## M.Sc., Biochemistry Semester System

**Credit System**

**SCHEME OF INSTRUCTION AND EXAMINATION**

<table>
<thead>
<tr>
<th>Paper No.</th>
<th>Title of the Paper</th>
<th>Periods/Week</th>
<th>No of Credits</th>
<th>Duration of Exam (hrs)</th>
<th>Max Marks</th>
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<tr>
<td><strong>I Semester:</strong></td>
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<td><strong>Theory:</strong></td>
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<tr>
<td>BC 1.1</td>
<td>Chemistry of Biomolecules</td>
<td>4</td>
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<tr>
<td>BC 1.2</td>
<td>Biochemical Techniques</td>
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<td>BC 1.3</td>
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<td>BC 1.4</td>
<td>Enzymology</td>
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<td><strong>Practicals:</strong></td>
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<tr>
<td>BC 1.5</td>
<td>Biochemical Techniques</td>
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<td>BC 1.6</td>
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<tr>
<td>BC 1.7</td>
<td>Viva – Voce</td>
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<td><strong>Total marks for I Semester</strong></td>
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<td>535 + 90* = 625</td>
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| BC 1.5    | Biochemical Techniques             | 12           | 2            | 6                      | 85        |
| BC 1.6    | Enzymology                         | 12           | 2            | 6                      | 85        |
| BC 1.7    | Viva – Voce                        | --           | 1            | --                     | 25        |
| **Total marks for I Semester** |                                   |              |              |                        | 535 + 90* = 625 |

| **II Semester:** |                                   |              |              |                        |           |
| BC 2.1    | Microbiology                       | 4            | 4            | 3                      | 85        |
| BC 2.2    | Cell Biology and Genetics          | 4            | 4            | 3                      | 85        |
| BC 2.3    | Intermediary Metabolism            | 4            | 4            | 3                      | 85        |
| BC 2.4    | Molecular Biology                  | 4            | 4            | 3                      | 85        |
| **Practicals:** |                                   |              |              |                        |           |
| BC 2.5    | Microbiology and Genetics          | 12           | 2            | 6                      | 85        |
| BC 2.6    | Quantitative Analysis and Molecular Biology | 12           | 2            | 6                      | 85        |
| BC 2.7    | Viva-Voce                          | --           | 1            | --                     | 25        |
| **Total marks for II Semester** |                                   |              |              |                        | 535 + 90* = 625 |

| **III Semester:** |                                   |              |              |                        |           |
| BC 3.1    | Plant Biochemistry and Human Nutrition | 4          | 4            | 3                      | 85        |
| BC 3.2    | Immunology                         | 4            | 4            | 3                      | 85        |
| BC 3.3    | Regulation of Gene Expression and Genetic Engineering | 4          | 4            | 3                      | 85        |
| BC 3.4    | Industrial Biotechnology           | 4            | 4            | 3                      | 85        |
| **Practicals:** |                                   |              |              |                        |           |
| BC 3.5    | Immunology and Food Analysis       | 12           | 2            | 6                      | 85        |
| BC 3.6    | Biotechnology and Genetic Engineering | 12           | 2            | 6                      | 85        |
| BC 3.7    | Viva – Voce                        | --           | 1            | --                     | 25        |
| **Total marks for III Semester** |                                   |              |              |                        | 535 + 90* = 625 |

| **IV Semester:** |                                   |              |              |                        |           |
| BC 4.1    | Clinical Biochemistry and Endocrinology | 4          | 4            | 3                      | 85        |
| BC 4.2    | Genomics, Proteomics and Bioinformatics | 4          | 4            | 3                      | 85        |
| BC 4.3    | Applied Biochemistry               | 4            | 4            | 3                      | 85        |
| **Practicals:** |                                   |              |              |                        |           |
| BC 4.4    | Clinical Biochemistry and Bioinformatics | 12         | 2            | 6                      | 85        |
| BC 4.5    | Viva - Voce                        | --           | 1            | --                     | 25        |
| BC 4.7    | Project Work                       | --           | 4            | --                     | 200       |
| **Total marks for IV Semester** |                                   |              |              |                        | 565 + 60* = 625 |
| **Grand Total for 4 Semesters** |                                   |              |              |                        | 2170 + 330 = 2500 |

*Internal assessment component carries 15 marks for each theory and practical papers.*
M.Sc., BIOCHEMISTRY SEMESTER SYSTEM

CREDIT SYSTEM

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Total marks for III Semester: 535 + 90* = 625

*Internal assessment component carries 15 marks for each theory and practical papers.

I SEMESTER

BC: 1.1: Chemistry of Biomolecules

Unit – 1

Unit – 2
Classification, chemical properties of carbohydrates, Chemistry and biological roles of homo and heteropolysaccharides, peptidoglycan, glycosaminoglycans, glycoconjugates, glycoproteins, Structural elucidation of polysaccharides; Oligosaccharides – lectin interaction in biochemical processes.

Unit – 3
Unit – 4

BC 1.2: Biochemical Techniques
Unit – 1:
Separation Techniques: Principles, methods and applications of chromatography – Paper, thin layer, ion exchange, gel filtration and affinity chromatography, GLC, HPLC and chromatofocussing.
Unit – 2:
Tissue homogenization. Disruption of tissues and cells, Centrifuges – Principle, applications and types. Differential and density gradient centrifugation. Preparative and analytical ultracentrifuge. Principles and applications of manometry and oxygen electrode, Principle and applications of microscopy, types of microscopes, phase contrast, fluorescent and electron microscopes.
Unit – 3:
Basic Principles of spectroscopy, basic laws of light absorption; instrumentation and applications of UV_visible, IR,ESR,NMR, atomic absorption and Mass spectroscopy, fluorimetry, flame photometry, bephelometry, ORD, CD, X-ray diffraction.
Unit – 4:
Nuclear techniques – nature of radioactivity, detection and measurements of radioactivity. Radio isotopic techniques, Biochemical uses of isotopes. Radiation hazards and methods of radioactive disposal. Principles, methods and applications of electrophoresis, moving boundary electrophoresis, zone electrophoresis, paper, starch, agarose, PAGE, High voltage and Capillary electrophoresis, Isolelectric focusing, two-dimensional electrophoresis, PFGE.
BC 1.3: Physiology and Bioenergetics

Unit – 1:

Unit – 2:

Unit – 3:
Composition and structure of cell membranes, Molecular constituents of membranes, asymmetric organization of lipids and proteins, fluidity of membranes, different membrane models. Membrane channels and pumps, ligand gated ion channels, Ionic channels. Molecular models of transport mechanism, Membrane biogenesis, cell-cell interactions, ionophores, gap junctions, artificial membranes and liposomes.

Unit – 4:

BC 1.4: Enzymology

Unit: 1
Classification of enzymes, Remarkable properties of enzymes – catalytic power, specificity. Transformation of different forms of energy. Enzyme localization and assay of enzymes, Units of enzyme activity, Active site – Fisher and Koshland models,
formation of enzyme – substrate complex and experimental evidences. Nature of active
site, mapping of enzyme active site through chemical procedures and site directed
mutagenesis, Factors affecting enzyme activity, Modern concepts of evolution of
catalysis, ribozymes, abzyme and synzymes.
Unit – 2:
Kinetics of single substrate enzyme catalyzed reactions, Michaelis – Menten equation,
Lineweaver - Burk, Eadie – Hofstee and Hanes plots. Significance of Vmax, Km, Kcat,
specificity constant (Kcat/Km)
Kinetics of multistubstrate reaction – Classification with examp0les. Rate expression for
non-sequential (ping-pong) and sequential (ordered and random) mechanisms.
Use of initial velocity, Inhibition and exchange studies to differentiate between multi
substrate reaction mechanisms. Flexibility and conformational mobility of enzymes.
Ebztn ubguvutuib – reversible inhibition – competitive, non-competitive , un-
competitive inhibition; irreversible inhibition, Determination of Ki values
Unit – 3;
Types of reaction catalysis – General acid – base, electrostatic, covalent, intermolecular,
metal – ion catalysis, Proximity and orientation.
Mechanism of reaction catalyzed by serine proteases – trypsin and chymotrypsin,
carboxypeptidase, lysozyme, triose phosphate isomerise, ribonuclease
Rotational catalysis – ATPase.
Mechanism of catalysis with coenzymes – pyridoxal phosphate, flavin
nucleotides, thiamine lpyrophosphate, biotin, tetrahydrofolate, lipoic acid.
Unit – 4:
Enzyme regtuation – general mechanisms of enzyme regulation. Allosteric enzymes
(ATCase). Cooperativity phenomenon. Hill and Scatchard plots. Sigmodal kinetics and
their physiological significance, Symmetric and sequential models of action of allosteric
enzymes and their significance. Feedback inhibition and feed forward stimulation.,
Control of enzymatic activity by products and substrates. Reversible and irreversible
activation
Isoenzymes, Multifunctional enzymes, Multi – enzyme
systems – properties, mechanism of action and regulation of Pyruvate dehydrogenase and
Fatty acid synthase complex

PRACTICAL – I
BC 1.5: Biochemical Techniques

Paper chromatography – ascending and descending – separation of amino acids, sugars,
purines and pyrimidines. Qualitative tests for their identification.
Thin – layer chromatography of amino acids and lipids.
Column chromatographic separation of plant pigments.
Separation of amino acids by paper electrophoresis.
Polyacrylamide Gel Electrophoresis of serum proteins.
Ion Exchange chromatography of amino acids.
Absorption spectrum of chlorophyll extracted from green leaves.
Absorption spectrum of aromatic amino acids, purines, pyrimidines and heme.
Determination of Molar absorption coefficient of tyrosine.
Optical rotation of glucose and fructose using polarimeter.
Sub – cellular fraction of organelles of liver cells and identification by the marker enzymes.
Affinity Chromatography.
N and C terminal analysis of proteins. (End group analysis of proteins).
Peptide mapping.
Molecular weight of protein by SDS-PAGE
Estimation of proteins by Spectrophotometric method
Density gradient centrifugation – Isolation of rat liver mitochondria.
2- Dimensional electrophoresis of lproteins
Isoelectric focusing

PRACTICAL – II
BC 1.6: Enzymology
Assay of Amylase from saliva
Assay of Acid phosphatise from potato
Assay of Trypsin
Assay of urease from Horse – gram
Assay of Succinate dehydrogenase from the liver
Isoenzymes of LDH – electrophoretic separation and specific staining technique
Time course of enzyme activity
Effect of PH on enzyme activity and determination of optimum PH
Effect of temperature on enzyme activity and calculation of energy of activation.
Effect of substrate concentration on enzyme activity and determination of Michealis constant.
Enzyme inhibition – irreversible inhibition of Papain Or Serine proteases by appropriate inhibitors
Effect of substate and regulators on allosteric enzyme – Phosphorylase Or ATCase
Enzyme purification by 3 or 4 steps
   a) Acetone precipitation
   b) Ammonium sulphate fractionation
   c) Ion – exchanging chromatography
   d) Gel filtration
   e) Electrophoresis
Effect of metal ions on enzyme ions on enzyme – Alcohol dehydrogenase

II SEMESTER

B.C. 2.1: MICROBIOLOGY
**Unit 1:1**


**Unit 2:**


**Unit 3:**


**Unit 4:**


**B.C: 2.2: CELL BIOLOGY AND GENETICS**
**Unit-1**

Structure of a typical cell, Differences between prokaryotic and eukaryotic cells, animal and plant cells. Cytoskeleton – microtubules, microfilaments, Epithelial tissue, Basement membrane, Extracellular matrix – collagen, elastin, fibrillin, fibronectin, laminin, proteoglycans, integrins. Autocrine, paracrine, exocrine and endocrine systems, Molecular mechanism of signal transduction (Biosignalling), G proteins, Second messenger system – cAMP, cGMP, Calcium, IP_3_, DA G, nitric oxide, Mechanism of their generation and action. Role of different protein kinases.

**Unit-2**


**Unit-3**

Mendel’s experiments as an example of good scientific technique, Genotype and phenotype; Genotype-environment interaction; Norm of reaction, Developmental Noise; Concept of Dominance; Penetrance and expressivity; Concept of alleles- Multiple alleles, Test for allelism, types of alleles, Benzer’s rII alleles; Concept of cistron, recon, and muton; Interaction between genes - Modified dihybrid ratios; Sex determination with special reference to genetic basis of sex determination in humans-sry gene; Sex linked inheritance.

**Unit-4**

Linkage and crossing over- 2 point test cross, 3 point test cross, recombination as a basis for variation; Quantitative inheritance; Extra chromosomal inheritance; Concept on origin of mutations taking bacteria as an example-Classical experiments of Luria and Delbruck, Newcombe and Lederberg – Fluctuation test, Plate spreading, Replica plating and Sib selection; Mutations – Types of mutations, Mutagens and their mechanism of action, Molecular mechanism of mutations; Modern concept of the gene-Split gene; Overlapping genes, Assembled genes, Repeated genes, Polyprotein genes, Nested genes.
BC 2.3: INTERMEDIARY METABOLISM

Unit-1:


Unit-2:


Unit-3:


Unit-4:

Unit-1:
Models of DNA Replication, Origin and direction of replication, Semidiscontinuous replication, DNA polymerases of prokaryotes and their mechanism of action; Primase, Ligase, Single strand DNA binding protein, Helicase, Topoisomerase
Replication strategies for replicating circular DNA: $\phi$ mode replication, $\sigma$ mode or rolling circle replication and D-loop replication.
Eucaryotic DNA polymerases, Reverse transcriptase, Strategies for replicating linear DNA, Fidelity and processivity of replication, Inhibitors of replication.

Unit-2:
DNA Repair mechanisms, Photoreactivation, Excision repair mechanism, Post replication repair mechanisms - recombination repair, mismatch repair system, SOS response, transcription-repair coupling.
Recombination - models of general recombination; Hollyday model, asymmetric strand transfer model, double strand break repair model, site-specific recombination.
Transposition of DNA; Transposable elements, Prokaryotic transposons, Eukaryotic transposons, Retroposons.

Unit-3:
Principles of transcription, Prokaryotic RNA polymerase, Conserved sequences of prokaryotic promoters, Initiation of transcription, Chain elongation, Chain termination, Eukaryotic RNA polymerases, Conserved sequences of eukaryotic promoters, Transcriptional factors and basal eukaryotic transcription complex, Enhancers, Transcriptional termination in eukaryotes
Post transcriptional processing of pre-mRNA - addition of Cap to the 5’ end, Polyadenylation to the 3’ end, mechanism of intron removal and exon splicing,
Processing of r-RNA, Self-splicing of group-1 and group-11 introns, Processing of tRNA, RNA editing changes.
General features of genetic code, Structural components of prokaryotic and eukaryotic ribosomes, Mechanism of protein synthesis in prokaryotes and eukaryotes - aminoacylation of tRNA, protein synthesis - initiation, elongation and chain termination, Protein synthesis inhibitors, Translational control in eukaryotes, Protein targetting and processing; Singal sequences, signal recognition particle, signal hypothesis, molecular chaperons.

PRACTICAL – I

BC: 2.5: MICROBIOLOGY AND GENETICS

Sterilization Techniques-Autoclaving, hot-air oven sterilization, Sieve filtration, membrane filtration.
Preparation of culture media – Nutrient Broth, Nutrient Agar, Blood agar
MacConkey’s agar, Potato dextrose agar.
Isolation of bacteria – Streak plate and pour plate methods.
Motility of Bacteria – “Hanging drop” technique
Bacteriological examination of water and milk
Bacterial growth curve
Identification of bacteria by staining techniques – simple, differential, Gram staining and acid-fast staining.
Identification of bacteria – Morphological, cultural and biochemical characteristics
Microbiological assay of a vitamin/amino acid
Analysis of domestic and industrial effluents - MPN, BOD, COD and DO
Isolation of phage and plaque formation units (PFU)
Mitosis in onion root tip cell
Meiosis in onion flower buds
Karyotyping
Problems on monohybrid ratio, dihybrid ratio, gene interaction, linkage and crossing over – 2 point test cross.
PRACTICAL – II

BC: 2.6: QUANTITATIVE ANALYSIS AND MOLECULAR BIOLOGY

Determination of P${}_{ka}$ and P${}_{i}$ values of an amino acid by titrimetric method
Estimation of proteins by Lowry, Bradford methods
Determination of carbohydrates by Anthrone method
Determination of RM value and polensky number of oils
Estimation of pyruvate by 2,4 Dinitrophenyl hydrazine method
Estimation of Ca$^{++}$/Zn$^{++}$ by EDTA titrimetric method
Determination of melting temperature (T$\text{m}$) of DNA
Isolation of DNA from bacterial, plant and animal cells.
Estimation of DNA by Diphenylamine method.
Isolation of RNA from yeast cells.
Estimation of RNA by Orcinol method.
Estimation of DNA and RNA by UV absorption method and determination of purity of nucleic acids.

Determination of sugar and phosphate ratios in DNA and RNA samples.
Conjugation: Use of broad host range plasmid RP in demonstrating conjugation transfer of plasmid bacteria.
Catabolite repression: Evidence of B-Galactosidase induction in presence of lactose in E.coli lac strains.
Mutations: UV damage and repair mechanism in Escherichia coli Or Seratia marcesens
Strain improvement of Aspergillus niger using chemical mutagen – Ethidium bromide
III SEMESTER

BC 3.1: PLANT BIOCHEMISTRY AND HUMAN NUTRITION

Unit-1

Unit-2:

Unit-3:

Unit-4:
Vitamins: sources, physiological role and deficiency disorders of vitamins A, D, E, K, Vitamin C and B complex vitamins—Thiamine, riboflavin, niacin, pantothenic acid, lipoic acid, pyridoxine, biotin, folic acid and Vitamin B₁₂. Functions and deficiency disorders of minerals.

**BC 3.2: IMMUNOLOGY**

**Unit-1**


**Unit-2**


**Unit-3**

Unit-4

Immune effector mechanisms – Hypersensitivity: immediate (type I, type II, type III) and delayed hypersensitivity reactions, Immunodeficiencies - SCID and AIDS. Autoimmunity - organ specific (Hashimoto’s thyroiditis) and systemic (Rheumatoid arthritis) diseases. Tissue transplantation - auto, allo, iso and xenograft, tissue matching, transplantation rejection, mechanism and control, immunosuppressive agents. Cancer immunology – Tumor associated antigens, Immunological surveillance of cancer.

Unit-1:

Structure and function of lac operon, Induction of lac operon – a negative control system, Catabolite repression – a positive control system, Function and regulation of trp operon, Atenuation of trp operon, ara operon: dual functions of the repressor, Diversity of sigma factor - Bacterial sporulation and Phage infection in Bacillus subtilis, Heat-shock response in E.coli, Regulation of phage variation in Salmonella. Regulation of lytic phase and lysogenic phase of Bacteriophage λ.

Unit-2:

Structural changes in the eukaryotic active chromatin - hypersensitive sites, chromatin remodeling, Levels of eukaryote gene control - Control at the level of transcription, processing of RNA, mRNA stabilization in the cytoplasm and translation of mRNA. Eukaryote promoter and enhancer sequence organization. Interaction of eukaryote transcriptional factors with DNA - helix-turn-helix motif, zinc-finger motif, leucine zipper, helix-loop-helix motif. Regulation of galactose metabolism in yeast. Steroid hormone induced gene expression. Regulation of gene expression by anti-sense RNA.

Unit-3:

Restriction endonucleases, Restriction maps, isolation of gene fragments using restriction endonucleases and mechanical shearing. Cloning vectors - Isolation and properties of plasmids, bacteriophage cosmids, Ti plasmid (binary vector), expression vectors, viral vectors, YAC, BAC, phagemids and vectors used for cloning in mammalian cells, other enzymes related to molecular cloning. Hosts - Prokaryotic: E.coli, B.subtilis, Eukaryotic: Yeast and mammalian cell lines. Ligation of fragments - Cohesive and blunt ends,
Homopolymer tailing. Gene transfer techniques. Biological and artificial delivery system, knockout mice.

**Unit-4:**


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**BC 3.4: INDUSTRIAL BIOTECHNOLOGY**

**Unit-1:**

Fermentation technology – Principles of fermentation, surface, submerged and solid state fermentations. Batch, fed batch, semi-continuous and continuous culture techniques. Design and operation of fermentors, Agitation and aeration, Types of fermentors-continuous stirred tank fermentor (CSTF), air-lift fermentor, Types of reactions in fermentations, Selection and characteristics of industrial microorganisms, Primary and secondary metabolites, Strategies for strain improvement and maintenance of the industrial strains, Raw materials, different types of fermentation media, Recovery of products, steps in downstream processing, Bioreactors.

**Unit-2:**

Production of ethyl alcohol and beer by yeast, Fermentative production of Antibiotics - penicillin, streptomycin, tetracycline, Organic acids - citric acid, lactic acid, acetic acid, Enzymes - amylase, proteases, streptokinase, Amino acids - glutamic acid, lysine and Vitamins - B12, B2, and vitamin C. Production of biogas from agricultural wastes.

**Unit-3:**

Immobilization of enzymes and cells – methods of immobilization, effect of partition on kinetic properties of enzymes, immobilization of multienzyme systems, enzyme reactors, packed bed reactors, fluidized bed reactors, problems in using immobilized biocatalysts,
Industrial and medical applications of immobilized enzymes and cells. Principle and applications of Protein engineering. Principle, types and applications of Biosensors.

**Unit: 4:**

Single cell protein- Production and applications, Microbial transformations (bioconversions)-: Types and applications, steroidal transformations. Bioleaching, biosorption, biodegradation, bioremediation. Biofertilizers – Blue-green algal fertilizers (Azolla, Aneabena), seaweed fertilizers, Mycorrhiza, Biocontrol agents- Siderophores, biopesticides – Insecticidal toxin of Bacillus thuringiensis, mode of action and control, Bacculoviruses.

**PRACTICAL-I**

**BC 3.5: IMMUNOLOGY AND FOOD ANALYSIS**

Determination of A, B, O and Rh blood groups in human beings
Dissection and Identification of thymus, spleen and lymph nodes
Techniques of Immunization and Bleeding
Ouchterlony immunodiffusion for detection of Antigens
Radial Immunodiffusion
Immunoprecipitation and precipitin curve
Immunoelectrophoresis
Rocket immunoelectrophoresis
Purification of bovine serum IgG by ammonium sulphate precipitation
Enzyme Linked Immuno Sorbent Assay (ELISA)
Western blotting
Diagnostic test for typhoid fever
VDRL Test
Pregnancy Test
Isolation of Glycogen from Sheep Liver
Preparation of Carotenes from Carrots
Preparation of Haemoglobin from Blood
Preparation of Chloroplasts from green leaves
Isolation of Glutamic acid from Gluten of Wheat
Extraction and estimation of total lipids from oil seeds (solvent extraction)
Quantitative analysis of foods for -
a) Moisture
b) Ash
c) Iron
d) Calcium
e) Copper

PRACTICAL-II

BC 3.6: BIOTECHNOLOGY AND GENETIC ENGINEERING

Fermentative production and quantification of:
Antibiotics - penicillin/ streptomycin/ tetracycline
Organic acid: citric acid/ lactic acid/ acetic acid
Enzymes: amylase/ protease/urease
Amino acid: glutamic acid/ lysine
Vitamins: B\textsubscript{12}, B\textsubscript{2}, vitamin C
Ethyl alcohol/ fruit wine and calculation of fermentation efficiency
Methods of immobilization of protein/enzyme and microbial cells
Isolation of plasmids and estimation of plasmid DNA by UV method
Restriction digestion of \(\lambda\) DNA, Ligation of RE fragments
Agarose and Polyacrylamide gel electrophoresis of nucleic acids
Recovery of DNA/RNA fragments from agarose gels
Preparation of competitive \textit{E.coli} cells and transformation
Expression of cloned gene (GFP)
DNA finger printing (RFLP or RAPD)
PCR
Southern blotting

\textbf{M.Sc., BIOCHEMISTRY SEMESTER SYSTEM}

\textbf{CREDIT SYSTEM}

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BC 3.2: Immunology 4 4 3 85
BC 3.3: Regulation of Gene Expression and Genetic Engineering 4 4 3 85
BC 3.4: Industrial Biotechnology 4 4 3 85

Practicals:

BC 3.5: Immunology and Food Analysis 12 2 6 85
BC 3.6: Biotechnology and Genetic Engineering 12 2 6 85
BC 3.7: Viva – Voce -- 1 25 ----

Total marks for III Semester 535 + 90* = 625

*Internal assessment component carries 15 marks for each theory and practical papers.

IV SEMESTER

BC 4.1: CLINICAL BIOCHEMISTRY AND ENDOCRINOLOGY

Unit 1:


Unit 2:
Liver function tests, their significance, Liver diseases – Jaundice, hepatitis, gall stones, cirrhosis and fatty liver. Free radical mechanism and role of reactive oxygen species in diseases. Role of liver in metabolic regulation and drug metabolism. Clinical chemistry of new born.

Clinical enzymology - Plasma enzymes in diagnosis and prognosis, Isoenzymes in health and diseases (Liver, cardiac and skeletal muscle enzymes)


Unit 3:

Thyroidal hormones – Chemistry, function and metabolism. Hypo and hyper thyroidism, tests for thyroid function. Parathyroid hormones – Parathormone and calcitonin, their role in calcium and phosphate metabolism, abnormalities of parathyroid functions and methods of evaluation.
Adrenals - Chemistry and biosynthesis of adrenal medullary and adrenal cortical hormones. Disorders of adrenal cortex and adrenal medulla, tests for the evaluation of adrenal functions. Biochemical effects of tumours.

Unit 4:

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BC 4.2: GENOMICS, PROTEOMICS AND BIOINFORMATICS

Unit: 1
Organisation of computers, External and internal storage devices, Basics of operating systems – DOS, Windows, Unix, Linux. WWW, HTML, HTTP, Internet and Internet concepts.
Origin of Bioinformatics, Branches of bioinformatics, Scope of Bioinformatics

Unit: 2
High throughput DNA sequencing, Whole genome sequencing, shot gun sequencing, sequencing editing, contig assembly
Genome projects: Human genome projects, features of yeast, Arabidopsis genomes.
Introduction to Data Bases, types of Data Bases.
INSD-International Nucleotide Sequence Database, Gen Bank, EMBL, DDBJ, special focus on NCBI, Protein sequence Data base- Swissprot, Tr- EMBL, PIR, Uniprot and Pfam, Structural Data bases-PDB, CATH, SCOP, MMDB

Unit: 3
Molecular phylogeny concept. Tree types, Tree constructions – UPGMA, Neighbor joining, Maximum parsimony, Minimum evolution, Boot strapping, Blast search tool.

Unit: 4
Proteomics: Significance and applications of proteomics in Biology. Introduction to principle and techniques – 2D gel electrophoresis, DIGE electrophoresis, MALDI-TOF/TOF, Q-TOF.
Molecular Modeling – Structure of protein at Primary, secondary, tertiary and quaternary level. Understanding Molegro Molecular viewer for protein 3D visualization – RASMOL. Protein secondary structure prediction – Chou Fasman method.
Homology modeling and docking studies (Using Molegro Virtual Docker) Molecule Import and preparation from PDB. Docking, Analysis, Constrains, Data analyser, sidechain flexibility and templet docking.
Drug discovery – target identification, target validation, lead identification, lead optimization, Phase I,II and III clinical trials, pharmacodynamics.
BC 4.3: APPLIED BIOCHEMISTRY

Unit: 1
DNA fingerprinting, SNPS, Mapping Genes – Somatic cell hybridization mapping, FISH, Transposon tagging. RNA silencing – siRNAs and anti-sense RNAs-their design and applications; shRNA, epigenetic gene silencing.

Unit: 2
Plant tissue culture: Culture media – Composition and preparation, Totipotency, Organogenesis and plant regeneration, Somatic embryogenesis, Artificial seeds, Micropropagation. Isolation and culture of protoplasts, Somatic hybridization. Plant cell cultures, Plating efficiency, Production of secondary metabolites through in vitro culture.

Unit: 3
Animal tissue culture: Composition and preparation of culture media, Primary cultures, established/continuous cell lines. Tissue and organ culture. Stem cells – Sources - embryonic stem cells, adult stem cells, cord blood stem cells. Generation of stem cells by cloning, stem cell differentiation, stem cell plasticity, preservation of stem cells. Organogenesis through stem cells for transplantation. Applications of stem cell therapy-Parkinson’s disease and Alzheimer’s disease.

Unit: 4

PRACTICAL – 1

BC 4.4 CLINICAL BIOCHEMISTRY AND BIOINFORMATICS

Analysis of Blood for:
Hemoglobin and derivatives – Spectroscopy
Glucose by chemical and enzymatic methods
Glycosylated hemoglobin

Analysis of serum for:
Creatine and creatinine
Uric acid by chemical and enzymatic methods
Bilirubin
Chlorides
Calcium
HDL Cholesterol and LDL cholesterol
Total proteins, Albumins and globulins
Thymol turbidity and zinc sulphate turbidity tests
GOT and GPT
LDH, Gamma glutamyl transferase
Acid and Alkaline Phosphatase
Creatine Kinase

Analysis of Plasma for:
Fibrinogen

Analysis of Urine for:
Qualitative tests and microscopic examination
Urea by micro diffusion method
17 Oxo and 17 – Oxogenic steroids

Search of databases:
Using DNA sequence, identifying the protein through database
Using amino acid sequence of a protein, identifying the gene through database
Alignment of DNA and protein sequence using BLAST, FASTA
Multiple sequence alignment (MSA) of proteins and nucleic acids
Phylogenetic tree construction using CLUSTAL tools

Demonstration of 2D electrophoresis