Maharshi Dayanand University, Rohtak

Examination Scheme / Course Structure of 3-Years B.Sc. Bioinformatics (2012-15)

Semester I:

Course No.	Course Name	T	I.A	Total	Time
BIN 101	English	40	10	50	3 Hours
BIN 102	Plant diversity-1 and bioprospecting	40	10	50	3 Hours
BIN 103	Cell biology and biochemistry	40	10	50	3 Hours
BIN 104	Concepts in bioinformatics	40	10	50	3 Hours
BIN 105	Physical chemistry	40	10	50	3 Hours
BIN 106	Inorganic chemistry	40	10	50	3 Hours
BIN 107	Organic chemistry	40	10	50	3 Hours
	Total			350	

Semester II:

Course No.	Course Name	T	I.A	Total	Time
BIN 201	Biostatistics	40	10	50	3 Hours
BIN 202	Microbiology and Genetics	40	10	50	3 Hours
BIN 203	Introduction to C	40	10	50	3 Hours
BIN 204	Animal Diversity-I	40	10	50	3 Hours
BIN 205	Physical chemistry	40	10	50	3 Hours
BIN 206	Inorganic chemistry	40	10	50	3 Hours
BIN 207	Organic chemistry	40	10	50	3 Hours
BIN 208	Seminar and term paper writing Landmark Experiments in Microbiology, Biostatistics & Genetics		50	50	
BIN 209	**Lab Course (1)** Chemistry	100		100	
BIN 210	**Lab course (2)** Microbiology, Genetics, Biostatistics, Animal diversity, C-programming	100		100	
BIN 211	**Lab course (3)** Cell biology and biochemistry; Plant diversity; Concepts in Bioinformatics	100		100	
	Total			700	

* All the practical course work of I semester will be examined along with II Semester, on annual basis.
# Course content of chemistry will be same as that of Chemistry of B.Sc. (Medical)

Semester- III:

Course No.	Course Name	T	I.A	Total	Time
BIN 301	Introduction to DBMS & Biological database	40	10	50	3 Hours
BIN 302	Bioanalytical Tools	40	10	50	3 Hours
BIN 303	Plant Physiology	40	10	50	3 Hours
BIN 304	Plant diversity-II	40	10	50	
BIN 305	Physical chemistry	40	10	50	3 Hours
BIN 306	Inorganic chemistry	40	10	50	3 Hours
BIN 307	Organic chemistry	40	10	50	3 Hours
	Total			350	

Semester IV:

Course No.	Course Name	T	I.A	Total	Time
BIN 401	Animal diversity-II and physiology	40	10	50	3 Hours
BIN 402	Molecular biology	40	10	50	3 Hours
BIN 403	Fundamentals of Computer Architecture & Networking	40	10	50	3 Hours
BIN 404	Animal Developmental Biology	40	10	50	3 Hours
BIN 405	Physical chemistry	40	10	50	3 Hours
BIN 406	Inorganic chemistry	40	10	50	3 Hours
BIN 407	Organic chemistry	40	10	50	3 Hours
BIN 408	Seminar and Term paper writing on historical development &Advances in Computer Sciences		50	50	
BIN 409	**Lab Course (1)** Chemistry	100		100	
BIN 410	**Lab course (2)** Molecular biology; Animal diversity-II; Animal Developmental Biology	100		100	
BIN 411	**Lab Course (3)** DBMS & Biological Database; Bioanalytical Tools; Plant diversity and Physiology	100		100	
	Total			700	

* All the practical course work of III semester will be examined along with IV Semester, on annual basis.
# Course content of chemistry will be same as that of Chemistry of B.Sc. (Medical)

Semester V:

Course No.	Course Name	T	I.A	Total	Time
BIN 501	Programming in Perl	40	10	50	3 Hours
BIN 502	Recombinant DNA technology	40	10	50	3 Hours
BIN 503	Immunology	40	10	50	3 Hours
BIN 504	Genomics and proteomics	40	10	50	3 Hours
BIN 505	Physical Chemistry	40	10	50	3 Hours
BIN 506	Inorganic chemistry	40	10	50	3 Hours
BIN 507	Organic chemistry	40	10	50	3 Hours
	Total			350	

Semester VI:

Course No.	Course Name	T	I.A	Total	Time
BIN 601	IPR's , BEntrepreneurship, Bioethics and biosafety	40	10	50	3 Hours
BIN 602	Techniques for sequence analysis & molecular phylogeny	40	10	50	3 Hours
BIN 603	Molecular Modeling & Drug Designing	40	10	50	3 Hours
BIN 604	Physical Chemistry	40	10	50	3 Hours
BIN 605	Inorganic Chemistry	40	10	50	3 Hours
BIN 606	Organic Chemistry	40	10	50	3 Hours
BIN 607	Project report and presentation	100		100	
BIN 608	**Lab course (1)** Chemistry	100		100	
BIN 609	**Lab course (2)** IPR; Molecular Phylogeny; Techniques for sequence and structure analysis & Molecular modeling	100		100	
BIN 610	**Lab Course (3)** RDT; Immunology; Perl; Genomics& proteomics.	100		100	
		Total		700	

* All the practical course work of V semester will be examined along with VI Semester, on annual basis.
# Course content of chemistry will be same as that of Chemistry of B.Sc. (Medical)
** Industry visit in summer/winter vacations.
* One Month project training during Semester V to be evaluated in Semester VI.

BIN-101 ENGLISH

MM 40+10 IA=50

The syllabus for English is same as that for B.Sc. (English) (Pass course) I .

BIN-102 PLANT DIVERSITY I AND BIOPROSPECTING

MM 40+10 IA = 50

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

UNIT I
General classification of plant kingdom diversity.
Algae:
General character, classification and economic importance. Life histories of algae belonging to various classes :
- Chlorophyceae – Volvox, Oedogonium
- Xantho phyceae –Vaucheria
- Phaeophyceae – Ectocarpus
- Rhodophyceae-Polysiphonia

UNIT II
Fungi:
General characters, classification & economic importance.
Life histories of Fungi-
- Mastigomycontina- Phytophthora
- Zygomycotina-Mucor
- Ascomycotina- Saccharomyces
- Basidomycotina-Agaricus
- Deutromycotina-Colletotrichum

UNIT III
Lichens :
Classification, general structure, reproduction and economic importance.
Plant diseases:
Casual organism, symptoms and control of following plant diseases.
- Rust & Smut of Wheat.
- White rust of Crucifers.
- Late blight of Potato.
- Red rot of Sugarcane.
- Citrus Canker.

UNIT IV
Bryophytes:
General characters, classification & economic impotance.
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 materials studied in theory.
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 materials and bryophytes available locally.

BIN-103   **CELL BIOLOGY & BIOCHEMISTRY**

MM 40+10 IA= 50

Note: Examiner is requested to set one compulsory and eight other questions at least two from each unit. The compulsory question should be of 150marks and should cover entire syllabus. Student should attempt four other questions i.e. one from each unit.
UNIT I
Cell: An introduction and classification of organisms by cell structure, cytosol, compartmentalisation of eukaryotic cells, cell fractionation.
Cell Membrane and Permeability: Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, membrane transport. Membrane receptors expression and function.
UNIT II
Structure and function of Membrane Vacuolar system, cytoskeleton and cell motility, Endoplasmic reticulum, Golgi Complex, Lysosomes, Mitochondria, Ribisomes, Chloroplasts and Nucleus.
UNIT III
Amino acids & Proteins: Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape. Different Level of structural organization of proteins. Introduction to enzyme action and kinetics.
Carbohydrates: Structure and properties of Monosaccharides, Oligosaccharides and Polysaccharides. Glycoprotein's and their biological functions.

UNIT IV
Lipids: Classification, structures, nomenclature and properties of fatty acids, essential fatty acids, Phospholipids, sphingomyelins, glycolipids, cerebrosides, gangliosides, Prostaglandins cholesterol.
Nucleic acids: Structure and properties of purines & pyrimidines, Nucleosides & Nucleotides. Biologically important nucleotides, Double helical model of DNA structure and forces responsible for its A,B, & Z – DNA.

PRACTICAL
1. Study the effect of temperature, organic solvent on semi permeable membrane.
2. Demonstration of dialysis.
3. Study of plasmolysis and deplasmolysis.
4. Cell fractionation and determination of enzyme activity in organelles using sprouted moong or rat or any suitable source.
5. Microscopy : Structure of Prokaryotic and Eukaryotic cell, Fixation.
6. Cell division in onion root tip/ insect gonads.
7. Determination of - pH optimum, Temperature optimum, Km value, Vmax value, Effect of inhibitor (Inorganic phosphate) and measurement of K.
8. Principles of Colorimetry: **(i)** Verification of Beer's law, estimation of protein and

phosphate. **(ii)** Finding out Xmax. Relation between O.D. and % transmission. pH, pK, Henderson's equation. Preparation of buffer.

9.   Separation of Amino acids by paper chromatography.

10.   Isolation of phospholipids from liver and their separation on thin layer chromatography (TLC).

BIN-104   **CONCEPTS IN BIOINFORMATICS**

MM 40+10IA= 50

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

UNIT I
Introduction to bioinformatics, History and development of bioinformatics, Bioinformatics as inter-disciplinary branch of science, Development of information technology and computational sciences aiding bioinformatics development.

UNIT II
Major branches of bioinformatics, Introduction to Genomics, Proteomics, Transcriptomics, System Biology, Metabolomics, Cheminformatics.

UNIT III
Types of biological data, Introduction to the major aims of bioinformatics – Data acquisition, tool and database development, Data analysis, Data integration

UNIT IV
Introduction to the scope of bioinformatics – Genome and Sequence analysis, From sequence to 3D structure prediction, Analysis of Genome-wide Biomedical Data and Functional Genomics, Mathematical Modelling of Life Processes, Database creation and management, Drug discovery research.

PRACTICALS
1. Introduction to different web-browsers for internet.
2. Online visit to major sequence data bases – NCBI, EMBL, DDBJ
3. Sequence retrieval of a gene from a sequence database.
4. Online visit and collection of major bioinformatics tools available in public domain (BLAST, Entrez, SRS, PubMed, Biomed, Expasy, Prosite, etc).

BIN-105   **PHYSICAL CHEMISTRY**

MM 40+10 IA

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN-106   **INORGANIC CHEMISTRY**

MM 40+10 IA

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN-107   **ORGANIC CHEMISTRY**

MM 40+10 IA

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN-201   **BIOSTATISTICS**

MM 40+10 IA=50

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

UNIT I

Relations between roots and coefficients of algebraic equations, Solution of cubic equations Permutation and Combination, Binomial theorem of integer, Logarithm (definition and laws of logarithm, use of log table), Trigonometric Identities. Matrices and their elementary operations.

UNIT II

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 III

Types of Data, Collection of data; Primary & Secondary data, Classification and Graphical representation of Statistical data. Measures of central tendency and Dispersion. Measures of Skewness and Kurtosis. Probability (classical & axiomatic definition of probability, Theorems on total and compound probability), Elementary ideas of Binomial, Poisson and Normal distributions.

UNIT IV

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 (ANOVA)

PRACTICAL
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**

MM 40+10IA=50

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

UNIT I
Fundamentals of microbiology: History and Evolution of Microbiology.
Classification of microorganisms: Microbial taxonomy, criteria used including molecular approaches, Microbial phylogeny and current classification of bacteria.
Microbial Diversity; Nutritional categories of micro-organisms, methods of isolation, Purification and preservation.

UNIT II
Microbial growth: Growth curve, Generation time, factors affecting microbial growth. Methods of sterilization.
Microbial Metabolism: Metabolic pathways, amphi-catabolic and biosynthetic pathways

Bacterial Reproduction: Transformation, Transduction and Conjugation.

UNIT III

Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance.

Mendelian genetics : Mendel's experimental design, monohybrid, di-hybrid and tryhybrid crosses, Law of segregation & Principle of independent assortment. Chromosome theory of inheritance, Allelic interactions: Concept of dominance, recessiveness, incomplete dominance, co-dominance, semi-dominance, pleiotropy, multiple allele, pseudo-allele, essential and lethal genes, penetrance and expressivity.

UNIT IV

Non allelic interactions: Interaction producing new phenotype complementary genes, epistasis (dominant & recessive), duplicate genes and inhibitory genes.

Genetic linkage, crossing over and chromosome mapping: Linkage and recombination of genes in a chromosome crossing over, Molecular mechanism of crossing over, Genetic mapping.

Extra chromosomal inheritance: Rules of extra nuclear inheritance, maternal effects, maternal inheritance, cytoplasmic inheritance, organelle heredity, genomic imprinting.

Population genetics: Hardy Weinberg law assumption, (prediction,derivation), allelic and genotype frequencies, forces changing allelic frequencies, systems of mating, Inbreeding and out breeding, evolutionary genetics, natural selection.

PRACTICAL

1. Microscopy & use of Microscope
2. Staining method – simple staining, grain staining, spore staining, negative staining
3. Preparation of media & sterilization, Methods of Isolation of bacteria from different sources
4. Determination of cell size by micrometry.
5. Enumeration of microorganism - total & viable count
6. Mendelian deviations in dihybrid crosses
7. Demonstration of - Barr Bod -*Rhoeo* translocation.
8. Karyotyping with the help of photographs

BIN-203   **INTRODUCTION TO C**

MM 40+10IA=50

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

UNIT I

Introduction to programming concepts, algorithm, flowchart., C Fundamentals Character set, Identifiers and Keywords, Data Types, Constants, Variables and Arrays, Declarations, Operators & Expressions, Library functions, Statements, Symbolic Constants, Preprocessor directives

UNIT II

Data Input and Output, getchar(), putchar(), scanf(), printf(), gets(), puts() functions Control Statements – if-else, while, do-while, goto, for statements nested control structures, switch, break, continue statements comma operator

UNIT III

Functions - Function prototypes, passing arguments to a function by value, recursion storage classes, automatic, External, static, register variables in single file environment.
Arrays - Defining - processing array, passing arrays to functions, Introduction to multidimensional arrays, arrays and strings.

UNIT IV

Pointers, Declarations, Referencing and de-referencing, passing pointers to functions, pointer to array, Operations on File using pointers.
Concept of Dynamic Allocation of Memory, Linked List. Structures and Unions , Defining and processing a structure.

PRACTICALS
1. Write a C program to accept five numbers from console and then to display them back on console in ascending order.
2. Write a C program to calculate the sum of all numbers from 0 to 100 (both inclusive) that are divisible by 4.
3. Write a C program to accept the length of three sides of a triangle from console and to test and print the type of triangle – equilateral, isosceles, right angled, none of these.
4. Write a program in C to reverse the digits of a given integer.
5. Write a program in C to generate first 20 Fibonacci numbers.
6. Write a program in C to generate prime numbers between 1 and n.
7. Write a program in C to compute the factorial of the given positive integer using recursive function.
8. Write a program in C to sort n integers using bubble sort.
9. Write a program in C to carry out following operations on strings using library functions
   a. To concatenate a string S2 to string S1.
   b. To find the length of a given string
   c. To compare two strings S1 and S2.
   d. To copy a string S2 to another string S1.

BIN-204   **ANIMAL DIVERSITY – I**

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

UNIT I

a) Outline of classification of Non- Chordates upto subclasses. Coelomata, Acoelomata, Symmetries, Deutrostomes, Protostomes.
b) Protozoa: Locomotion, Reproduction, evolution of Sex, General features and life history of Paramoecium and Plasmodium. Pathogenic protozoans
c) Porifera: General characters, outline of Classification ; skeleton , Canal System

UNIT II
a) Coelenterata: General Characters, Outline of classifications Polymorphism, Various types of stinging cells; Metagenesis, coral reefs and their formation.
b) Platyhelminthes- General Characters; Outline of classification; Pathogenic flatworms: Parasitic adaptations. Importantl Larval forms.
c) Aschelminthes: General features, Outline of classification, Pathogenic roundworms and their vectors in relation to man: Parasite adaptation.

UNIT III
a) Annelida: - General features, Outline of classification, Coelom: Metameric segmentation, General features and life history of Earthworm, Vermicomposting.
b) Arthropoda: General Features, Outline of Classification; Larval forms of crustacean, Respiration in Arthropoda; Metamorphosis in insects; Social insects; Insect vectors of diseases; Apiculture, Sericulture.

UNIT IV
a) Mollusca : general features, Outline of classification, Shell Diversity; Torsion in gastropoda, Life history of Pila.
b) Echinodermata: General features, Outline of Classification, Life history of starfish (Asterias) Larval forms
c) Hemichordata: Phylogeny: Affinities of Balanoglossus

PRACTICAL

1. Identification and Classification of any of the following   -
Porifera: Scypha, Leucosolenia, Euspongia, Hylonema, Euplectella
Cnidaria: Medrepora, Millepora, Physalia, Porpita, Valella, Aurelia, Metridium
Platyhelminthes: Taenia, Fasciola,
Aschelminthes: Ascaris, Ancylostoma, Enterobius
Annelida: Pheretima, Hirudinaria, Chaetopterus, Nereis, Aphrodite
Arthropoda: Julus, Scolopendra, Peripatus, Carcinus, Limulus, Lepisma, Dragonfly, Musca, Acheta
Mollusca: Pila, Unio, Mytilus, Loligo, Sepia, Octopus, Solen
Echinodermata: Asterias, Ophiothrix, Echinus, Holothuria, Astrophyton
Hemichordata: Balanoglossus
2. Identification of slides with two points of identification.
Amoeba, Paramoecium, Ceratium, Plasmodium, Opalina, L.S. Sponge,
Spicules of sponges, L.S. Hydra, Obelia, Bougainvillia, Larvae of Fasciola, Seta of Earthworm, Radula
3. Ecological Note – On any of the specimens in Exercise No 1

Dissection of Earthworm, Cockroach
Earthworm: Digestive, Nervous System,
Cockroach: Digestive Reproductive, Nervous System

BIN-205   PHYSICAL CHEMISTRY

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN-206   INORGANIC CHEMISTRY

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN-207   ORGANIC CHEMISTRY

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN 208

MM 50

Seminar and Term – paper writing as assignment on "Landmark experiments in Microbiology & Genetics".

BIN 209   LAB COURSE I   MM 100
Practical examination of Chemistry I semester will be held along with II Semester annually.

BIN 210   LAB COURSE II   MM 100
- Practical exam shall be conducted in two sessions of 4 hrs each
- Each student will be given two major and one minor exercises in examination
  Major exercises- Microbiology & Genetics and Animal Diversity

		(30+30=60 marks)
Minor exercise- C-Programming and Biostatistics		(15 marks)
Viva	-	15 marks
Practical record	-	10 marks
Total	-	100 marks

BIN 211

LAB COURSE I

MM 100

- Practical exam shall be conducted in two sessions of 4 hrs each
- Each student will be given two major and one minor exercises in examination
  Major exercises- Cell Biology and Biochemistry and Concept in Bioinformatics

		(30+30=60 marks)
Minor exercise- Plant Diversity I and Bioprospecting		(15 marks)
Viva	-	15 marks
Practical record	-	10 marks
Total	-	100 marks

SEMESTER III:

BIN 301   INTRODUCTION TO DBMS & BIOLOGICAL DATABASE

MM 40+10 IA=50

Note: Examiner will set one compulsory and eight other questions at least two from each unit. The compulsory question will be of 10 marks and should cover entire syllabus. Students will attempt

four other questions i.e. one from each unit.

UNIT I
DBMS Concepts: Data Abstraction, Database System Architecture, Schemas and Subschemas, Data Independence, Physical Data Organization- Hashed, Index File, B- Tree.
Data Models: Data Modelling using entity relationship, Hierarchical and Network Model, DBTG Proposals, Data Manipulation Languages.

UNIT II
Relational Model: Relational Algebra and Calculus, Storage Organization for Relations, Functional, Multivalued and Project-Joint Dependencies, Decomposition. Normal Forms- First, Second, Third BCNF, Fourth and PJ normal forms.
Relational Query language, Query Processing, Query Optimization- General Strategies of Optimization.

UNIT III
Security in DBMS to gain integrity mechanism of roll-back and recovery, validation and data translation of database operation and management.
Introduction to Data mining: Classification, Clustering, data Warehousing, Applications of Data Mining.

UNIT IV
Data Bases: Nucleic Acid Sequences, Genomes, Protein Sequence and Structures, Bibliographic Access to Molecular Biology Data Bases: Entrez, Sequence Retrieval System (SRS), Protein Identification Resources (PIR).

PRACTICAL
1. Study of DBMS, RDBMS and ORDBMS.

2. To study Data Definition language Statatements.

3. To study Data Manipulation Statatements.

4. Study of SELECT command with different clauses.

5. Study of SINGLE ROW functions (character, numeric, Data functions).

6. Study of GROUP functions (avg, count, max, min, Sum).

7. Study of various type of SET OPERATORS (Union, Intersect, Minus).

8. Study of various type of Integrity Constraints.

9. Study of Various type of JOINS.

10. To study Views and Indices.

BIN 302   BIOANALYTICAL TOOLS

MM 40+10 IA=50

Note: Examiner will set one compulsory and eight other questions at least two from each unit. The compulsory question will be of 10 marks and should cover entire syllabus. Students will attempt

four other questions i.e. one from each unit.

UNIT I

Simple microscopy, phase contrast microscopy, florescence and electron microscopy (TEM and SEM), pH meter, absorption and emission spectroscopy

UNIT II

Principle and law of absorption fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), centrifugation, cell fractionation techniques, isolation of sub-cellular organelles and particles

UNIT III

Introduction to the principle of chromatography. Paper chromatography, thin layer chromatography, column chromatography: silica and gel filtration, affinity and ion exchange chromatography, gas chromatography, HPLC

UNIT IV

Introduction to electrophoresis. Starch-gel, polyacrylamide gel (native and SDS-PAGE), agrose-gel electrophoresis, immuno electrophoresis, isoelectric focusing, western blotting.

Introduction to Biosensor and Nanotechnology and their applications.

PRACTICAL

1 Native gel electrophoresis of proteins
2 SDS-polyacrylamide slab gel electrophoresis of proteins under reducing conditions
3 Preparation of the sub-cellular fractions of rat liver cells
4 Preparation of protoplasts from pea leaves
5 Separation of amino acids by paper chromatography
6 To identify lipids in a given sample by TLC
7 To verify the validity of Beer's law and determine the molar extinction co-efficient of NADH

BIN 303   **PLANT PHYSIOLOGY**

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

UNIT I: Anatomy
The shoot and root apical meristem and its histological organization, simple & complex permanent tissues, primary structure of shoot & root, secondary growth, growth rings, leaf anatomy (dorsi-ventral and isobilateral leaf)

UNIT II:
Plant water relations and micro & macro nutrients
Plant water relations: Diffusion, osmosis, plasmolysis, imbibition, guttation, transpiration, stomata & their mechanism of opening & closing.
Micro & macro nutrients: criteria for identification of essentiality of nutrients, roles and deficiency systems of nutrients, mechanism of uptake of nutrients, mechanism of food transport

UNIT III: Carbon and nitrogen metabolism
Photosynthesis- Photosynthesis pigments, concept of two photo systems, photphosphorylation, calvin cycle, CAM plants, photorespiration, compensation point
Nitrogen metabolism- inorganic & molecular nitrogen fixation, nitrate reduction and ammonium assimilation in plants

UNIT IV: Growth and development
Growth and development: Definitions, phases of growth, growth curve, growth hormones (auxins, gibberlins, cytokinins, abscisic acid, ethylene): Physiological role and mode of action, seed dormancy and seed germination, concept of photo-periodism and vernalization

PRACTICAL
1. Preparation of stained mounts of anatomy of monocot and dicot's root, stem & leaf.
2. Demonstration of plasmolysis by *Tradescantia* leaf peel.
3. Demonstration of opening & closing of stomata.
4. Demonstration of guttation on leaf tips of grass and garden nasturtium.
5. Separation of photosynthetic pigments by paper chromatography.
6. Demonstration of aerobic respiration.
7. Preparation of root nodules from a leguminous plant.

BIN 304   **PLANT DIVERSITY II**

MM 40+10 IA =50

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

UNIT I: Pteridophytes
General characters of pteridophytes, affinities with bryophytes & gymnosperms, classification, economic importance, study of life histories of fossil Pteridophytes – Rhynia
UNIT II: Pteridophytes: Type studies
Life histories of Selaginella- (Heterospory and seed habit), Equisetum, Pteris, Lycopodium
UNIT III: Gymnosperms
General characters, classification, geological time scale, theories of fossil formation, types of fossils, fossil gymnosperms- Williamsonia & Glossopteris, telome and steel concept
UNIT IV: Gymnosperms: Type studies
Life histories of Cycas & Pinus, economic importance of gymnosperms

PRACTICAL
1. Examination of morphology and anatomy of vegetative and reproductive parts of Selaginella, Equisetum & Pteris.
2. Examination of morphology and anatomy of vegetative & reproductive parts of - Cycas & Pinus
3. Plant collection (pteridophytes & gymnosperms)

BIN-305   **PHYSICAL CHEMISTRY**

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN-306   **INORGANIC CHEMISTRY**

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN-307   ORGANIC CHEMISTRY

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

SEMESTER IV:

BIN 401   ANIMAL DIVERSITY II AND PHYSIOLOGY

MM 40+10 IA =50

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

UNIT I: Proto-chordates, Pisces and Ambhibia
Proto-chordates: Outline of classification, General features and important characters of Herdmania, Branchiostoma
Origin of Chordates
Pisces: Migration in Pisces, Outline of classification
Amphibia: Classification, Origin, Parental care, Paedogenesis
UNIT II: Reptilia, Aves and Mammalia
Reptelia: Classification, Origin
Aves: Classification, Origin, flight- adaptations, migration
Mammalia: Classification, Origin, dentition
UNIT III:
Digestion: Mechanism of digestion & absorption of carbohydrates, Proteins, Lipids and nucleic acids.
Respiration: Exchange of gases, Transport of O_2 and CO_2, Oxygen dissociation curve, Chloride shift
Composition of blood, Plasma proteins & their role, blood cells, Haemopoisis, Mechanism of coagulation of blood, Mechanism of working of heart.
UNIT IV:
Structure of cardiac, smooth & skeletal muscle, threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction, Excretion: modes of excretion, Ornithine cycle, Mechanism of urine formation.
Mechanism of generation & propagation of nerve impulse, structure of synapse, synaptic conduction, saltatory conduction, Neurotransmitters; Hormone action,
Different endocrine glands– Hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals, hypo & hyper-secretions

PRACTICAL
1. Identification & Classification upto order of the following:
Proto-chordata: Salpa, Doliolum, Herdmania, Branchiostoma
Cyclostomata: Myxine, Petromyzon
Chondrichthyes: Scoliodon, Zygnea, Pristis, Trygon, Raja, Chimaera
Ostiechthyes: Labeo, Mystus, Catla, Hippocampus, Anabas, Echeneis, Lophius, Polypeterus
Amphibia: Rana, Hyla, Amblystoma, Necturus, Proteus.
Reptiles: Hemidactylus, Calotes, Draco, Phrynosoma, Naja Vipera, Bungarus
Aves: Columba, Alcedo, Passer
Mammalia: Ornithorhynchus, Macropus, Didelphes, Dasypus
2. An Ecological Note on any one of the specimens in Experiment 1
3. Identification of the following slides
Mammalian Histology: Liver, Lung, Intestine, Kidney, Ovary, Testes

Salpa, Doliolum, Spicules of Herdmania, Tadpole of Frog
4. Preparation of a permanent mount of Salpa, Placoid scales, Tadpole Larva of frog
5. Identification of endoskeletons of frog and rabbit
7. Finding the coagulation time, blood groups, RBC count, TLC, DLC
8. Demonstration of action of an enzyme
9. Determination of Haemoglobin

BIN 402   MOLECULAR BIOLOGY

MM 40+10 IA =50

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

UNIT I: DNA structure and replication
DNA as genetic material, Structure of DNA, Types of DNA, Replication of DNA in prokaryotes and eukaryotes: Semiconservative nature of DNA replication, Bidirectional replication, DNA polymerases, The replication complex: preprimimng proteins, primosome, replisome, Rolling circle replication, Unique aspects of eukaryotic chromosome replication, Fidelity of replication

UNIT II: DNA damage, repair and homologous recombination
DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair: Photoreactivation, base excision repair, nucleotide excision repair, mismatch repair, translesion synthesis, recombinational repair, non homologous end joining. Homologous recombination: models and mechanism

UNIT III: Transcription and RNA processing
RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains
Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation
RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing

UNIT IV: Regulation of gene expression and translation
Regulation of gene expression in prokaryotes: Operon concept (inducible and repressible system)
Genetic code and its characteristics
Prokaryotic and eukaryotic translation: ribosome structure and assembly, Charging of tRNA, aminoacyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides, Fidelity of translation, Inhibitors of translation. Posttranslational modifications of proteins

PRACTICAL
1. Isolation of DNA from bacterial cells
2. Isolation of Plasmid DNA by alkaline method
3. Agarose gel electrophoresis of genomic DNA & plasmid DNA
4. Preparation of restriction enzyme digests of DNA samples

BIN 403   ANIMAL DEVELOPMENTAL BIOLOGY

MM 40+10 IA =50

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

UNIT I: Gametogenesis and Fertilization

Definition, scope & historical perspective of development Biology, Gametogenesis – Spermatogenesis, Oogenesis
Fertilization - Definition, mechanism, types of fertilization.
Different types of eggs on the basis of yolk

UNIT II: Early embryonic development
Cleavage: Definition, types, patterns & mechanism
Blastulation: Process, types & mechanism
Gastrulation: Morphogenetic movements– epiboly, emboly, extension, invagination, convergence, de-lamination. Formation & differentiation of primary germ layers
Fate Maps in early embryos

UNIT III: Embryonic Differentiation
Differentiation: Cell commitment and determination- the epigenetic landscape: a model of determination and differentiation, control of differentiation at the level of genome, transcription and post-translation level
Concept of embryonic induction
Primary, secondary & tertiary embryonic induction
Neural induction and induction of vertebrate lens

UNIT IV: Organogenesis
Neurulation, notogenesis, development of vertebrate eye.
Fate of different primary germlayers
Development of behaviour: constancy & plasticity
Extra embryonic membranes, placenta in Mammals

PRACTICAL
1. Identification of developmental stages of chick and frog embryo using permanent mounts
2. Preparation of a temporary stained mount of chick embryo
3. Study of developmental stages of *Anopheles* mosquito

BIN 404   FUNDAMENTALS OF COMPUTERS & NETWORKING
MM 40+10 IA =50
Note: Examiner will set one compulsory and eight other questions at least two from each unit. The compulsory question will be of 10 marks and should cover entire syllabus. Students will attempt four other questions i.e. one from each unit.

UNIT I:
System buses: Computer Components, Computer function, Interconnection Structures, Bus Interconnection, PCI. Internal Memory: Computer Memory System Overview, Semiconductor Main memory, Cache Memory, Advanced DRAM Organization. Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels and Producers, The External Interface. Operating System Overview.

UNIT II:
Computer Arithmetic: The Arithmetic and Logic Unit (ALU), Integer Arithmetic,
Floating-Point Representation, Floating-Point Arithmetic. Problem Solving Approaches: Notion of an algorithm, problem solving using top-down design and decomposition into sub-problems, stepwise methodology of developing an algorithm.

UNIT III:
Basic concepts: Components of data communication, distributed processing, standards and organizations. Line configuration, topology, transmission mode, categories of networks.

UNIT IV:

OSI and TCP/IP Models: Layers and their functions, comparison of models.
Digital transmission: Interfaces and modems: DTC-DCE interface, modems, cable modem.

PRACTICAL

1. 32 bit Binary Arithmetic (Addition, subtraction, division, Multiplication of 2 binary numbers, each 32 bit).
2. 8 digits BCD Arithmetic (Addition and Subtraction of BCD numbers each 8 digits).
3. Convert an ASCII coded decimal number into its binary equivalent.
4. Basic commands of DOS, LINUX, UNIX.

BIN-405   PHYSICAL CHEMISTRY

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical).

BIN-406   INORGANIC CHEMISTRY

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical).

BIN-407   ORGANIC CHEMISTRY

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical).

BIN 408

MM 50

Seminar and Term – paper writing as assignment on historical development & Advances in Computer Sciences.

BIN 409   LAB COURSE I   MM 100

Practical examination of Chemistry III semester will be held alongwith IV Semester annually.

BIN410   LAB COURSE II   MM 100

- Practical exam shall be conducted in two sessions of 4 hrs each
- Each student will be given two major and one minor exercises in examination
  Major exercises- Molecular Biology, Animal diversity-II and Mammalian Physiology
  (30+30=60 marks)
  Minor exercise- Development Biology and Fundamentals of computers
  (15 marks)

Viva	-	15 marks
Practical record	-	10 marks
Total	-	100 marks

BIN 411   LAB COURSE III   MM 100

Practical exam shall be conducted in two sessions of 4 hrs each

- Each student will be given two major and one minor exercises in examination
  Major exercises- DBMS & Biological Database and Bioanalytical tools
  (25+25=50 marks)

Minor exercise- Plant diversity II and Plant physiology   (15 marks)

Viva	-	15 marks
Practical record	-	10 marks
Total	-	90 marks

BIN 501   **PROGRAMMING IN PERL**

                                                        MM 40+10 IA=50
UNIT I
Introduction to PERL
What is PERL; Comparison with other languages like JAVA, C, Python; Installing PERL on Windows and UNIX environment; Installing PERL modules; Writing and running a PERL script; Numeric data and string literals; How to store string/numbers in variables; Input/output variables.
UNIT II
Concept of Programming – Operators (Unary, Binary, Multiplicative, Conditional, logical etc.); Control Statements (IF, DO, WHILE, FOR); Defining and calling functions; List Processing; Arrays handling; Input from command (ARGV, ARGC); Reading values from file and screen; Writing/appending in files.
UNIT III
Pattern Matching – Manipulation of strings; Regular expressions; Pattern-Matching Operators; Standard Modules; Subroutines; Using system command; Important functions (split, index, substr, chomp, length, reverse, shift, sort)
UNIT IV
Perl and Internet – Introduction to TCP/IP protocol; Internet applications; HTML and submission forms; installation/configuration of Apache; Common Gateway Interface (CGI); Reading and processing HTML forms; using perl with web servers
PRACTICAL
1. Writing a script code to illustrate "while" and "do" operator
2. Writing a script code to illustrate use of Arithmetical and String operators
3. Writing a Perl script that declares three arrays and assigns lists to them
4. Writing a code to show ascending and descending sorting
5. Writing a script code that read a HTML form via CGI

BIN 502   **RECOMBINANT DNA TECHNOLOGY**

                                                        MM 40+10 IA=50
UNIT I
Gene Recombination and Gene transfer: Bacterial Conjugation, Transformation, Transduction, Episomes, Plasmids, Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication, Liposome fusion, Microlaser.

UNIT II
Changing genes: site-directed mutagenesis and Protein engineering: Primer extension is a simple method for site directed mutation, PCR based site directed mutagenesis, Random mutagenesis, Use of Phage display techniques to facilitate the selection of mutant peptides, Gene shuffling, production of chimeric proteins.

UNIT III
Genetic engineering in animals: Production of transgenic mice, ES cells can be used for gene targeting in mice, Applications of gene targeting, Using Yeast to study Eukaryotic gene function, Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines, Transgenic animals, Production of proteins of Pharmaceutical value.

UNIT IV
Genetic engineering in plants: Use of Agrobacterium tumefaciens and Arhizogenes, Ti plasmids, Strategies for gene transfer to plant cells, Direct DNA transfer to plants, Gene targeting in plants,

Use of plant viruses as episomal expression vectors

PRACTICAL
1. DNA isolation from plants
2. DNA isolation from E.coli
3. Spectrophotometer analysis of DNA
4. Agarose gel electrophoresis of DNA
5. Plasmid DNA isolation
6. Restriction digestion of DNA
7. Southern Blotting
8. Making competent cells
9. Transformation of competent cells.

BIN 503   IMMUNOLOGY

MM 40+10 IA=50

UNIT I
Immune Response - An overview, components of mammalian immune system, molecular structure of Immunoglobulins or Antibodies, Humoral & Cellular immune responses, T-lymphocytes & immune response (cytotoxic T-cell, helper T-cell, suppressor T-cells), T-cell receptors, genome rearrangements during B-lymphocyte differentiation, Antibody affinity maturation class switching, assembly of T-cell receptor genes by somatic recombination.

UNIT II
Regulation of immunoglobulin gene expression – clonal selection theory, allotypes & idiotypes, allelic exclusion, immunologic memory, heavy chain gene transcription, genetic basis of antibody diversity, hypotheses (germ line & somatic mutation), antibody diversity.

UNIT III
Major Histocompatibility complexes – class I & class II MHC antigens, antigen processing. Immunity to infection – immunity to different organisms, pathogen defense strategies, avoidance of recognition. Auto-immune diseases, Immunodeficiency-AIDS.

UNIT IV
Vaccines & Vaccination – adjuvants, cytokines, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents, passive & active immunization. Introduction to immunodiagnostics – RIA, ELISA.

PRACTICAL
1. Differential leucocytes count
2. Total leucocytes
3. Total RBC count
4. Haemagglutination assay
5. Haemagglutination inhibition assay
6. Separation of serum from blood
7. Double immunodiffusion test using specific antibody and antigen.
8. ELISA

BIN 504   GENOMICS & PROTEOMICS

MM 40+10 IA=50

UNIT I
Introduction to Genomics, DNA sequencing methods – manual & automated: Maxam and Gilbert and Sangers method. Chain termination method, Pyrosequencing, Genome Sequencing methods:

Shotgun & Hierarchical (clone contig) methods, Computer tools for sequencing projects: Genome sequence assembly software.

UNIT II
Managing and Distributing Genome Data: Web based servers and softwares for genome analysis: ENSEMBL, VISTA, UCSC Genome Browser, NCBI genome. Selected Model Organismal Genomes and Databases.

UNIT III
Introduction to protein structure, Chemical properties of proteins. Physical interactions that determine the property of proteins. Short-range interactions, electrostatic forces, van der waal interactions, hydrogen bonds, Hydrophobic interactions. Determination of sizes (Sedimentation analysis, gel filteration, SDS-PAGE); Native PAGE, Determination of covalent structures – Edman degradation.

UNIT IV
Introduction to Proteomics, The proteome. Analysis of proteomes. 2D-PAGE. Sample preparation, solubilization, reduction, resolution. Reproducibility of 2D-PAGE.   Mass spectrometry based methods for protein identification. De novo sequencing using mass spectrometric data.

PRACTICAL
1. Use of SNP databases at NCBI and other sites
2. Use of OMIM database
3. NCBI Genome site
4. Detection of Open Reading Frames using ORF Finder
5. Proteomics 2D PAGE database
6. Softwares for Protein localization.
7. Hydropathy plots
8. Native PAGE
9. SDS PAGE

BIN-505   PHYSICAL CHEMISTRY

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN-506   INORGANIC CHEMISTRY

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN-507   ORGANIC CHEMISTRY

MM 40+10 IA=50

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical)

BIN 601   **I.P.R. ENTREPRENEURSHIP BIOETIHCS &**
                              BIOSAFETY

                                                                    MM 40+10 IA

UNIT-I
Introduction to Indian Patent Law. World Trade Organization and its related intellectual property provisions. Intellectual/Industrial property and its legal protection in research, design and development. Patenting in Biotechnology, economic, ethical and depository considerations.

UNIT II
Entrepreneurship: Selection of a product, line, design and development processes, economics on material and energy requirement, stock the product and release the same for making etc. The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential etc.

UNIT III
Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National &
International.Ethical issues against the molecular technologies.

UNIT IV
Biosafety – Introduction to biosafety and health hazards concerning biotechnology. Introduction to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).

PRACTICAL
1. Proxy filing of Indian Product patent.
2. Proxy filing of Indian Process patent.
3. Planning of establishing a hypothetical biotechnology industry in India

BIN 602   **TECHNIQUES FOR SEQUENCE ANALYSIS &**
                         MOLECULAR PHYLOGENY

                                                                    MM 40+10 IA

UNIT I
Sequence databases - Primary and secondary databases. Nucleotide sequence databases, nucleotide sequence flat files. Protein sequence databases: Uniprot, Swissprot, PIR. Sequence formats: Genbank, FASTA, ASN. Information retrieval from biological databases. The NCBI resource: Entrez, Pubmed, Medline. Entrez Boolean search terms and statements.

UNIT II
Sequence alignment – Pairwise sequence alignment: Dot Plot, Local and Global alignments
Database homology search: concepts, Similarity and Identity of sequences, General gap and affine gap penalty, Scoring functions and matrices.

UNIT III
Database homology search - Concepts behind BLAST: Applications & Biological Significance; homology, similarity & identity. Statistical significance of BLAST: E value, Scores BLAST versions- BLASTp, BLASTn

UNIT IV

Multiple sequence alignment – SP (Sum of Pairs) measure, Motifs and Profile. Clustal W.
Phylogenetic analysis - Basic terminology in Phylogenetics, Distance and parsimony methods; Clustering methods. Rooted and unrooted trees, Brief introduction to Bootstrapping, Phylip.

PRACTICAL
Sequence information resource: Understanding and using on the web:
> 1. NCBI Home & Entrez
> 2. GenBank

Protein information resource: Understanding and using on the web
> 3. Expasy Home & Swissprot/ TrEMBL

Aligning two or more sequences: Understanding and using on the web
> 4. Multiple sequence alignment: Clustal X/Clustal W
> 5. BLAST page at NCBI and its features
> 6. BLASTp and BLASTn analysis and data interpretation: E value, Scores

BIN 603   MOLECULAR MODELLING & DRUG DESIGNING
<div align="right">

MM 40+10 IA
</div>

UNIT I
Basics of molecular modeling, Different equations used in molecular modeling, Drug Structure drawing and minimization, Different minimization methods- MNDO, AM1 and their respective calculations, etc., homology modeling, threading, Ab Initio modeling, Active site detection
UNIT II
Docking, Different methods of docking, Pharmacophore modeling, Molecular Dynamics Simulations, AMBER and CHARMM. Ramachandran plot and its significance and related calculations.

UNIT III
Drug receptors: Drug-receptor interaction, involvement of binding forces in drug
interaction. Drug action not mediated by receptors. Structural based drug design,
mechanism of their action. Design of ligands for known macromolecular target
sites and drug receptor interactions. Lipinski's rule of 5, Clinical trials 1-4 phases. **UNIT IV**
Quantitative Structure Activity Relationship (QSAR). Types of descriptorsconstitutional, topological, charge, quantum chemical, walk and path counts, geometric descriptors. Types of QSAR methods-In static contour plot, in electrostatic contour plots, 3D-QSAR.

PRACTICAL
> 1. Use of energy minimization program for molecule.
> 2. Use of docking program for ligand-recptor docking.

BIN-604   PHYSICAL CHEMISTRY
<div align="right">

MM 40+10 IA
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The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical).

BIN- 605   INORGANIC CHEMISTRY
<div align="right">

MM 40+10 IA
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The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical).

BIN-606   ORGANIC CHEMISTRY
<div align="right">

MM 40+10 IA
</div>

The Course contents of Chemistry will be the same as that of Chemistry of B.Sc. (Medical).

BIN- 607   **Physical Bhemistry**

<div align="right">MM 100</div>

Project report and presentation.

BIN- 608   **LAB COURSE I**   **MM 100**

Practical examination of Chemistry V Semester will be held alongwith Semester VI annually.

BIN- 609   **LAB COURSE II**   **MM 100**

- Practical exam shall be conducted in two sessions of 4 hrs each
- Each student will be given two major and one minor exercises in examination

Major exercises- Techniques for sequence analysis and Molecular Phylogeny, Molecular Modelling   (30+30=60 marks)

Minor exercise- IPR & Entrepreneurship   (15 marks)

Viva	-	15 marks
Practical record	-	10 marks
Total	-	100 marks

BIN 610   **LAB COURSE III**   **MM 100**

Practical exam shall be conducted in two sessions of 4 hrs each

- Each student will be given two major and one minor exercises in examination

Major exercises- r-DNA Technology, Perl Programming

          (25+25=50 marks)

Minor exercise- Genomics & Proteomics/ Immunology   (15 marks)

Viva	-	15 marks
Practical record	-	10 marks
Total	-	90 marks