Course outline of B.Sc Bioinformatics

Semester-1

Course no.	Course name		Marks	IA
BIN 101	English	(T)	50	5
BIN 102	Plant diversity-1 and bioprospecting	(T + P)	50	5
BIN 103	Cell biology and biochemistry	(T + P)	50	5
BIN 104	Concept in bioinformatics	(T + P)	50	5
BIN 105	Physical chemistry	(T + P)	50	5
BIN 106	Inorganic chemistry	(T + P)	50	5
BIN 107	Organic chemistry	(T+P)	50	5
BIN 108	Seminar and term paper writing on concepts in bioinformatics and biotechnology		25	
BIN 109	Lab course 1.Cellbiology and biochemistry, Plant diversity} 2. Basic computers and bioinformatics} 90			

Total-500

Semester-2

Course no.	Course name		Marks	IA
BIN 201	Biostatistics	(T + P)	50	5
BIN 202	Microbiology and genetics	(T +P)	50	5
BIN 203	Introduction to C and DBMS	(T + P)	50	5
BIN 204	Animal Diversity-1 and economic zoology	(T+P)	50	5
BIN 205	Physical chemistry	(T+P)	50	5
BIN 206	Inorganic chemistry	(T + P)	50	5
BIN 207	Organic chemistry	(T+P)	50	5
BIN 208	Seminar and term paper writing on agricultural bioinformatics		15	
BIN 209	Lab Course 1 Chemistry 100 2 microbiology, genetics, Biostatistics, Animal diversity, Introduction to C and DBMS. 100			

Total-600

Semester-3

Course no.	Course name		Marks	IA
BIN 301	Biological database and data analysis	(T+P)	50	5
BIN 302	Computer graphics and visualizations	(T+ P)	50	5
BIN 303	Plant diversity-II and physiology	(T + P)	50	5
BIN 304	Physical chemistry	(T + P)	50	5
BIN 305	Inorganic chemistry	(T + P)	50	5
BIN 306	Organic chemistry	(T + P)	50	5
BIN 307	Seminar and term paper writing		25	
BIN 308	Lab Course 1.Plant diversity and Physiology,Computer graphics, Biological databases and data analysis	90		

Total-500

Semester-4

Course no.	Course name		Marks	IA
BIN 401	Animal diversity-II and physiology	(T + P)	50	5
BIN 402	Molecular biology	(T + P)	50	5
BIN 403	Computer added drug designing	(T + P)	50	5
BIN 404	Taxonomy and Phlogeny	(T + P)	50	5
BIN 405	Physical chemistry	(T + P)	50	5
BIN 406	Inorganic chemistry	(T + P)	50	5
BIN 407	Organic chemistry	(T + P)	50	5
BIN 408	Seminar and Term paper writing	15		
BIN 409		Lab Course -1 Chemistry -100 2. Molecular biology; Immunology; Taxonomy & phylogeny; Animal diversity-2 100 marks		

Total-60

Semester-5

Course no.	Course name		Marks	IA
BIN 501	Perl	(T + P)	50	5
BIN 502	Recombinant DNA technology	(T + P)	50	5
BIN 503	Immonology	(T + P)	50	5
BIN 504	Genomics and proteomics	(T+P)	50	5
BIN 505	Physical Chemistry	(T+P)	50	5
BIN 506	Inorganic chemistry		50	5
BIN 507	Organic Chemistry		50	5
BIN 508	Seminar and term paper writing			25
BIN 509	Lab Course1 RDT-25 2 Perl-25;CADD-20;Genomics and proteomics-20			

Total-500

Semester-6

Course no.	Course name		Marks	IA
BIN 601	IPR's ,Bioethics and biosafety	(T+P)	50	5
BIN 602	Biodiversity informatics	(T+P)	50	5
BIN 603	Techniques for sequence and structure analysis	(T+P)	50	5
BIN 604	Molecular modelling	(T+P)	50	5
BIN 605	Physical Chemistry	(T+P)	50	5
BIN 606	Inorganic Chemistry	(T+P)	50	5
BIN 607	Organic Chemistry	(T+P)	50	5
BIN 608	Project report and presentation			100
BIN 609	Industry visit report		100	
BIN 610	Lab course 1. Chemistry -100 2. IPR; Biodiversity informatics; Molecular modeling and Techniques for sequence and structure analysis. -100			

Total - 800

- Industry visit in summer vacations.
- One Month project training in VI semester.

BIN-101 COMMUNICATIVE ENGLISH

MM 50 +5IA

The syllabus for English is same as that for B.A./B.Sc. I.

BI-102 PLANT DIVERSITY-1 AND BIOPROSPECTING

MM 50 +5IA

Note: Examiner is requested to set one compulsory and eight other questions at least two from each unit. The compulsory question will be of 10 marks and should cover the entire syllabus. Student should attempt four other questions i.e. one from each unit.

UNIT 1

Algae:
General characters, classification and economic importance. Life histories of algae belonging to various classes :

- Chlorophyceae- volvo,oedogonium
- Xantho phyceae-vaucheria
- Phaeophyceae-ectocarpus
- Rhodophyceae-polysiphonia

UNIT 2

Fungi:
General characters , classification & economic importance.
Life histories of fungi-

- Mastigomycontina - phytophthora.
- Zygomycotina – mucor
- Ascomycotina- saccharomyces
- Basidomycotina-agaricus
- Deutromycotina – colletotrichum

UNIT 3

Lichens:
Classification , general structure , reproduction and economic importance.
Plant diseases:
Casual organism, symptoms and control of following plant diseases.

- Rust and smut of wheat.
- White rust of crucifers.
- Late blight of potato.
- Red rot of sugarcane.
- Citrus canker.
-

UNIT 4

Bryophytes-
General characters,classification & economic importance.
Life histories of following:

- Marchantia.
- Funaria.

PRACTICALS

1) Comparative study of thallus and reproductive organs of various algae mentioned in theory.
2) Comparative study of vegetative and reproductive parts of various fungi mentioned in theory.
3) Study and section cutting and lectophenol mount of plant disease.
4) Study of various types of lichens.
5) Study of external features & anatomy of vegetative and reproductive parts of marchantia and funaria.
6) Collection of algae, fungi, plant diseases material and bryophytes available locally.

BIN 103 CELL BIOLOGY and BIOCHEMISTRY

CELL BIOLOGY

UNIT-1

Cell: An introduction and classification of organism by cell structure, cytosol, compartmentalization of eukaryotic cells, Cell fractionation. Cell Membrane and Permeability: Chemical components of biological membranes, organization and fluid Mosaic Model.

UNIT-2

Membrane vacuolar system, cytoskeleton and cell motility: Structure and function of microtubules, Microfilaments, Intermediate filaments.
Endoplasmic reticulum: Structure, function including role in protein segregation.
Golgi complex: Structure, biogenesis and functions including role in protein secretion
Lysosomes: Vacuoles and microbodies: Structure and functions.
Ribosomes: Structure and function including role in protein synthesis.
Mitochondria: Structure, Genomes, biogenesis.
Chloroplasts: Structures, Genomes, biogenesis.

UNIT-3

Nucleus: Structure, Cell cycle (Interphase & M Phases), Mitosis, Meiosis, Regulation of cell cycle, Chromosome-Structure and characteristics
Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics of cancer cells, molecular basis of cancer.

BIOCHEMISTRY

UNIT-4

Introduction to Biochemistry: a historical perspective, structural classification & properties of major biomolecules-cabohydrates, fats, proteins, Water.
Amino acids & Proteins - Structure & function. Structure and properties of aminoacids, Types of proteins and their classification, Forces stabilizing protein structure and shape. Different level of structural organization of proteins, Purification of proteins and criteria of their purity. Denaturation and renaturation of proteins. Fibrous and globular proteins.
Carbohydrates - Structure and properties of monosaccharides, Oligosaccharides and Polysaccharides. Homo & hetero Polysaccharides, Mucopolysaccharides.
Lipids - Structure & functions-Classification, structures, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids structure and properties of different types of phospholipids, sphingomyelins, glycolipids, cerebrosides, gangliosides, Prostaglandins cholesterol-its structure and biological properties, utilization of cholesterol.

UNIT-5

Nomenclature and classification of Enzymes, Holoenzymes, Apoenzymes, Cofactors, coenzyme, prosthetic groups, metalloenzymes, monomeric & oligomeric enzymes,activation energy and transition state, enzyme activity, specific activity, common features of active sites, enzyme specificity: types and theories, ribozymes,abzymes, Biocatalysts from extreme thermophilicand hyper thermophilic

archea and bacteria.Role of cofactors in enzyme catalysis: NAD+, NADP+, FMN/FAD, coenzymesA, VitminB12, lipoic acid, biotin,tetrahydofolate and metallic ions.
Carbohydrate metabolism: Glycolysis: reactions, energetics and regulation, Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway and its significance, Gluconeogenesis, Glycogenolysis and glycogenesis.
TCA cycle: ETC, Oxidative phosphorylation
Beta oxidation of fatty acids
Biochemistry of photosynthesis.

PRACTICALS

1. Effect of pH, temperature on activity of salivary amylase enzyme activity.
2. Separation of aminoacids by paper chromatography.
3. Quantitation of proteins and sugar.
4. Colorimetric determination of pK.
5. Analysis of oils-Iodine number, saponification value,acid number.
6. Cell division in onion root tip.
7. Study the effect of temperature, organic solvent on semi permeable membrane.
8. Study of plasmolysis and deplasmolysis.
9. Microscopy: Structure of prokaryotic and eukaryotic cell, fixation.

BIN -104 Concepts in Bioinformatics

UNIT-1

Overview and functions of a computer system, Input and output devices, Storage devices: Hard disk, Diskette, Magnetic tapes, RAID, ZIP devices, Digital tape, CD-ROM, DVD.
Main Circuit board of a PC: Chips, Ports, Expansion slots
Memory: Register, buffer, RAM, ROM, PROM, EPROM, EEPROM (comparison), Types of processing: Batch, Real-Time, Online, Offline.

UNIT-2

Introduction to operating systems: Operating system concept, Windows 98/XP, UNIX/LINUX
The Internet and its Resources, WWW
Computer networking: OSI reference model, Network topologies and protocols, Networking gadgets, Data communication (ISDN, VPN, DSI, cable modem etc.), Network security (Firewall, Packet filtering etc.) Local Area Network (LAN), Wide Area Network (WAN), Metropolitan Area Network (MAN).

UNIT-3

Bioinformatics: Definition, Scope and applications, Bioinformatics companies, areas of research.
Sequence and structure databases: EMBL, DDBJ, GenBank, PIR, SwissProt, CSD, PDB etc.
NCBI, EXPASY

UNIT-4

Sequence analysis: Sequence alignment, pairwise and multiple sequence alignment, local and global alignment, BLAST, FASTA, CLUSTALW, TCoffee

UNIT-5

Introduction to Medline, Pubmed, OMIM. Genomics and proteomics(Basic concepts), Data mining, ENTREZ and SRS.

PRACTICALS

1. Working with MS-WORD, MS-PowerPoint, MS-Excel,MS-Access
2. Searching on internet, using email.
3. Downloading and installing softwares. Hands on session with RASMOL, SWISS-PDB, Chimera etc.
4. Searches on medline and bibliographic databases.
5. Hands on session with NCBI, Genbank, Expasy,PDB.

BIN-105 PHYSICAL CHEMISTRY

MM 50+5IA

The course content of Chemistry will be same as that of Chemistry of B.Sc. (Medical).

BI-106 INORGANIC CHEMISTRY

MM 50+5IA

The course content of Chemistry will be same as that of Chemistry of B.Sc. (Medical).

BI-107 ORGANIC CHEMISTRY

MM 50+5IA

The course content of Chemistry will be same as that of Chemistry of B.Sc. (Medical).

IIND SEMESTER

BIN-201 BIOSTATISTICS

MM 50+5IA

Note: Examiner is requested to set one compulsory and eight other questions at least two from each unit. The compulsory question will be of 10 marks and should cover the entire syllabus. Student should attempt four other questions i.e. one from each unit.

UNIT-1

Relation between roots and coefficients of algebraic equations, Solutions of cubic equations permutation and combination, binomial theorem of integer, logarithms (definition and laws of logarithms, use of log table), trigonometric identities. Matrices and their elementary operations.

UNIT-2

Functions, limits of functions (basic idea of limits of functions without analytic definition), derivatives of functions, differentiation, integration (general introduction, significance and application for simple algebraic and trigonometric functions. Applications of differentiation and integration.

UNIT-3

Types of data, Collection of data, Primary and secondary data, Classification and graphical representation of statistical data. Measures of central tendency and dispersion. Measures of Skewness and Kurtosis. Probability (classical and axiomatic definition of probability, Theorems on total and compound probability), Elementary ideas of Binomial, Poisson and Normal distributions.

UNIT-4

Methods of sampling, confidence level critical region, testing of hypothesis and standard error, large sample test and small sample test. Problems on test of significance, t-test, chi-square test for goodness of fit and analysis of variance.

PRACTICALS

1. Based on graphical Representation.
2. Based on measures of central tendency & Dispersion.
3. Based on Distributions – Binomial, Poisson, Normal.
4. Based on t, F, Z and Chi-Square.

BIN 202 Microbiology and Genetics

Microbiology

UNIT I

Fundamentals & history of microbiology, Classification of microorganisms, microbial taxonomy, criteria used including molecular approaches, Microbial phylogeny and current classification of bacteria, structure of bacterial cell. Difference between gram positive and gram negative cell walls.

UNIT II

Cultivation and maintainence of microorganisms, nutritional categories of microorganisms, methods of isolation, purification & preservation of pure culture.
Microbial growth, Growth curve, generation time, Synchronous, batch and continuous culture, measurement of growth and factors effecting growth.

UNIT III

Control of microorganisms,Preservation of Food, waste water treatment, major foodborne infections and intoxications, industrial use of bacteria, yeast and moulds

Genetics

UNIT IV

Principles of heredity and variation: Mendel and his experiments, monohybrid crosses, incomplete dominance and codominance, dihybrid crosses, rediscovery of Mendelism, multiple alleles, epistasis (probability in prediction and analysis of genetic data)

UNIT V

The chromosome theory of inheritance, sex linked, sex limited and sex influenced inheritance, variation in chromosome number and structure. Linkage and recombination of genes in a chromosome, crossing over and genetic mapping, three point test cross, tetrad analysis, gene recombination and complementation.

PRACTICALS
1. microscopy, preparation of culture media

2. isolation of microorganisms from different sources

3. maintainence of pure cultures

4. Microbiological staining methods

5. Demonstration of Barr body
6. mendelian deviations in dihybrid crosses

7. karyotyping with help of photographs

BIN 203 Programming in C and DBMS

Programming in C

UNIT-1

C fundamentals: Data types, Operators and expressions, Hierarchy of operators, C instructions.

Control statements: Decision (*if, if –else*) and loop (*while, do-while, for*) controls, branching (*switch, break and continue*).

Functions: Passing arguments to a function, function declaration prototypes, call by value, pointers and call by reference, recursion.

Arrays: Initializations, passing arrays to functions, multidimensional arrays, pointers and arrays.

UNIT-2

Strings: Standard library string functions, pointers and strings.

Input/output in C: Types of I/O, Console I/O, Disk I/O, formatted and unformatted I/O functions.

Structures: Defining, accessing structure elements, array of structures and pointers, passing structures to a function

Some additional features of C: Command line arguments, C preprocessors, macros, enumerations, user defined datatypes (*typedef*), typecasting, memory allocation (*malloc, calloc*).

Database development and management systems

UNIT-3

Data abstraction, Data models, Instances and schemes.

E-R model: Entity and entity sets, Relations and relationship sets, E-R diagrams, Reducing E-R diagrams to tables.

Network data model (basic concepts), Hierarchical data model (basic concepts), Multimedia databases- Basic concepts and applications.

UNIT-4

Indexing and Hashing.

Basic concepts: ISAM, B+ Tree indexed files, B Tree indexed files, Static and dynamic hash functions.

Text databases, introduction to distributed database processing.

UNIT-5

SQL

Select statements, Data definition systems, data manipulation statements, Data control systems.

Other database objects: Views, sequences, synonyms.

PRACTICALS

1. Exercises on WINDOWS,LINUX
2. Internet search and graphics
3. Programming in C
4. To make database of: Tablespace, datafiles, Blocks, Extents, segments.
5. To make relational database design using WWW.

BIN – 204 ANIMAL DIVERSITY I

MM 50 +5IA

Note: Examiner is requested to set one compulsory and eight other questions at least two from each unit. The compulsory question will be of 10 marks and should cover the entire syllabus. Student should attempt four other questions i.e. one from each unit.

UNIT-1

a) Outline of classification of non-chordates upto subclasses. Coelometa, Acoelomata, Symmetries, Deutrostomes, Protostomes.
b) Protozoa: locomotion, reproduction, evolution of sex, general features and life history of paramecium and plasmodium, pathogenic protozoans.
c) Porifera: general characters, outline of classification; skeleton, canal system.

UNIT-2

a) Coelenterata - General characters, outline of classification, polymorphism, various types of stinging cells, Metagenesis, Coral reefs and their formation.
b) Platyhelminthes - General characters, outline of classification, Pathogenic flatworms:Parasitic adaptations. Important larval forms.
c) Aschelminthes - General characters, outline of classification, pathogenic roundworms and their vectors in relation to man: Parasitic adaptations.

UNIT-3

a) Annelida - General characters, outline of classification, Coelom: Metameric segmentation, General features and life history of earthworm, Vermicomposting.
b) Arthropoda - General characters, outline of classification, larval forms of crustacean, Respiration in Arthropoda; Metamorphosis in insects; Social insects; Insect vectors of diseases; Apiculture; Sericulture.

UNIT-4

a) Mollusca - General characters, outline of classification, shell Diversity; Torsion of gastropoda, Life history of Pila.
b) Echinodermata - General characters, outline of classification, Life history of starfish(Asterias) Larval forms
c) Hemichordata – Phylogeny: Affinities of Balanoglossus.

PRACTICALS
Same as that mentioned in B.Sc. Biotechnology syllabus

BIN-205 PHYSICAL CHEMISTRY

MM 50+5IA

The course content of Chemistry will be same as that of Chemistry of B.Sc. (Medical).

BIN-206 INORGANIC CHEMISTRY

MM 50+5IA

The course content of Chemistry will be same as that of Chemistry of B.Sc. (Medical).

BIN-207 ORGANIC CHEMISTRY

MM 50+5IA

The course content of Chemistry will be same as that of Chemistry of B.Sc. (Medical).