

DEPARTMENT OF BIOCHEMISTRY UNIVERSITY OF KASHMIR



PhD (Integrated) Entrance Test Syllabus for Biochemistry (Effective from 2018)

Syllabus for PhD (Integrated) Entrance Test in Biochemistry
(Effective from 2018)

(The syllabus is based on core papers in MSc Biochemistry programme in effect since 2017)

Core Papers

S.No.	Course Name
1.	Biomolecules
2.	Cell Biology
3.	Metabolism
4.	Molecular biology
5.	Physiology and Clinical Biochemistry
6.	Immunology



(Detailed syllabus on next page)

1. Biomolecules

Unit-I

Carbohydrates

Definition, classification, characterization and biological importance of mono- and disaccharides

Structure and conformation of sugars

Stereo- and optical isomerisms

Structure and function of homo- and heteropolysaccharides

Mucopolysaccharides and proteoglycans

Chemical reactions of functional groups present in carbohydrates

Unit-II

Lipids

Classification of lipids

Chemical composition and properties of triglycerides

Nomenclature and properties of saturated and unsaturated fatty acids

Properties and functions of phosphoglycerides and sphingolipids

Structure and functions of steroids (cholesterol and bile acids)

Prostanoids

Unit-III

Amino acids

Structure, classification and physiochemical properties

Essential and non-essential amino acids

Characteristics of a peptide bond

Oligo-peptides and polypeptides

Chemical synthesis of a peptide

Proteins

Levels of protein structure

Elucidation of primary structure

Forces stabilizing the tertiary structure

Protein denaturation and renaturation

Unit- IV

Nucleic Acids

Primary, secondary and tertiary structure of DNA

Various forms of DNA, structural polymorphism of DNA

Properties of DNA

Denaturation and annealing of DNA, Cot Curve

DNA as a genetic material

Primary, secondary and tertiary structure of RNA

Functions of various types of RNA



2. Cell Biology

Unit-I

Basic properties of cells

Structural organization of prokaryotic and eukaryotic cells

Introduction of viruses

Cell membrane

Chemical composition

Structure and function of membrane proteins

Membrane lipids and membrane fluidity

Dynamic nature of plasma membrane

Movement of substance across cell membrane

Membrane potentials

Mitochondria

Structure and function

Oxidative metabolism in mitochondria

Role of mitochondria in ATP formation

Translocation of protons and establishment of a proton motive force

Unit-II

Introduction to endomembrane system

Approaches to study endomembrane

Endoplasmic reticulum, structure, functions

Golgi complex

Types of vesicle transport and their types

Lysosomes and plant vacuoles, peroxisomes

Moving membranes and materials into the cell interior

Posttranslational uptake of proteins by peroxisome, mitochondria and chloroplasts

Unit-III

Cell wall

Detailed structure and functions of Cell wall

Microbodies

Chloroplast

Structure, function

Photosynthetic units and reaction centers

Photophosphorylation

Unit IV

Extracellular matrix and cell interaction

Extracellular space

Interaction of cells with extracellular material

Tight Junction- sealing the extracellular space

Cell -cell adhesion

Cell -cell communication

The cytoskeleton

Microtubules

Intermediate filaments

Microfilaments

3. Metabolism

Unit-I

Bioenergetics

Energy transformation by biological systems

Concept and significance of free energy

Phosphoryl transfer potential

Coupled reactions

ATP as energy currency

Metabolon concept

Unit-II

Carbohydrate metabolism

Glycolysis

Citric acid cycle, its function in energy generation and biosynthesis of energy rich-bonds

Pentose phosphate pathway and its regulation

Alternate pathways of carbohydrate metabolism

Gluconeogenesis

Biosynthesis of glycogen and starch

Unit-III

Lipid metabolism

Fatty acid oxidation- α , β , ω , oxidation and lipo-oxidation.

Fatty acid biosynthesis- Acetyl CoA carboxylase, Desaturase and elongase

Biosynthesis of triacylglycerols, Phosphoglycerides and sphingolipids

Biosynthetic pathways for terpenes, steroids and prostaglandins

Ketone bodies- Formation and utilization

Unit-IV

Regulation of carbohydrate and lipid metabolism -hormonal/enzymatic

Interactions between carbohydrate and lipid metabolism – role of insulin and adiponectin

Inborn errors of carbohydrate and lipid metabolism



4. Molecular Biology

Unit-I

Replication

Unit of replication,
Replication Origin and Replication Fork
Enzymes involved in replication,
Initiation, Elongation and Termination of Replication
Fidelity of Replication,

Unit-II

Transcription

Transcription in prokaryotes and eukaryotes
Transcriptional factors and their role
RNA polymerases
Formation of initiation complex
Elongation and termination
Inhibitors of transcription
RNA processing, splicing, polyadenylation, capping
Structure and function of different types of RNA's

Unit-III

Regulation of gene expression

Prokaryotes
Eukaryotes
Viruses
Transcriptional activators and repressors
Role of chromatin in regulating gene expression and gene silencing
Epigenetics and its importance in regulation of gene expression

Unit- IV

Translation

Protein synthesis and genetic code
General characteristics of genetic code
Deciphering of genetic code
Ribosomes as the site of protein synthesis, polysomes
Activation of amino acids
Chain initiation, elongation and termination in prokaryotes and eukaryotes
Control of translation (Role of Guanine nucleotides).
Translational fidelity, Kinetic proof reading
Positive and negative regulation of translation
Inhibitors of protein synthesis



5. Physiology And Clinical Biochemistry

Unit-I Hematology

Composition of blood

Mechanism and regulation of blood coagulation, fibrinolysis

Neuro-muscular system

Mechanism of conduction of nerve impulse along axon, neurotransmitters

Biochemistry of vision

Ultra structure and molecular mechanism of contraction of skeleton and smooth muscles and its regulation

Unit-II

Gastrointestinal physiology

Digestion and absorption

Gastrointestinal disorders

Excretory system

Formation of urine

Normal and abnormal constituents of urine

Unit – III

Introduction to clinical biochemistry

Water and electrolyte balance

Regulation of water and electrolyte balance, role of kidney and hormones

Acid base balance regulation by human body, concept of metabolic and respiratory acidosis and alkalosis

Unit – IV

Principles of diagnostic enzymology

Evaluation of organ function tests

Clinical presentation and diagnosis of renal, hepatic and pancreatic diseases

Cardiac function tests and Thyroid function tests

Diagnostic significance and interpretation of glucose tolerance test

Diagnostic tests for Apo lipoproteins, HDL cholesterol, LDL cholesterol and triglyceride disorders



6. Immunology

Unit-I

Historical perspective, terms associated with immunology, Antigenicity, Features of Antigenicity, super antigens, adjuvants. Cells of immune system: Myeloid, Mononuclear cells, T-Lymphocytes, B-Lymphocytes, NK-Cells
Primary and secondary lymphoid organs: Thymus, Bursa of fabricus, Peyer's Patch, spleen, lymph nodes, mucosal associated and cutaneous associated lymphoid tissues.

Unit - II

Immunoglobulin, structure, classes and subclasses
Multigene organization of Ig gene, variable region gene rearrangements, allelic exclusion, generation of diversity of Ig, Assembly and secretion of Ig, class switch, regulation of Ig transcription.
Humoral and cell mediated immunity: B cell development and activation, BCR, T cell development and activation, TCR.
Regulation of system: complement cascade, Biological function and its regulation. , Complement fixation test.
Introduction to cytokines.

Unit - III

Major histocompatibility complex: different classes, organization and biological function. Transcription regulation of MHC
Hypersensitivity: Type I, II, III, and IV
Autoimmunity and autoimmune diseases
Single organ and systemic autoimmune diseases
Brief introduction to Primary and secondary immunodeficiencies, AIDS
Mechanisms of transplantation. Examples of organ transplantation.
Examples of immune response to Viruses, bacteria, protozoa, fungal and helminthic infection

Unit-IV

Immunoblotting and diagnosis of various important diseases, only infectious and few cancerous types
Techniques – ELISA, RIA, fluorescent IA, agglutination of pathogenic bacteria, Haemagglutination and its inhibition. Affinity, avidity
Immunoelectron microscopy
Enumeration of total T-cell numbers by sRBC, resetting technique
Determination of total number of B-lymphocytes by staining for surface IgG.
Antigen – antibody interaction and its applications.
Total hemolytic assay