Documentation, Maintenance, Interdependencies, Cost Considerations, Cryptography, Uses of Cryptography , Data Encryption, Integrity, Electronic Signatures, Implementation Issues , Selecting Design and Implementation Standards, Deciding between Software, Hardware, or Firmware Implementations , Managing Keys, Security of Cryptographic Modules, Applying Cryptography to Networks , Complying with Export Rules, Interdependencies

Placement Semester	Semester VI
Name of the Program	B.Sc. Bioinformatics
Program Code	BSC0223
Name of the Course	Medical Record Management
Course Code	BSC023S606T
Course Type	Elective
Credits	4
Hours per Semester	60

Introduction:

- Definition and Types of medical record, Importance of medical record
- Flow chart of function, Assembling & deficiency check
- Format types of MR, Characteristics of MR, ownership of MR, Maintenance of records in the ward, Content of MR

Coding:

- Coding, Indexing, Filing, Computerization of MR, Microfilming,
- Report and returns by the record department, Statistical information of Hospital
- ICD 10
- Organizations & management of Medical Records Department
- Process of arranging medical records
- Retention of MR
- Preservation of MR
- Role of MRD personnel in Medical record keeping
- Basic knowledge of legal aspects of Medical Records including
 - Factories Act, Workmen
 - Compensation Act
 - Consumer Protection Act
- Medical Audit

MODEL PAPER**B. Sc. Bioinformatics Semester I****BSC0223S101T****First Semester****B. Sc. Bioinformatics****Examination (Month/year)****Paper-I****Basics of Bioinformatics****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Introduction to bioinformatics and its significance in biological research.
- B Describe about biological databases and data retrieval methods.
- C Describe Applications of Bioinformatics in various fields.

2. Short Essay (Attempt any Two)**2X10 = 20**

- A Introduction to sequence analysis and alignment techniques
- B What is medical microbiology?
- C Describe Basics of molecular biology and genetics for bioinformatics.

3. Short notes (Any four)**4X5 = 20**

- A. Biotechnology
- B. Protein sequence
- C. DNA sequencing technologies
- D. Introduction to sequence motifs
- E. sequence analysis

MODEL PAPER**B. Sc. Bioinformatics Semester I****BSC0223S102T****First Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-II****Basics of Clinical Sciences****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Identify all anatomical structures of the human body.
- B Describe Integumentary system.
- C Describe Chemistry of the human body fluids in health and diseases

2. Short Essay (Attempt any Two)**2X10 = 20**

- A Describe Gross anatomy of external, middle and internal ear.
- B What is Inflammation?
- C Describe Infectious Disease.

3. Short notes (Any four)**4X5 = 20**

- A. hormones.
- B. carbohydrates.
- C. Cardiovascular system.
- D. Disease of white cells and lymph nodes.
- E. Blood groups.

MODEL PAPER**B. Sc. Bioinformatics Semester I****BSC0223S103T****First Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-III****Basics of Computer****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A functions and components of computers-Central processing unit.
- B Describe Computer networks.
- C Describe types of computers

2. Short Essay (Attempt any Two)**2X10 = 20**

- A Introduction to E-mail
- B Internet basics Protocols?
- C network topology

3. Short notes (Any four)**4X5 = 20**

- A Introduction to Multimedia.
- B. Characteristics of DBMS
- C. Decimal number system.
- D . Multimedia tools.
- E. storage devices

MODEL PAPER**B. Sc. Bioinformatics Semester I
BSCO223S104T****CE-IV****First Semester****B. Sc. Bioinformatics****Examination (Month/year)****Paper IV
Communicative English****Time: Three Hours****Maximum Marks: 70****Attempt all questions.****1. Long Answer (Attempt any two)****2X15 = 30**

- A Define Communication in detail with its various types and forms.
- B Illustrate a note on the elements of sentence.
- C Demonstrate the process of communication?

2. Short Essay (Attempt any Two)**2X10 = 20**

- A. Define between spoken and written communication.
- B “In healthcare, clear communication can be the difference between life and death”.
- C. Communication in healthcare?

3. Short notes (Any four)**4X5 = 20**

- A. Communication Channels.
- B. Barriers and Strategies of communication.
- C. She has been learning to swim for a long time.
- D He offered his friend some helpful advice.
- E. she carefully placed the delicate vase on the table.

MODEL PAPER**B. Sc. Bioinformatics Semester I****BSC0223S105T****BOHIT-V****First Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-V****Basics of Healthcare Information Technology****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two) 2X15 = 30

- A Discuss about HCIT?
- B Describe about Current trends and challenges in HCIT implementation.?
- C Describe EHR adoption and interoperability?

2. Short Essay (Attempt any Two) 2X10 = 20

- A What is Health Information Exchange?
- B Discuss about health data for decision-making and quality improvement?
- C Describe Health Care Mobile Applications?

3. Short notes (Any four) 4X5 = 20

- A. EMR
- B. HIS
- C. CDSS
- D. EMR
- E. Information Technology

MODEL PAPER**B. Sc. Bioinformatics Semester I****BSC0223S106T****MT-VI****First Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-VI****Medical Terminology****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two) 2X15 = 30

- A Describe word roots, prefixes, and suffixes with example?
- B Describe terms position, direction, and planes of the body and their applications.
- C Explain the role of medical terminology in hospital management?

2. Short Essay (Attempt any Two) 2X10 = 20

- A Explain the rule of word building in medical terminology?
- B Mentioned procedures medical terms related to the integumentary system.?
- C Explain diagnostic medical terms related to the nervous system.?

3. Short notes (Any four) 4X5 = 20

- A. Suffixes and prefixes medical terms of Cardiovascular system.
- B. Laboratory medical terms of skin
- C. Diagnostic & Procedure terms of Endocrine system
- D. Structure and Function medical terms of Bones
- E. Pharmacological medical terms of Reproductive system.

MODEL PAPER**B. Sc. Bioinformatics Semester II****BSC0223S201T****Second Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-I****Cell Biology****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Cell organization of prokaryotic and eukaryotic cells.
- B Discuss about Structural and functional capitalization of cell
- C Describe Packing of DNA.

2. Short Essay (Attempt any Two)**2X10 = 20**

- A Describe Chromosome structure
- B Discuss about Repetitive DNA sequence.
- C Polytene and lamp brush chromosomes.

3. Short notes (Any four)**4X5 = 20**

- A Cell trafficking.
- B. nucleosome
- C. Chloroplast.
- D . Chromosome structure
- E. DNA

MODEL PAPER**B. Sc. Bioinformatics Semester II****BSC0223S202T****Second Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-II****Basics of Biostatistics****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Introduction to Biostatistics & research methodology.
- B Discuss about principles of probability theory.
- C Describe types of variables & scales of measurements.

2. Short Essay (Attempt any Two)**2X10 = 20**

- A Describe Types of errors and levels of significance
- B Discuss about Meta-analysis.
- C Sequence Analysis

3. Short notes (Any four)**4X5 = 20**

- A Sampling & Non sampling errors.
- B. Methods of minimizing errors
- C. Measures of central tendency and dispersion
- D . Structure of research protocol
- E. Normal distribution

MODEL PAPER**B. Sc. Bioinformatics Semester II****BSC0223S203T****Second Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-III****Basics of Mathematics****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Determinants: - Definition, properties
- B Discuss about Trigonometry and Derivatives.
- C Describe inverse of matrices.

2. Short Essay (Attempt any Two)**2X10 = 20**

- A Substraction of matrices
- B Discuss about elementary transformation.
- C Types of matrices.

3. Short notes (Any four)**4X5 = 20**

- A Finite set
- B. infinite set
- C. subset
- D . Matrices
- E. properties of matrices

MODEL PAPER**B. Sc. Bioinformatics Semester II****BSC0223S204T****I&I-IV****Second Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-IV****Innovation and IPR****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two) 2X15 = 30

- A Explain Importance of innovation in economic development?
- B Describe Patents and Patenting Process.
- C Explain the Meaning and significance of IPR?

2. Short Essay (Attempt any Two) 2X10 = 20

- A Describe Trade Secrets and Confidentiality?
- B Explain Valuation, and monetization of intellectual property?
- C Explain Challenges in enforcing IPR internationally?

3. Short notes (Any four) 4X5 = 20

- A. Trademarks.
- B. Copyrights
- C. Balancing IPR
- D. Non-disclosure agreements (NDAs)
- E. Licensing

MODEL PAPER**B. Sc. Bioinformatics Semester II****BSC0223S205T****T&T-V****Second Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-V****Transcription and Telemedicine****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A. Discuss about Medical Transcription?
- B. Describe about Technology of Telemedicine?
- C. Describe Clinical procedures?

2. Short Essay (Attempt any Two)**2X10 = 20**

- A. What is Telemedicine Research?
- B. Discuss about Rules of Medical Transcription?
- C. Describe Merits of Telemedicine in Health Care?

3. Short notes (Any four)**4X5 = 20**

- A. Prefixes
- B. Suffixes
- C. Forms
- D. EMR
- E. Telemedicine Act

MODEL PAPER**B. Sc. Bioinformatics Semester II****BSC0223S206T****HS-VI****Second Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-VI****Hospital Statistics****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two) 2X15 = 30

- A Explain Importance and Sources of hospital statistics ?
- B Describe Uses and Limitations of Hospital Statistics.
- C Explain the Analysis and Discharges process of Hospital Services ?

2. Short Essay (Attempt any Two) 2X10 = 20

- A Describe Measurement and Importance of morbidity statistics.?
- B Explain the role of hospital statistical data?
- C Explain inpatient census and bed occupancy rate?

3. Short notes (Any four) 4X5 = 20

- A. Bed occupancy rate.
- B. Bed turnover rate
- C. Hospital Census
- D. Crude rate
- E. Hospital Indicators

MODEL PAPER**B. Sc. Bioinformatics Semester III****BSC0223S301T****Third Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-I****Structural Bioinformatics****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Discuss about Nucleic acid structures?
- B Describe about Structure-based drug designing approaches?
- C Describe active site analysis and pharmacophore mapping?

2. Short Essay (Attempt any Two)**2X10 = 20**

- A what is Protein Data bank?
- B Discuss about Protein identification and characterization?
- C Describe Structural databases?

3. Short notes (Any four)**4X5 = 20**

- A. Grid maps
- B. receptor mapping
- C. RNA loops
- D Protein interactions
- E. RNA folding

MODEL PAPER**B. Sc. Bioinformatics Semester III****BSC0223S302T****Third Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-II****Basic programming in Bio-Perl****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Discuss about How to Run Perl Programs and Installing Perl on Your Computer?
- B Describe about Calculating the Reverse Complement in Perl?
- C Describe Modules and Libraries of Subroutines?

2. Short Essay (Attempt any Two)**2X10 = 20**

- A Operating on Strings Writing to Files?
- B Discuss about Arrays Scalar and List Context?
- C Describe Representing Sequence Data?

3. Short notes (Any four)**4X5 = 20**

- A. Mutations and Randomization
- B. Concatenating DNA Fragments
- C. RNA loops
- D Protein interactions

E. RNA folding

MODEL PAPER

B. Sc. Bioinformatics Semester III

BSC0223S303T

Third Semester

B. Sc. Bioinformatics

Examination (Month/year)

PAPER-III

Basics of Data Analysis and Visualization

Time: Three Hours

Maximum Marks: 70

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)

2X15 = 30

A Introduction to Data Analysis and Visualization?

B Importance and applications of data analysis and visualization?

C Introduction to popular data visualization tools?

2. Short Essay (Attempt any Two)

2X10 = 20

A Data Visualization Tools and Software?

B Data cleaning and preprocessing techniques?

C Principles of effective data visualization?

3. Short notes (Any four)

4X5 = 20

A. types of data

B. Data Analysis

C. Python

D Graphical representations of data

E. effective data visualization

MODEL PAPER

B. Sc. Bioinformatics Semester III

BSC0223S304T

PD -IV

Third Semester

B. Sc. Bioinformatics

Examination (Month/year)

PAPER-IV

Personality Development

Time: Three Hours

Maximum Marks: 70

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two) 2X15 = 30

A Explain the role of personality in health care organization?

B Describe the need for personality development.

C Explain biological and psychological factors of personality?

2. Short Essay (Attempt any Two) 2X10 = 20

A Describe self-awareness and self-motivation.?

B Explain Seven rules of motivation?

C Explain Techniques and strategies for self-motivation?

3. Short notes (Any four) 4X5 = 20

A. Self-esteem.

B. SMART

C. SWOC

D. Memory

E. Management

MODEL PAPER**B. Sc. Bioinformatics Semester III****BSC0223S305T****HS&A-V****Third Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-V****Healthcare Services and Its Application****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A. Discuss about public health systems in India.
- B. Describe about Health Planning in India.
- C. Describe National Health Policy?

2. Short Essay (Attempt any Two)**2X10 = 20**

- A. What are Determinants of health.
- B. Discuss about The Bismarck Model.
- C. Describe Rural Health development.

3. Short notes (Any four)**4X5 = 20**

- A. WHO
- B. UNICEF
- C. NVBDCP
- D. CANCER
- E. Hypertension

MODEL PAPER**B. Sc. Bioinformatics Semester III****BSC0223S306T****BLS-VI****Third Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-VI****Basic Life Support****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A. Explain the role of basic life support in health care.
- B. Explain rules and regulations of basic life support.
- C. Describe the importance of successful resuscitation teams.

2. Short Essay (Attempt any Two)**2X10 = 20**

- A. Explain BLS process of adult compression.
- B. Discuss about Child basic life support.
- C. Describe special consideration of advanced BLS.

3. Short notes (Any four)**4X5 = 20**

- A. Choking
- B. Bag mask device
- C. CPR
- D. Infant choking
- E. AED

MODEL PAPER**B. Sc. Bioinformatics Semester IV****BSC0223S401T****Fourth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-I****Basics of Proteomics****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Proteomics classification; Tools and techniques in proteomics?
- B Describe about 3-dimensional structure determination by X-ray and NMR?
- C Discuss about Mass spectroscopy for protein analysis?

2. Short Essay (Attempt any Two)**2X10 = 20**

- A 2-D gel electrophoresis?
- B Protein Micro array in protein expression?
- C Phylogenetic tree of life?

3. Short notes (Any four)**4X5 = 20**

- A. Clustal W
- B. Phylogenetic analysis tools
- C. ICAT
- D Affinity chromatography
- E. Tandem mass spectroscopy

MODEL PAPER**B. Sc. Bioinformatics Semester IV****BSC0223S402T****Fourth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-II****Database Management system****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

A Introduction and Basic Concepts and Structure of DBMS?

B What is database and its Applications and Purpose of Database Systems?

C Describe about database Access for applications Programs?

2. Short Essay (Attempt any Two)**2X10 = 20**

A Relational and their schemes integrity rules?

B Transaction Management?

C Data base Architecture?

3. Short notes (Any four)**4X5 = 20**

A. Relational Model

B. Advantages & Disadvantages of DBMS

C. Database Languages

D Storage Manager

E. Purpose of Database System

MODEL PAPER**B. Sc. Bioinformatics Semester IV****BSC0223S403T****Fourth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER III****Molecular Biology****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

A Describe about Role of nuclear matrix in chromosome organization and functions?

B Organization of bacterial genome?

C Describe about Transport of proteins and molecular chaperones?

2. Short Essay (Attempt any Two)**2X10 = 20**

A Matrix binding protein?

B Intragenic and intergenic?

C DNA repair enzymes?

3. Short notes (Any four)**4X5 = 20**

A. Repetitive and unique sequences

B. Nucleosome phasing

C. Photoreactivation

D Protein synthesis

E. Fidelity in replication

MODEL PAPER**B. Sc. Bioinformatics Semester V****BSC0223S501T****MODEL PAPER****B. Sc. Bioinformatics Semester IV****BSC0223S404T****ML&E-IV****Fourth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-IV****Medical Law and Ethics****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A. Describe about Role of Medical ethics.
- B. What are the Code of conduct?
- C. Describe about Rights of patients.

2. Short Essay (Attempt any Two)**2X10 = 20**

- A. What are the Rational and irrational drug therapy?
- B. What are the Autonomy and informed consent?
- C. Explain Basic principles of medical ethics

3. Short notes (Any four)**4X5 = 20**

- A. Informed consent
- B. Organ transplantation
- C. Unauthorized disclosure

D. Malpractice

E. Euthanasia

MODEL PAPER

B. Sc. Bioinformatics Semester IV

BSC0223S405T

DM-V

Fourth Semester

B. Sc. Bioinformatics

Examination (Month/year)

PAPER-V

Disaster Management

Time: Three Hours

Maximum Marks: 70

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)

2X15 = 30

A. Discuss about disaster Management in India.

B. Describe about Triage Fire Hazards.

C. Describe Disaster management Rules.

2. Short Essay (Attempt any Two)

2X10 = 20

A. What are Determinants of health.

B. Discuss about Disaster cycle.

C. Describe Assessment of Disaster Preparedness

3. Short notes (Any four)

4X5 = 20

A. Fire Manual Guideline

B. Fire Fighting

C. Mass Casualties Management

D. Manmade disasters

E. Natural disasters

MODEL PAPER

B. Sc. Bioinformatics Semester IV

BSC0223S406T

YP-VI

Fourth Semester

B. Sc. Bioinformatics

Examination (Month/year)

PAPER-VI

Yoga Practices

Time: Three Hours

Maximum Marks: 70

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)

2X15 = 30

- A. Explain the importance and Origin of Yoga.
- B. Explain the Etymology of Yoga.
- C. Describe the History and Development of Yoga.

2. Short Essay (Attempt any Two)

2X10 = 20

- A. Explain Aim and Objectives of Yoga.
- B. Discuss about Misconceptions of yoga.
- C. Describe True Nature and Principles of Yoga.

3. Short notes (Any four)

4X5 = 20

- A. Evolution of yoga
- B. Vedas, Upanishads, Prasthanatrayee and Purushartha Chatushtaya
- C. Yoga in Ramayana
- D. Yoga of Patanjali
- E. Yogic practices in Jainism, Buddhism and Sufism

Fifth Semester
B. Sc. Bioinformatics
Examination (Month/year)

PAPER I

Genetic Engineering

Time: Three Hours

Maximum Marks: 70

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)

2X15 = 30

A Describe about Types of restriction enzyme?

B Describe about PCR in molecular diagnostics, viral and bacterial detection?

C Describe about gene transfer by pronuclear microinjection?

2. Short Essay (Attempt any Two)

2X10 = 20

A Bacterial alkaline phosphatase?

B Polynucleotide kinase?

C Principle of automated DNA sequencing?

3. Short notes (Any four)

4X5 = 20

A. veterinary sciences

B. Gene Therapy

C. Electroporation

D RNA sequencing

E. Biolistic

MODEL PAPER**B. Sc. Bioinformatics Semester V****BSC0223S501T****Fifth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER II****Introduction to Python****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

A Introduction to Python Applications in Bioinformatics.

B. Describe Python Datatypes?

C. Define Arithmetic operation of Python.

2. Short Essay (Attempt any Two)**2X10 = 20**

A. Define Python Libraries.

B. Explain String operation.

C Define Bio python.

3. Short notes (Any four)**4X5 = 20**

A. List

B. Tuple

C. Variables

D. Comparison function

E. Loop

MODEL PAPER**B. Sc. Bioinformatics Semester V****BSC0223S503T****Fifth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER III****Basics of Genomics****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

A Describe about Nucleotide sequence Databases, its Analysis and Identification?

B Goals of the Human Genome Project?

C Describe about EMBL Nucleotide sequence databank?

2. Short Essay (Attempt any Two)**2X10 = 20**

A Restriction enzymes?

B Resource for restriction enzyme?

C Coding sequences?

3. Short notes (Any four)**4X5 = 20**

A. DNA polymorphism

B. Untranslated regions

C. Database formats

D DNA Data Bank of Japan

E. Polymerase chain reaction

MODEL PAPER**B. Sc. Bioinformatics Semester VI****BSC0223S601T****MODEL PAPER****B. Sc. Bioinformatics Semester V****BSC0223S504T****AIH-IV****Fifth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-IV****Artificial Intelligence in Healthcare****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A. Describe about Artificial Intelligence in Health Care.
- B. What are the Goals of the AI Project.
- C. Describe about AI Technique.

2. Short Essay (Attempt any Two)**2X10 = 20**

- A. Explain any two examples of AI?
- B. What are the Difference between Human and Machine Intelligence?
- C. What are the Research Areas of AI?

3. Short notes (Any four)**4X5 = 20**

- A. NLP
- B. Search Algorithms
- C. Robotics
- D. Intelligence

E. Logic System.

MODEL PAPER

B. Sc. Bioinformatics Semester V

BSC0223S505T

BOCG-V

Fifth Semester

B. Sc. Bioinformatics

Examination (Month/year)

PAPER-V

Basics of Computer Graphics

Time: Three Hours

Maximum Marks: 70

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two) 2X15 = 30

- A. Discuss about computer graphics.
- B. Explain about evolution of computer graphics.
- C. Describe Introduction to digital images.

2. Short Essay (Attempt any Two) 2X10 = 20

- A. What are Applications of computer graphics in various industries?
- B. Discuss about image manipulation techniques.
- C. Describe Assessment of real-world graphics.

3. Short notes (Any four) 4X5 = 20

- A. Visualizations
- B. Image acquisition
- C. Interactive demo
- D. Digital images
- E. 2D/3D game

MODEL PAPER**B. Sc. Bioinformatics Semester V****BSC0223S506T****BOML-VI****Fifth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-VI****Basics of Machine Learning****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A. Discuss about Machine Learning.
- B. Explain about Data Cleaning and Handling.
- C. Describe Backpropagation Algorithm.

2. Short Essay (Attempt any Two)**2X10 = 20**

- A. What are Applications of Machine Learning in various industries?
- B. Discuss about Bag-of-Words and Word Embeddings.
- C. Describe Types of Machine Learning.

3. Short notes (Any four)**4X5 = 20**

- A. Activation Functions
- B. Sentiment Analysis
- C. Text Preprocessing
- D. Feature Scaling
- E. Real-world Examples of ML.

MODEL PAPER**B. Sc. Bioinformatics Semester VI****IR-I****BSC0223S602T**

B. Sc. Bioinformatics
Examination (Month/year)

PAPER-I**Introduction to Research****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Research tools and Data collection methods.
- B Discuss about Ethical issues in research.
- C Presentation of data

2. Short Essay (Attempt any Two)**2X10 = 20**

- A Developing a research proposal
- B Definition of Statistics and Biostatistics
- C Frequency Distribution

3. Short notes (Any four)**4X5 = 20**

- A Research methods.
- B. Definitions of Classical Probability
- C. Measures of Central Tendency
- D Sampling
- E. Correlation and Regression

MODEL PAPER**B. Sc. Bioinformatics Semester VI****PM-II****BSC0223S602T****Six Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-II****Project Management****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Discuss about Project Management Functions
- B Discuss about Project Management.
- C Types of estimates & Pricing process.

2. Short Essay (Attempt any Two)**2X10 = 20**

- A Meaning & Definition of project
- B Project Driven Vs Non Project Driven organization
- C Product Vs Project Management

3. Short notes (Any four)**4X5 = 20**

- A Project Evaluation and Review techniques
- B. Pricing Estimating & Cost Control
- C. Project Feasibility
- D Management policies
- E. technical feasibility

MODEL PAPER**B. Sc. Bioinformatics Semester VI****BC-III****BSC0223S603T****Six Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-III****Basics of Chemoinformatics****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two)**2X15 = 30**

- A Introduction to cheminformatics.
- B Discuss about Natural resources of lead compounds.
- C Discuss about Chemical Database Design

2. Short Essay (Attempt any Two)**2X10 = 20**

- A Use of cheminformatics.
- B The MOS Database
- C Combinatorial chemistry technologies

3. Short notes (Any four)**4X5 = 20**

- A Bio Catalysts Database
- B. Chemical information sources
- C. Prodrugs and soft drugs
- D. Drug solubility
- E. Amines

MODEL PAPER**B. Sc. Bioinformatics Semester VI****BSC0223S604T****BI-IV****Sixth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-IV****Biomedical Instrumentation****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two) 2X15 = 30

- A. Describe about Types of Equipment's maintenance systems.
- B. Explain Replacement policy.
- C. Describe about Estimation of cost and planning?

2. Short Essay (Attempt any Two) 2X10 = 20

- A. Describe Spares management.
- B. What is the Maintenance planning?
- C. What is the Sterilizer-Autoclave?

3. Short notes (Any four) 4X5 = 20

- A. X-Ray
- B. Multi-channel machine
- C. PFT machine
- D. Cell saver machine
- E. Plasma

MODEL PAPER**B. Sc. Bioinformatics Semester VI****BSC0223S605T****IS-V****Sixth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-V****Information Security****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. Long Answer (Attempt any two) 2X15 = 30

- A. Explain the elements of information security?
- B. What are the Information security roles and responsibilities?
- C. Explain the role of Information security in healthcare organizations?

2. Short Essay (Attempt any Two) 2X10 = 20

- A. Explain the Interdependencies of security controls.
- B. What are the principles of Information Security?
- C. Describe the societal and cultural factors of Information Security?

3. Short notes (Any four) 4X5 = 20

- A. Malicious Hacker
- B. Threats and Vulnerabilities
- C. Operational Security Rules
- D. Errors and Omissions
- E. Cost Considerations

MODEL PAPER**B. Sc. Bioinformatics Semester VI****BSC0223S606T****MRM-VI****Sixth Semester****B. Sc. Bioinformatics****Examination (Month/year)****PAPER-VI****Medical Record Management****Time: Three Hours****Maximum Marks: 70**

Attempt all Questions

All the parts of one question should be answered at one place.

Only one Supplementary Copy along with one main answer book is allowed

1. **Long Answer (Attempt any two)** **2X15 = 30**
- A. What are the Importance of medical record?
- B. Describe Types of medical record.
- C. Define Organizations & management of Medical Records Department.
2. **Short Essay (Attempt any Two)** **2X10 = 20**
- A. What are Content of MR?
- B. What is ICD 10 ?
- C. What is Retention of MR ?
3. **Short notes (Any four)** **4X5 = 20**
- A. Compensation Act
- B. Factories Act
- C. Medical Audit
- D. Consumer Protection Act
- E. Microfilming