

Maharshi Dayanand University, Rohtak
COURSE STRUCTURE of 3 - Years B.Sc. Biotechnology
SEMESTER-I - (2016-17)

Course No.	Course Name	Marks in		Total marks	Period per week	Exam. Duration
		Theo	+ I.A			
BT 101	English	40	10	50	4	3 Hours
BT 102	Plant Diversity I and Bioprospecting	40	10	50	4	3 Hours
BT-103	Cell Biology	40	10	50	4	3 Hours
BT-104	Biochemistry and Metabolism	40	10	50	4	3 Hours
BT 105	Physical Chemistry	40	10	50	4	3 Hours
BT-106	Inorganic Chemistry	40	10	50	4	3 Hours
BT-107	Organic Chemistry	40	10	50	4	3 Hours
BT-108	Lab Course I, BT-105-107	50	-	50	5	4hrs
BT-109	Lab Course II, BT-101-104	100	-	100	10	8hrs
Total					500	

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

SEMESTER-II - (2016-17)

Course No.	Course Name	Marks in		Total marks	Period per week	Exam. Duration
		Theo.	+ I.A			
BT 201	Biostatistics	40	10	50	4	3 Hours
BT 202	Microbiology	40	10	50	4	3 Hours
BT-203	Genetics	40	10	50	4	3 Hours
BT 204	Animal Diversity & Economic Zoology	40	10	50	4	3 Hours
BT-205	Physical Chemistry	40	10	50	4	3 Hours
BT 206	Organic Chemistry	40	10	50	4	3 Hours
BT-207	Inorganic Chemistry	40	10	50	4	3 Hours
BT 208	Seminar and term paper writing on Biostatistics/Microbiology/Genetics/Animal Diversity	-	50	50		4 hrs
BT-209	Lab Course –I BT 205-207	50	-	50	5	
BT-210	Lab Course-II, 201-204	100	--	100	10	8hrs
Total					550	

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

COURSE STRUCTURE of 3 - Years B.Sc. Biotechnology
SEMESTER-III – 2017-18

Course No.	Course Name	Marks in		Total marks	Periods per week	Exam. duration
		Theo.	+ I. A.			
BT 301	Medical Microbiology	40	10	50	4	3 Hours
BT 302	Bioanalytical Tools	40	10	50	4	3 Hours
BT 303	Plant Physiology	40	10	50	4	3 Hours
BT 304	Plant Diversity II	40	10	50	4	3 Hours
BT-305	Physical Chemistry	40	10	50	4	3 Hours
BT-306	Organic Chemistry	40	10	50	4	3 Hours
BT-307	Inorganic Chemistry	40	10	50	4	3 Hours
BT-308	Lab Course-I BT-305 to BT-307	50	-	50	5	8hrs
BT-309	Lab Course-II BT-301 to 304	100	-	100	10	4 hrs
Total				500		

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

SEMESTER-IV- 2017-18

Course No.	Course Name	Marks in		Total marks	Periods per Week	Exam. Duration
		Theo.	+ I. A.			
BT 401	Animal Diversity II	40	10	50	4	3 Hours
BT 402	Molecular Biology	40	10	50	4	3 Hours
BT-403	Animal Developmental Biology	40	10	50	4	3 Hours
BT 404	Mammalian Physiology	40	10	50	4	3 Hours
BT-405	Physical Chemistry	40	10	50	4	3 Hours
BT-406	Organic Chemistry	40	10	50	4	3 Hours
BT-407	Inorganic Chemistry	40	10	50	4	3 Hours
BT 408	Seminar and term paper writing on Molecular Biology/Animal Developmental biology / Physiology	-	50	50	---	
BT-409	Lab Course-I: BT 405 to BT -407	50		50	5	4 hrs
BT-411	Lab Course II: BT-401-404	100		100	10	8 hrs
	Total			550		

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

COURSE STRUCTURE of 3 - Years B.Sc. Biotechnology**SEMESTER-V- 2018-19**

Course No.	Course Name	Marks in		Total marks	Periods per week	Exam. Duration
		Theo.	+ I. A.			
BT 501	Bioinformatics	40	10	50	4	3 Hours
BT 502	Recombinant DNA Technology	40	10	50	4	3 Hours
BT-503	Immunology	40	10	50	4	3 Hours
BT 504	Genomic & Proteomics	40	10	50	4	3 Hours
BT-505	Physical Chemistry	40	10	50	4	3 Hours
BT-506	Organic Chemistry	40	10	50	4	3 Hours
BT-507	Inorganic Chemistry	40	10	50	4	3 Hours
BT-508	Lab Course-I BT-505 to BT-507	50	-	50	5	-8 hrs
BBT-509	Lab Course-II BT-501 to BT-504	-100	-	100	10	-4 hrs
	Total			500		

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

SEMESTER-VI- 2018-19

Course No.	Course Name	Marks in		Total marks	Periods per Week	Time
		Theo.	+ I. A.			
BT 601	I.P.R. Entrepreneurship Bio-ethics & Bio Safety	40	10	50	4	3 Hours
BT 602	Animal Biotechnology	40	10	50	4	3 Hours
BT-603	Bioprocess Technology	40	10	50	4	3 Hours
BT 604	Plant Biotechnology & Environmental Biotechnology	40	10	50	4	3 Hours
BT-605	Physical Chemistry	40	10	50	4	3 Hours
BT-606	Organic Chemistry	40	10	50	4	3 Hours
BT-607	Inorganic Chemistry	40	10	50	4	3 Hours
BT 608	Project report and presentation	-	50	50	-	
BT-609	Lab Course- I BT-605-607	50	-	50	5	4 hrs
BT-610	Lab Course II BT-601-604	-100		100	10	8 hrs
	Total			550		

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

SEMESTER – I

BT-101 ENGLISH

MM 40+10 IA

Time: 3 Hours

The syllabus for English is same as that for B.Sc. 1st Semester (Pass course).

BT-102 PLANT DIVERSITY I AND BIOPROSPECTING

MM 40+10IA Time: 3 Hours

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

Algae:

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

x Chlorophyceae – Volvox, Oedogonium x Xantho phyceae –Vaucheria

x Phaeophyceae – Ectocarpus

x Rhodophyceae-Polysiphonia

UNIT II

Fungi:

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

x Mastigomycotina- Phytophthora x Zygomycotina-Mucor

x Ascomycotina- Saccharomyces xBasidomycotina-Agaricus

X Deutromycotina-Colletotrichum

UNIT III

Lichens :

Classification, general structure, reproduction and economic importance. Plant diseases:

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Casual organism, symptoms and control of following plant diseases. x Rust & Smut of Wheat.

x White rust of Crucifers. x Late blight of Potato.

x Red rot of Sugarcane. x Citrus Canker.

UNIT IVBryophytes:

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

x Marchantia. x 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.

BT-103

MM 40+10 IA

CELL BIOLOGY

Time: 3 Hours Note: Examiner is requested to set one compulsory

and eight other questions at least two from each unit. The compulsory question should be of 10marks 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, cell recognition and membrane transport.

UNIT II

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

UNIT III

Lysosomes: Vacuoles and microbodies : Structure and functions
Ribosomes: Structures and function including role in protein synthesis. **Mitochondria:** Structure, Genomes, biogenesis

Chloroplasts: Structure, genomes, biogenesis

Nucleus: Structure, Cell cycle (Interphase & M Phases), regulation of cell cycle.

UNIT IV

Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function.

Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics of cancer cells, molecular basis of cancer.

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. Microtomy of various organ systems, Mitochondrial staining and enzyme localization (Histo-chemistry).
7. Cell division in onion root tip/ insect gonads.
8. Preparation of Nuclear, Mitochondrial & cytoplasmic fractions.

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BT-104 BIOCHEMISTRY and METABOLISM

MM 40+10 IA

Time: 3 Hours 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 Biochemistry: A historical prospective.

Amino acids & Proteins: Structure & Function. 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, Purification of proteins and criteria of their purity. Denaturation and renaturation of proteins. Fibrous and globular proteins.

Carbohydrates: Structure and Function : Structure and properties of Monosaccharides, Oligosaccharides and Polysaccharides. Homo & Hetero Polysaccharides, Mucopolysaccharides, Bacterial cell wall polysaccharides, Glycoprotein's and their biological functions.

UNIT II

Lipids: Structure and 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.

Nucleic acids: Structure and functions: Physical & chemical properties of 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, denaturation and annealing of DNA.

UNIT III

Enzymes: Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, 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 & Theories, ribozymes, abzymes Biocatalysts from extreme thermophilic and hyperthermophilic archaea and bacteria. Role of cofactors in enzyme catalysis: NAD⁺, NADP⁺, FMN/FAD, coenzymes A, thiamine pyrophosphate, pyridoxal phosphate, lipoic-acid, biotin vitamin B12 tetrahydrofolate and metallic ions.

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UNIT IV

Carbohydrates 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.

PRACTICALS

1. Effect of pH, temperature on the activity of salivary amylase enzyme activity.
2. To study activity of enzyme pancreatic trypsin under optimum conditions.
3. Estimation of blood glucose - glucose oxidase method.
4. Determination of - pH optimum, Temperature optimum, Km value, Vmax value, Effect of inhibitor (Inorganic phosphate) and measurement of K.
5. 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.
6. Separation of Amino acids by paper chromatography.

7. Isolation of phospholipids from liver and their separation on thin layer chromatography (TLC).
 8. Isolation of enzyme Acid Phosphatase from germinating lentils (moong) using $(\text{NH}_4)_2\text{SO}_4$ precipitation and its assay using p-nitrophenyl phosphate and calculation of specific activity.

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BT-105 PHYSICAL CHEMISTRY
MM 40+10 IA **Time: 3 Hours**

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

BT-106 INORGANIC CHEMISTRY
MM 40+10 IA **Time: 3 Hours**

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

BT-107 ORGANIC CHEMISTRY
MM 40+10 IA **Time: 3 Hours**

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

BT-108 Lab Course-I (Based on BT-105-107)
BT-109 Lab Course-II (Based on BT-101-104)

BT- 109 LAB COURSE II **MM 100**
 (Plant Diversity, cell biol., Biochem. & Metabolism)

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 metabolism (25+25=50 marks)
 Minor exercise- Plant Diversity I and Bio-prospecting (25 marks)

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

SEMESTER II

BT-201 BIOSTATISTICS
MM 40+10 IA

Time: 3 Hours **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

BT-202 MICROBIOLOGY

MM 40+10 IA

Time: 3 Hours 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: Distribution and characterization Prokaryotic and Eukaryotic cells, Morphology and cell structure of major groups of micro-organisms eg – bacteria, algae, Fungi, Protozoa and Unique features of viruses.

UNIT II

Cultivation and Maintenance of microorganisms: Nutritional categories of micro-organisms, methods of isolation, Purification and preservation.

UNIT III

Microbial growth: Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria.

Microbial Metabolism: Metabolic pathways, amphi-catabolic and biosynthetic pathways

Bacterial Reproduction: Transformation, Transduction and Conjugation. Endospores and sporulation in bacteria

UNIT IV

Control of Microorganisms: By physical, chemical and Chemo-therapeutic Agents

Water Microbiology: Bacterial pollutants of water, coliforms and non-coliforms. Sewage composition and its disposal.

Food Microbiology: Important microorganism in food

Microbiology: Moulds, Yeasts, bacteria. Major food born infections and intoxications, Preservation of various types of foods. Fermented Foods **Industrial Microbiology:** Bio engineering of micro organism for Industrial purposes, Industrial uses of bacteria, Yeasts, moulds. Petroleum microbiology and Deterioration of materials.

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

BT-203 GENETICS

MM 40+10 IA

Time: 3 Hours 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: Historical developments in the field of genetics. Organisms suitable for genetic experimentation and their genetic significance.

Cell Cycle: Mitosis and Meiosis: Control points in cell-cycle progression in yeast. Role of meiosis in life cycle.

Mendelian genetics : Mendel's experimental design, monohybrid, di-hybrid and trihybrid crosses, Law of segregation & Principle of independent assortment. Verification of segregates by test and back cross, 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 II

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

Chromosome and genomic organization: Eukaryotic nuclear genome- nucleotide sequence composition –unique & repetitive DNA, satellite DNA. Centromere and telomere DNA sequences, middle repetitive sequences- VNTRs & dinucleotide repeats, repetitive transposed sequences- SINES & LINEs, middle repetitive multiple copy genes, noncoding DNA.

Genetic organization of prokaryotic and viral genome.

Structure and characteristics of bacterial and eukaryotic chromosome- chromosome morphology, concept of euchromatin and heterochromatin, packaging of DNA molecule into chromosomes, chromosome banding pattern, karyotype, giant chromosomes, one gene one polypeptide hypothesis, concept of cistron, exons, introns, genetic code, gene function.

UNIT III

Chromosome and gene mutations: Definition and types of mutations, causes of mutations, Ames test for mutagenic agents, screening procedures for isolation of mutants and uses of mutants, variations in chromosomes structure - deletion, duplication, inversion and translocation (reciprocal and Robertsonian), position effects of gene expression, chromosomal aberrations in human beings, abnormalities – Aneuploidy and Euploidy.

Sex determination and sex linkage : Mechanisms of sex determination, Environmental factors and sex determination, sex differentiation, Barr bodies, dosage compensation, genetic balance theory, Fragile-X-syndrome and chromosome, sex influenced dominance, sex limited gene expression, sex linked inheritance.

UNIT IV

Genetic linkage, crossing over and chromosome mapping: Linkage and recombination of genes in a chromosome crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Crossing over at four- strand stage, Multiple crossing overs Genetic mapping.

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

Evolution and population genetics: Inbreeding and out breeding, Hardy Weinberg law assumption, (prediction, derivation), allelic and genotype frequencies, changes in allelic frequencies, systems of mating, evolutionary genetics, natural selection.

PRACTICALS

1. Permanent and temporary mount of mitosis.
2. Permanent and temporary mount of meiosis.
3. Mendelian deviations in dihybrid crosses
4. Demonstration of - Barr Body -*Rhoeo* translocation.
5. Karyotyping with the help of photographs

BT-204 ANIMAL DIVERSITY & ECONOMIC ZOOLOGY

MM 40+10 IA

Time: 3 Hours 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. Important 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 these of the following - Porifera: Scypha, Leucosolenia, Euspongia, Hylonema, Euplectella

Cnidaria: Medusae, Millepora, Physalia, Porpita, Velella, 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

PHYSICAL

BT-205

CHEMISTRY

MM 40+10 IA

Time: 3 Hours

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

BT-206

ORGANIC

CHEMISTRY

MM 40+10 IA

Time: 3 Hours

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

INORGANIC CHEMISTRY

BT-207

MM 40+10 IA

Time: 3 Hours

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

BT 208

MM 50

Seminar and Term – paper writing as assignment on Biostatistics/

Microbiology/Genetics/Animal Diversity.

BT 209 LAB COURSE- I (Based on BT-205-207)

MM 50

BT- 210 LAB COURSE II (Microbiol., Genetics, Animal Diversity & Economic Zoology, Biostatistics) 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 and Animal Diversity (25+25=50 marks)

Minor exercise- Genetics and Biostatistics	(25 marks)
Viva	- 15 marks
Practical record	- 10 marks
Total	- 100 marks

SEMESTER III

BT 301 MEDICAL MICROBIOLOGY

MM 40+10 IA

Time: 3 Hours 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: Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels.

Morphology, pathogenesis, symptoms, laboratory diagnosis, preventive

measures and chemotherapy caused by gram positive bacteria: *S. aureus*,
S. pyogenes, *B. anthracis*, *C. perferinges*, *C. tetani*, *C. botulinum*, *C.*
diphtheriae *M. tuberculosis* *M. leprae*

Unit II

Morphology, pathogenesis, symptoms, laboratory diagnosis, preventive

measures and chemotherapy caused by gram negative bacteria: *E. coli*, *N.*

gonorrhoea, *N. meningitidis*, *P. aeruginosa*, *S. typhi*, *S. dysenteriae*, *Y. pestis*, *B. abortus*, *H. influenzae*, *V. cholerae*, *M. pneumoniae*, *T.*
pallidum

M. pneumoniae, *Rickettsiaceae*, *Chlamydiae*

Unit III

Diseases caused by viruses- Picornavirus, Orthomyxoviruses, Paramyxoviruses, Rhabdoviruses, Reoviruses, Pox virus, Herpes virus, Papova virus, Retro viruses (including HIV/AIDS) and Hepatitis viruses

Unit IV

Fungal and Protozoan infections

Dermatophytoses (*Trichophyton*, *Microsporun* and *Epidermophyton*)

Subcutaneous infection (*Sporothrix*, *Cryptococcus*), systemic infection (*Histoplasma*, *Coccidioides*) and opportunistic fungal infections (*Candidiasis*, *Aspergillosis*), Gastrointestinal infections (Amoebiasis, Giardiasis), Blood-borne infections (Leishmaniasis, Malaria)

PRACTICAL

- 1 Isolation of bacteria & their biochemical characterization.
 - 2 Growth curve of bacteria
 - 3 Antibiotic sensitivity of microbes, use of antibiotic disc
 - 4 Testing quality of water (BOD, COD & E. coli count)
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BIOANALYTICAL TOOLS

**BT 302
MM 40+10 IA**

Time: 3 Hours 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, fluorescence 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), agarose-gel electrophoresis, immunoelectrophoresis, 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 coefficient of NADH
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**BT 303
MM 40+10 IA**

PLANT PHYSIOLOGY

Time: 3 Hours 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: Importance of water to plant life, 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, photophosphorylation, 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, gibberellins, cytokinins, abscisic acid, ethylene): Physiological role and mode of action, seed dormancy and seed germination, concept of photoperiodism 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.

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BT 304 PLANT DIVERSITY II
MM 40+10 IA

Time: 3 Hours 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)

BT-305 PHYSICAL
MM 40+10 IA CHEMISTRY

Time: 3 Hours

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

BT-306 ORGANIC
MM 40+10 IA CHEMISTRY

Time: 3 Hours

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

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BT-307: INORGANIC CHEMISTRY
MM 40+10 IA

Time: 3 Hours

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

BT-308 Lab Course-I (Based on BT-305-307) Max. Marks 50 **BT-309** **Lab Course-II (Based On BT-301-304)**

(Bioanalytical tools, Pl. Physiol. Pl. Diversity & Med. Microbiology)

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

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

Major exercises- Microbiology and Analytical tools (25+25=50 marks) Minor exercise- Plant diversity II and Plant physiology (25 marks)

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

SEMESTER IV

BT 401 ANIMAL DIVERSITY II MM 40+10 IA

Time: 3 Hours 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: Comparative anatomy of vertebrates I

Comparative anatomy of various systems of vertebrates: Integumentary, digestive respiratory systems.

UNIT IV: Comparative anatomy of vertebrates II

Comparative Anatomy of vertebrates – Heart, Aortic arches, Kidney & urino- genital system, Brain, Eye, Ear

Autonomic Nervous system in Mammals

PRACTICAL

1. Identification & Classification upto order of the following: Proto-chordata: Salpa, Doliolum, Herdmania, Branchiostoma Cyclostomata:

Myxine, Petromyzon

Chondrichthyes: Scoliodon, Zygynea, Pristis, Trygon, Raja, Chimaera Osteichthyes: Labeo, Mystus, Catla, Hippocampus, Anabas, Echeuis, Lophius, Polypeterus

Amphibia: Rana, Hyla, Amblystoma, Necturus, Proteus.

Reptiles: Hemidactylus, Calotes, Draco, Phrynosoma, Naja Vipera, Bungarus Aves: Columba, Alcedo, Passer

Mammalia: Ornithorhynchus, Macropus, Didelphes, Dasyus

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, spicules of Herdmania, Pharynx of Amphioxus, Tadpole Larva of frog

5. Identification of endoskeletons of frog and rabbit

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BT 402 MOLECULAR BIOLOGY MM 40+10 IA

Time: 3 Hours 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: prepriming 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

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ANIMAL DEVELOPMENTAL BIOLOGY

BT 403 MM 40+10 IA

Time: 3 Hours 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 germ layers

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

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BT 404 MAMMALIAN PHYSIOLOGY

MM 40+10 IA

Time: 3 Hours 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: Digestion and Respiration

Digestion: Mechanism of digestion & absorption of carbohydrates, Proteins, Lipids and nucleic acids. Composition of bile, Saliva, Pancreatic, gastric and intestinal juice

Respiration: Exchange of gases, Transport of O₂ and CO₂, Oxygen dissociation curve, Chloride shift

UNIT II: Circulation

Composition of blood, Plasma proteins & their role, blood cells, Haemopoiesis, Mechanism of coagulation of blood

Mechanism of working of heart: Cardiac output, cardiac cycle, Origin & conduction of heart beat

UNIT III: Muscle physiology and osmoregulation

Structure of cardiac, smooth & skeletal muscle, threshold stimulus, All or None rule, single muscle twitch, muscle tone, isotonic and isometric contraction, Physical, chemical & electrical events of mechanism of muscle contraction

Excretion: modes of excretion, Ornithine cycle, Mechanism of urine formation.

UNIT IV: Nervous and endocrine coordination

Mechanism of generation & propagation of nerve impulse, structure of synapse, synaptic conduction, saltatory conduction, Neurotransmitters Mechanism of action of hormones (insulin and steroids)

Different endocrine glands– Hypothalamus, pituitary, pineal, thymus, thyroid, parathyroid and adrenals, hypo & hyper-secretions

PRACTICAL

1. Finding the coagulation time, blood groups, RBC count, TLC, DLC

2. Demonstration of action of an enzyme

3. Determination of Haemoglobin

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BT-405

**PHYSICAL
CHEMISTRY**

MM 40+10 IA

Time: 3 Hours

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

BT-406

**ORGANIC
CHEMISTRY**

MM 40+10 IA

Time: 3 Hours

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

BT-407: INORGANIC CHEMISTRY

MM 40+10 IA

Time: 3 Hours

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

MM 50

BT 408

Seminar and Term – paper writing as assignment on Molecular Biology/Developmental biology / Physiology.

BT 409 LAB COURSE I MM 50
(Based on BT-405-407)
BT-410 LAB COURSE II MM100
(Animal diversity II, Molecular Biology, Animal Developmental biology, Mammalian Physiology)

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 and Mammalian Physiology
(25+25=50 marks)

Minor exercise- Development Biology and Animal diversity-II marks)	(25
Viva	-15 marks
Practical record	-10 marks
Total	-100 marks

SEMESTER V

BT 501 BIOINFORMATICS
MM 40+10 IA

Time: 3 Hours Note: Examiner is requested to set one compulsory

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

UNIT I

History of Bioinformatics. The notion of Homology.

Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, Understanding the structure of each source and using it on the web.

UNIT II

Protein Information Sources, PDB, SWISSPROT, TREMBL, Understanding the structure of each source and using it on the web.

Introduction of Data Generating Techniques and Bioinformatics problem posed by them- Restriction Digestion, Chromatograms, Blots, PCR, Microarrays, Mass Spectrometry.

UNIT III

Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.

UNIT IV

Searching Databases: SRS, Entrez, Sequence Similarity Searches-BLST, FASTA, Data Submission.

Genome Annotation: Pattern and repeat finding, Gene identification tools.

PRACTICAL

- 1.Sequence information resource
- 2.Understanding and using on web: EMBL, Genbank, Entrez,Unigene, Protein information resource (PIR)
- 4.Understanding and using on web: PDB, Swisssprot, TrEMBL
- 6.Using various BLAST and interpretation of results.

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BT 502 RECOMBINANT DNA TECHNOLOGY
MM 40+10 IA

Time: 3 Hours Note: Examiner is requested to set one compulsory and eight other questions at least two from each unit. The compulsory question should be of 10marks and should cover entire syllabus. Student should attempt four other questions i.e. one from each unit.

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.

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BT 503 IMMUNOLOGY
MM 40+10 IA

Time: 3 Hours Note: Examiner is requested to set one compulsory and eight other questions at least two from each unit. The compulsory question should be of 10marks and should cover entire syllabus. Student should attempt four other questions i.e. one from each unit.

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-lymphocytedifferentiation, 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

BT 504 GENOMICS & PROTEOMICS
MM 40+10 IA

Time: 3 Hours

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

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 filtration, 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. Hydrophathy plots
 8. Native PAGE
 9. SDS PAGE
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BT-505 **PHYSICAL**
MM 40+10 IA **CHEMISTRY**

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

Time: 3 Hours

BT-506 **ORGANIC**
MM 40+10 IA **CHEMISTRY**

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

Time: 3 Hours

BT-507: INORGANIC CHEMISTRY
MM 40+10 IA

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

Time: 3 Hours

BT-508 Lab Course-I (Based on BT-505-507) MM. 50

BT-509 Lab Course-II (Based on BT-501-504) (Bioinformatics, rDNA Tech, Immunology, Genomics & Proteomics)
Practical exam shall be conducted in two sessions of 4 hrs each **MM 100**

Each student will be given two major and one minor exercises in examination
Major exercises- r-DNA Technology, Immunology

	(25+25=50marks)
Minor exercise- Genomics & Proteomics/Bioinformatics	(25marks)
Viva	- 15 marks
Practical record	- 10 marks
Total	- 100 marks

SEMESTER VI

BT 601 **I.P.R. ENTREPRENEURSHIP BIOETHICS & BIOSAFETY**
MM 40+10 IA

Time: 3 Hours Note: Examiner is requested to set one compulsory and eight other questions at least two from each unit. The compulsory question should be of 10marks and should cover entire syllabus. Student should attempt four other questions i.e. one from each unit.

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

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**ANIMAL
BIOTECHNOLOGY**

**BT 602
MM 40+10 IA**

Time: 3 Hours Note: Examiner is requested to set one compulsory and eight other questions at least two from each unit. The compulsory question should be of 10marks and should cover entire syllabus. Student should attempt four other questions i.e. one from each unit.

UNIT I

Gene transfer methods in Animals – Microinjection, Embryonic Stem cell, gene transfer, Retrovirus & Gene transfer.

UNIT II

Introduction to transgenesis. Transgenic Animals – Mice, Cow, Pig, Sheep, Goat, Bird, Insect. Animal diseases need help of Biotechnology –Foot-and- mouth disease, Coccidiosis, Trypanosomiasis, Theileriosis.

UNIT III

Animal propagation – Artificial insemination, Animal Clones. Conservation Biology – Embryo transfer techniques. Introduction to Stem Cell Technology and its applications.

UNIT IV

Genetic modification in Medicine - gene therapy, types of gene therapy, vectors in gene therapy, molecular engineering, human genetic engineering, problems & ethics.

PRACTICAL

- 1.Sterilization techniques: Theory and Practical: Glass ware sterilization, Media sterilization, Laboratory sterilization
- 2.Sources of contamination and decontamination measures.
- 3.Preparation of Hanks Balanced salt solution
- 4.Preparation of Minimal Essential Growth medium
- 5.Isolation of lymphocytes for culturing
- 6.DNA isolation from animal tissue
- 7.Quantification of isolated DNA
- 8.Resolving DNA on Agarose Gel.

**BT 603
MM 40+10 IA**

BIOPROCESS TECHNOLOGY

Time: 3 Hours

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

UNIT I

Introduction to bioprocess technology. Range of bioprocess technology and its chronological development. Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics– Batch, Fedbatch and Continuous culture.

UNIT II

Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture/production vessels- Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstream processing – Media preparation, Inocula development and sterilization.

UNIT III

Introduction to oxygen requirement in bioprocess; mass transfer coefficient; factors affecting K_La. Bioprocess measurement and control system with special reference to computer aided process control.

UNIT IV

Introduction to downstream processing, product recovery and purification. Effluent treatment. Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.

PRACTICAL

1. Calculation of bacterial growth curve.
2. Calculation thermal death point (TDP) of a microbial sample.
3. Production and analysis of ethanol.
4. Production and analysis of amylase.
5. Production and analysis of lactic acid.
6. Isolation of industrially important microorganism from natural resource.

BT-604 PLANT BIOTECHNOLOGY & ENVIRONMENTAL BIOTECHNOLOGY

MM 40+10 IA

Time: 3 Hours

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

UNIT I

Introduction to *in vitro* methods. Terms and definitions. Use of growth regulators. Embryo culture, embryo rescue after wide hybridization and its applications. Introduction to the processes of embryogenesis and organogenesis and their practical applications. Clonal multiplication of elite species (Micropropagation) axillary bud, shoot-tip and meristem culture. Haploids and their applications, Somaclonal variations and applications.

UNIT II

Endosperm culture and production of triploids. Single –cell suspension cultures. Introduction to protoplast isolation: Principles and applications. Various steps in the regeneration of protoplasts. Somatic hybridization – an introduction. Use of markers for selection of hybrid cells. Practical applications of somatic hybridization (hybrids vs cybrids).

UNIT III

Microbiological quality of food and water. Treatment of municipal waste and industries effluents. Degradation of pesticides and other toxic chemicals by microorganisms (Bioremediation).

UNIT IV

Thuringiensis toxin as a natural pesticide. Biological control of other insects swarming the agricultural fields. Enrichment of ores by microorganisms. Biofertilizers, Nitrogen fixing microorganisms enrich the soil with assimilable nitrogen.

PRACTICAL

1. Preparation of simple growth nutrient (Knop's medium), full strength, half strength, solid and liquid.
 2. Preparation of complex nutrient medium (Murashige & Skoog's medium)
 3. To selection, Prune, sterilize and prepare an explant for culture.
 4. Significance of growth hormones in culture medium.
 7. To demonstrate various steps of Micropropagation.
 8. Calculation of Total Dissolved Solids (TDS) of water sample.
 9. Calculation of BOD & COD of water sample.
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BT-605 PHYSICAL CHEMISTRY

MM 40+10 IA

Time: 3 Hours

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

BT 606 ORGANIC CHEMISTRY

MM 40+10 IA

Time: 3 Hours

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

BT-607 INORGANIC CHEMISTRY

MM 40+10 IA

Time: 3 Hours

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

BT 608 PROJECT

**MM
50**

Project report and presentation.

BT 609 LAB COURSE-I (Based on BT-605-607) MM 50

BT-610 LAB COURSE II MM 100

(Animal Biotech, Bioprocess Tech, Plant Biotech & Environmental Biotech, IPR)

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- Plant & Env. Biotechnology, Bioprocess technology
(25+25=50 marks) Minor exercise- Animal Biotechnology and IPR & Entrepreneurship

Viva	-15	(25 marks)
Practical record	-10	marks
Total	-100 marks	marks