GUJARAT UNIVERSITY

BIOCHEMISTRY SYLLABUS

M.SC. PART - II

To be implemented from 15th June, 2006

Paper	Titles	Marks
	M.Sc. Part- II	
V.	Enzymology and Immunology	75
VI.	Molecular Biology	75
VII.	Microbial Biochemistry	75
VIII.	Clinical Biochemistry	75
	Two practicals based on theory	100
	Dissertation	50
	Total marks of M.Sc part II	**450**
	Grand total marks of M.Sc Part I and II	**900**

Work load

3 periods of 60 min per paper X 4 papers	= 12 hours/week
Laboratory practicals 4hrs X 3 practicals	= 12 hours/week
Seminars	= 2 hours/week
Library	= 2 hours/week
Total	= 28 hours/week

It is also suggested that every students should undertake two hours library work under the supervision of faculty members. Research projects are incorporated in lieu of one practical in final year to inculcate aptitude for research and practical applications. The students will also have basic inputs on communication skills and computer knowledge and learn the basics of scientific writing and presentation.

M.SC. PART – II BIOCHEMISTRY

Paper V

ENZYMOLOGY AND IMMUNOLOGY

UNIT - I

Review of unisubstrate enzyme kinetics and factors affecting the rates of enzyme catalyzed reactions, Michaelis constant, its derivation, determination and their significance

Classification of multisubstrate reactions with examples of each class. Use of initial velocity, inhibition and exchange studies to differentiate between multisubstrate reaction mechanism,

Concept of Convergent and Divergent evolution of enzymes
Methods of examining enzyme-substrate complexes
Mechanism of enzyme reactions

Methods for measuring kinetic and rate constants of enzymic reactions and their magnitudes
Enzymes turnover and methods employed to measure turnover of enzymes, Significance of enzymes turnover
Protein – ligand binding, including measurement, analysis of binding isotherms, cooperativity phenomenon, hill and Scatchard Plots

UNIT - II

Immobilized enzymes and their industrial applications, Effect of partition on kinetics and performance with particular emphasis on changes in pH and hydrophobicity

Multienzyme system: Occurrence, isolation and their properties, Polygenic nature of multienzyme systems. Mechanism of action and regulation of pyruvate dehydrogenase and fatty acid synthetase complexes, Immobilized systems and their applications

Coenzymes and cofactors: Water soluble vitamins and their coenzymes, metalloenzymes

UNIT - III

Allosteric enzymes, Sigmoidal kinetics and their physiological significance, Symmetric and sequential modes for action of allosteric enzymes and their significance.

Enzyme regulation: General mechanisms of enzyme regulation: Feed back inhibition and feed forward stimulation; Enzyme repression, induction and degradation, control of enzymic activity by products and substrates; Reversible and irreversible covalent modifications of enzymes; Mono-cyclic and multi-cyclic cascade systems with specific exampies.

IMMUNOLOGY

UNIT - IV

Introduction to immune systems
Cells involved in Immune Responses
Phagocytic cells and their killing mechanisms
T, B lymphocytes, NK cells

Nature of Antigen and Antibody
Antigen vs immunogen, Haptens
Structure and functions of immunoglobulins
Clonal selection theory – concept of antigen specific receptor
Organization and expression of immunoglobulin genes: generation of antibody diversity
T cell receptor diversity
Humoral and Cell mediated Immune Responses
Complement system
Antigen processing and presentation
Cytokines and costimulatory molecules: Role of immune responses
T and B cell interactions

UNIT - V

Major Histocompatibility Complex (MHC) Genes and products
Polymorphism of MHC genes
Role of MHC antigens in immune responses
MHC antigens in transplantation
Measurement of antigen-antibody interaction
Production of polyclonal and monoclonal antibodies: Principles, techniques and applications
Agglutination and precipitation techniques
Radioimmunoassay
ELISA, FACS
Immunofluorescence assays

Immune tolerance, Immunosuppression, Hypersensitivity (Types I, II, III and IV)

Paper – VI

MOLECULAR BIOLOGY

UNIT - I

Chromatin: Histone and non-histone proteins, general properties of histones, packing density, Nucleosomes, size variable linker, role of H1. Solenoid structure, Transcriptionally active chromatin
Structure of DNA, DNA polymorphism, Classes of RNA, rRNA, tRNA, mRNA, HnRNA etc. Structure and methods of isolation and fractionation, gel electrophoresis and Dnases, Rnases, phosphodiesterases
Cot values, C-value paradox, possible functions of satellite DNA, Mechanical strength, gene library, suppressor mutation, centromeric DNA, split genes
Transposons and associated inverted repeats, The cassette model.
Eukaryotic transcription

UNIT - II

Recombinant DNA technology
Methods of creating recombinant DNA molecule, splicing, properties of restriction endonucleases and their mode of acion, selection/screening, construction of DNA library, genomic Vs cDNA library, chemical synthesis of gene, cloning vectors (λ-phage, plasmid, M-13 phase, cosmid) shuttle vectors, yeast and viral vectors, expression vectors, uses of cloned gene, subcloning, sequencing by Sanger's and chemical methods, proteins production in bacteria, site directed mutagenesis, RFLP, PCR, DNA fingerprinting, antisense-RNA technology, chromosomal walking

UNIT - III

Hybridoma Technology
Monoclonal antibodies, mycelium cell fusin, selection of hybrids, hybridomas, protoplast fusion and HAT medium, screening assays, purification and application of monoclonal antibodies

UNIT - IV

Animal tissue culture
Introduction, components required for tissue culture, culture types, Media, Factors affecting tissue culture, banding techniques, karyotyping, genetic toxicology techniques and applications, Gene cloning, transgenic animals

UNIT - V

Fermentation Technology

Primary and secondary metabolites in biotechnology, continuous and batch type culture techniques, principle types of fermentors, general design of fermentor, fermentation processes- brewing, manufacture of penicillin, production of single cell proteins, production strategies for other antibiotics and organic compounds

Paper VII

MICROBIAL BIOCHEMISTRY

UNIT – I: Introduction to microorganisms

Discovery of microbial world
Types of microorganisms,
General characteristics of main group of micro organisms,
Staining of Gram- negative and Gram- positive microorganisms and its mechanism,
Introduction to microbial classification,
Criteria and methods used for classification

UNIT – II: Microbial growth and physiology

Cultivation of microorganisms,
Microbial growth and growth kinetics,
Synchronous culture,
Physico-chemical factors influencing microbial growth,
Diversity in microorghanisms: microbial photosynthesis, nitrogen fixation and inorganic metabolism

UNIT – III: Microorganisms and environments

Microbial interactions in ecosystems
Role of microorganisms in carbon, nitrogen, sulphur and phosphorus cycle
Role of microorganisms in remediation of environmental pollutants: organic and inorganic

UNIT – IV: Biochemistry of immune reaction

Immune responses to diseases: viral and bacterial
Biochemistry of host-parasite interactions
Cancer and immune system
Immunodeficiency disorders
Autoimmunity, AIDS
Immunization
Active immunization (immunoprophylaxis)
Passive immunization (immunotherapy)
Role of vaccines in the prevention of diseases

UNIT – V: Viruses

Discovery of viruses
Structure of viruses
Introduction to virus classification
Biochemistry of replication of viruses
Lysogeny
Viroids and prions

Paper- VIII

Paper- VIII

CLINICAL BIOCHEMISTRY

UNIT - I

Disorders of carbohydrate metabolism
Diabetes mellitus
Glycohemoglobins
Hypoglycemia's
Ketone bodies
Various types of glucose tolerance tests
Glycogen storage diseases
Galactosemia

Lipids, Lipoproteins and apolipproteins
Physiology of lipids/lipoproteins, lipidosis
Clinical inter-relationships of lipids (Sphingolipidosis, multiplsclerosis), Lipoproteins and apolipoproteins
Diagnostic tests for apolipoproteins, HDL-cholesterol, LDL-cholesterol and triglycerides disorders

UNIT - II

Disorders of amino acid metabolism
Phenylalaninemia, homocystineuria, tyrosinemia and related disorders, aminoacidurias

Disorders of nucleic acid metabolism
Purine metabolism
Pyrimidine metabolism

Inborn errors of metabolism
Electolytes, blood gases, respiration, acid-base balance and acid-base disorders, respiratory and renal mechanism of acid balance disorders

UNIT - III

Evaluation of organ function tests
Assesssment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions, bilirubin metabolism

Clinical presentation and diagnosis of various organ diseases
Diagnostic enzymes
Principles of diagnostic enzymology
Clinical significance of
-Aspartate aminotransferase
-Alanine aminotransferase
-Creatine kinase
-Aldolase
-Lactate dehydrogenase
-Enzyme tests in determination of myocardial infarction
-Enzymes of pancreatic origin, biliary tract

UNIT - IV

Hormonal disturbances
Protein hormones, anterior pituitary hormones, posterior pituitary hormones, steroid hormones, adrenocortical steroids, reproductive endocrinology, thyroid function

UNIT - V

Hypercalcemia, hypocalcemia, nomocalcemia, hypophosphatemia, hyerphosphatemia
Biochemical aspects of hematology
Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemias, and anemias

Detoxification Mechanism in the Body
Enzymes of detoxification –polymorphism in drug metabolizing enzymes
Detection of toxic substances by specific procedures

Disorders of vitamins

Disorders of nervous system