

DETAILED SYLLABUS FOR THE POST OF ASSISTANT PROFESSOR IN BIOCHEMISTRY IN MEDICAL EDUCATION - DIRECT RECRUITMENT

(Cat.Nos: 386/2023, 393/2023)

CELL

(5 MARKS)

Cell structure – organelle, cytoskeleton and biomembranes – structure and function
Methods of separation and analysis. Water, pH and buffers, Henderson Hasselbach equation, buffer system, colloids, laws of mass action, surface tension, osmosis, diffusion.

ENZYMES

(5 MARKS)

Enzymes – Classification, mechanism of action, factors affecting enzyme activity
Inhibition and activation of enzyme activity, regulation of enzyme activity, isoenzymes, clinical enzymology – diagnostic and therapeutic applications

CHEMISTRY METABOLISM AND DISORDERS OF AMINOACIDS & PROTEINS (15 MARKS)

Chemistry of amino acids and proteins – classification of amino acids, physical and chemical properties of amino acids.
Structural organization of proteins. Study of protein structure
Structure – Function – relationship of proteins
Special proteins – Plasma proteins, immunoglobulin (techniques of detection, separation and quantitation)
Contractile proteins, structural proteins (collagen, elastin, keratin) and functional proteins
Glycoprotein – Types, functions and formation
Hemoglobin: Structure of hemoglobin, different types of Hb – Transport of oxygen, CO₂-buffering action, Hb variants – hemoglobinopathies and thalassemias, myoglobin.
Heme synthesis and break down, porphyrias and jaundice.
Disorders of hemopoietic system, Ferro kinetic studies, Hemoglobinopathies, immunoglobulinopathies, porphyrias and their lab diagnosis, Coagulation studies.
Inborn errors of Aminoacids and protein metabolism.
Abnormalities in tissue proteins – inherited and protein folding disorders, Prions

CHEMISTRY, METABOLISM AND DISORDERS OF CARBOHYDRATE

(10 MARKS)

Chemistry of carbohydrates – classification and biological importance, chemistry and functions of monosaccharides, disaccharides, and polysaccharides including glycosaminoglycans.

Metabolism of carbohydrates, TCA cycle and biological oxidation (Major and minor metabolic pathways – steps, significance, regulation and interrelationships etc)

CHEMISTRY, METABOLISM AND DISORDERS OF LIPID

(10 MARKS)

Chemistry of lipids – classification and biological importance, chemistry and functions of triglycerides, phospholipids, glycolipids, fatty acids, cholesterol, lipoproteins and prostaglandins.

Metabolic profile of different organs – Liver, skeletal muscle, cardiac muscle, brain, kidney, erythrocytes, adipose tissue, lens and retina.

Metabolic interrelationships & metabolic alterations in starvation and obesity.

Ketosis, atherosclerosis, fatty liver, lysosomal storage disorders, dyslipidemias and their lab diagnosis.

Organic acidurias and their laboratory diagnosis.

Regulation of glucose levels in body fluids-diabetes mellitus, metabolic alterations, complications and biochemical basis of management. Biochemical basis of complications in Diabetes mellitus and secondary degenerative changes associated with diabetes mellitus. Glycogen Storage diseases, galactosemia, reducing substances in urine and aids to laboratory diagnosis of these disorders.

Inborn errors of Carbohydrate metabolism

BIOSTATISTICS

(5 MARKS)

Basic principles of research methodology – Formulation of research hypothesis, study designing, sampling, data analysis and reporting with essential knowledge of statistical analysis.

Population distributions: Populations and samples-Frequency distributions

Basic distribution statistics: Measures of central tendencies, measures of variation, confidence intervals and measures of accuracy and precision

Parametric comparisons of populations : Null hypothesis and statistical significance, two hypothesis, comparison of random variation (precision)-the F test, comparison of means (accuracy or bias)-the t test, ANOVA (one way analysis of variance), testing a sample for outliers using the gap test

Reference intervals and clinical decision limits: Reference population, reference individuals, reference sample group, reference values, reference distribution, reference limits, reference intervals, Protocol for obtaining reference values and establishing health associated reference intervals, selection of reference intervals, pre analytical and analytical variables

Analysis of reference values: Statistical methods, confidence intervals, treatment of outlying observations, partitioning of reference values, transference, presentation of reference intervals, intra individual reference intervals, ROC curve (receiver operating characteristic curve)

MOLECULAR BIOLOGY AND TECHNIQUES

(20 MARKS)

Purines and pyrimidines – their derivatives – nucleosides, nucleotides, nucleic acids.

Metabolism of purines and pyrimidines and disorders

Structure and functions of nucleic acids, organization of DNA in cells

Replication –steps (prokaryotic and eukaryotic), enzymes, fidelity, DNA repair, inhibitors
Transcription – (prokaryotic and eukaryotic) different types of RNA polymerases, post transcriptional modifications, inhibitors

Translation – (prokaryotic and eukaryotic) Steps, factors involved, post translational modifications, inhibitors, protein folding and targeting

Regulation of gene expression, prokaryotic and eukaryotic Epigenetics

Cell cycle, cell to cell adhesion, recognition, signaling, growth factors and cytokines

Apoptosis, Role of mitochondria, mitochondrial DNA, Mitochondrial cytopathies.

Genetic basis of cancer, Oncogenes and oncosuppressor genes, tumour markers

Techniques in molecular biology : Recombinant DNA technology, Southern blotting, RFLP, PCR, Genomic library, DNA finger printing, transgenics, gene knock out, stem cell biology, RNA interference, Gene targeting, DNA micro array, Gene therapy and vectors.

Molecular methods in prenatal & new born screening, Markers of chromosomal aneuploidy in maternal serum (Quad screen) NAT for foetal DNA in maternal circulation.

Immunology –Immunity-Antigen, Antibodies – Immunoglobulins, Antigen-Antibody reactions, complement system, Structure and functions of the Immune system, Immune Response, Immunodeficiency diseases, Hypersensitivity, Autoimmunity,

Immunology of Transplantation and Malignancy, Immuno heamatology, Stem cell biology and applications

Basic principles of Bioinformatics

NUTRITION

(10 MARKS)

Nutrition – Food composition – general nutritional requirements, energy requirements, biological value of proteins, Respiratory quotient, B.M.R., SDA, balanced diet, diet formulation in health and disease, mixed diet, nutritional supplements, food toxins, additives, parenteral nutrition

Digestion and absorption of different nutrients. Disorders of digestion and malabsorption syndromes, dietary fibers

Disorders of nutrition- PEM, obesity, dietary fibers, laboratory diagnosis of nutritional disorders and national nutritional programme

Vitamins – Classification, source active forms, metabolic role, deficiency manifestations, RDA and hypervitaminosis, antivitamins, assays.

Minerals: Macro and micro minerals – Source, requirements, biochemical functions, deficiency and excess

Biochemistry of free radicals and antioxidants

Environmental toxicology, metabolism of xenobiotics.

Muscular contraction, nerve conduction, coagulation of blood

Inborn errors of metabolism:

Inborn errors of carbohydrates, lipids, nucleic acids & mineral metabolism.

CLINICAL BIOCHEMISTRY & BIOCHEMICAL TECHNIQUES

(10 MARKS)

Chromatography, electrophoresis, fluorometry, ultracentrifugation, colorimetry, spectrophotometry, atomic absorption, spectrophotometry, mass spectrometry, nephelometry, turbidimetry, flame photometry, ISE, immunochemistry Radioactive isotopes – their application in clinical diagnosis and biomedical research, measurement of radioactivity, tracer techniques, autoradiography, radioimmunoassay (RIA)

Gastric and pancreatic function tests, Malabsorption syndromes and their lab diagnosis.
Renal function tests, Acute renal failure and Chronic Kidney disease azotemia uremia
CSF in health and disease

LFT, jaundice, alcoholic liver disease and NASH (non alcoholic liver disease)

Clinical enzymology

Lab diagnosis of cardiac dysfunction

Principles of peritoneal and hemodialysis

Lab diagnosis of diseases of lungs and musculoskeletal system

Lab diagnosis of diseases of CNS

Lab diagnosis of AIDS and cancers and other immunological disorders

Life style diseases, Metabolic syndrome and laboratory evaluation

Laboratory evaluation methods of pregnancy related problems and infertility,
Fetoplacental function tests

Metabolic bone disease and gammopathies - lab diagnosis

Composition and analysis of calculi – salivary, renal and biliary system

Automation in clinical chemistry

Quality control programmes – external and internal QCs and QC methods.

Point of care testing (POCT)

ENDOCRINOLOGY

(10 MARKS)

Classification and general mechanism of action of hormones.

Biogenesis, secretion, control, transport and mode of action of following-
hypothalamic peptides, adenohipophyseal and neurohypophyseal hormones, thyroid
parathyroid hormones, calcitonin, pancreatic hormones, adenocortical and medullary
hormones, gonadal hormones, gastrointestinal hormones, opioid peptides,
endorphins, parathormones.

Biochemistry of ovulation, conception, reproduction and contraception,
endocrinological change of pregnancy.

Endocrine interrelationship and their involvement in metabolic regulation.

Assessment of endocrine function and laboratory diagnosis of different
endocrinopathies

Neuromodulators and their mechanism of action, physiological significance.

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.