

# RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

## SYLLABUS FOR SCREENING TEST FOR THE POST OF ASSISTANT PROFESSOR (Broad Speciality) BIO-CHEMISTRY MEDICAL EDUCATION DEPARTMENT

### UNIT I : BIOCHEMISTRY LABORATORY

1. **Measurement of mass** - Basic calculations and preparation of solutions.
2. **Laboratory essentials** – Laboratory glassware, basic equipments, collection and preservation of biological fluids, blood collection- methods, separation, precaution, preservation, storage and transport of blood sample.
3. **Good safe laboratory practice** - Hazards of dangerous chemicals, infection hazards, first-aid and emergency treatment in laboratory.
4. **Instrumentation/techniques** - pH Meter, colorimetry, spectrophotometry, electrophoresis, chromatography, ISE, mass spectrometry, flow cytometry, chemiluminescence, radioimmunoassay, ELISA, autoanalyser, arterial blood gas analyser and clinical applications of the techniques.
5. **Biomedical waste management** - Classification of hazardous waste, waste management process.
6. **Total quality management** - Quality laboratory processes, quality assurance, quality assessment, quality control, quality control charts, six sigma process, accreditation and certification.

### UNIT II : PROTEIN STRUCTURE AND FUNCTION

1. **Amino acids and peptides** - Classification and reactions of amino acids, peptide bond, biologically active peptides, amino acids separation techniques.
2. **Proteins** - Properties, functions, classification, organisation of proteins, sequence analysis of protein structure, protein misfolding, quantitative estimation of proteins, clinical aspects.
3. **Plasma proteins** - Functions and clinical significance of plasma proteins.
4. **Enzymes** - Classification and nomenclature, coenzymes, mode of action of enzymes, catalysis, enzyme kinetics, factors affecting enzyme activity, regulation of enzyme activity, enzyme inhibition, isoenzymes, enzyme assay methods, enzymes in clinical diagnosis, therapeutic enzymes.
5. **Hemoproteins** - Structure, function of Hemoglobin, myoglobin, oxygen dissociation curve, allosteric effects, minor hemoglobins, hemoglobinopathies.

### UNIT III : OVERVIEW OF METABOLISM

1. Metabolic adaptations during fasting, starvation and under well fed state, interconversion of metabolic fuels.
2. Metabolic profile of organs, brain, skeletal muscle, cardiac muscle, adipose tissue, liver, heart, kidney, erythrocytes, metabolic changes during, pregnancy, lactation, trauma & critical illness.

### UNIT IV : BIOENERGETICS AND CARBOHYDRATE METABOLISM

1. **Biologic oxidation, respiratory chain and oxidative phosphorylation** - Role of high energy phosphates, redox potential, enzymes involved in oxidation reduction reactions, electron transport chain, transport systems, Oxidative phosphorylation, clinical aspects.
2. **Citric acid cycle** - Amphibolic role, reactions, energetics and regulation.

- 3. Metabolism of Carbohydrates** - Functions, classification, properties and reactions of carbohydrates, glycosaminoglycans, Dietary carbohydrate metabolism, glucose transporters, glycolysis and the oxidation of pyruvate, metabolism of glycogen, pentose phosphate pathway and other pathways of hexose metabolism, gluconeogenesis and control of blood glucose, Diabetes mellitus and its laboratory diagnosis, metabolism of alcohol, amino sugars, blood group substances, glycosaminoglycans, proteoglycans and glycoproteins, clinical aspects of carbohydrate metabolism .

#### **UNIT V : LIPID METABOLISM**

- 1. Metabolism of Lipids** - Functions, classification, properties of lipids, fatty acids, prostaglandins, eicosanoids. Dietary lipid metabolism, oxidation & biosynthesis of fatty acids, diseases associated with impaired fatty acid oxidation, phospholipid, glycosphingolipid and eicosanoid metabolism, ketone body and acylglycerol metabolism, lipid transport and storage, metabolism of adipose tissue, fatty liver, lipotropic factors, cholesterol metabolism, role of dyslipidemia in atherosclerosis and cardiac biomarkers, clinical aspects of lipid metabolism.

#### **UNIT VI : PROTEIN AND AMINO ACID METABOLISM**

- 1. Amino acid metabolism** - Dietary protein metabolism , catabolism of proteins and amino acid nitrogen, metabolism of ammonia, urea cycle and related disorders, catabolism of carbon skeletons of amino acids, conversion of amino acids to specialised products, synthesis of nutritionally non essential amino acids. metabolic defects in amino acid metabolism.
- 2. Heme synthesis and breakdown** - Structure, biosynthesis and degradation of heme, porphyrias, bilirubin metabolism, jaundice.

#### **UNIT VII : NUCLEOTIDE METABOLISM**

- 1. Metabolism of nucleotides** - Biosynthesis, degradation and regulation of purine and pyrimidine nucleotides, disorders of purine and pyrimidine metabolism.

#### **UNIT VIII : NUTRITION**

- 1. Energy metabolism and nutrition** - Energy requirements in humans, importance of dietary fats, carbohydrates and proteins, calorific value of foods, respiratory quotient, Basal metabolic rate (BMR), Specific dynamic action (SDA), dietary fibers, balanced diet, glycemic index, enteral and Total parenteral nutrition, Nutritional Disorders- Protein energy malnutrition (PEM), obesity, atherosclerosis.
- 2. Electrolytes, water balance and body fluids** - Water Balance, sodium, potassium, chloride, magnesium, clinical aspects .
- 3. Mineral metabolism** - Major elements and trace elements, clinical conditions resulting from deficiency or excess of minerals.
- 4. Vitamins** - Sources, biochemical functions, RDA, clinical features, role in health and disease.

#### **UNIT IX : HORMONES**

1. Classification of hormones, mechanism of action of endocrine hormones.
2. Production, transport and storage of hormones, clinical aspects.

#### **UNIT X : STRUCTURE, FUNCTION AND REPLICATION OF INFORMATIONAL MACROMOLECULES**

- 1. Nucleotides and nucleic acids** - Composition of nucleotides, synthetic nucleotides, Structure , functions and higher organisation of DNA, structure, types and functions of RNA.

2. **Molecular genetics, Recombinant technology and genomic technology**-- Principles of heredity, laws and patterns of inheritance, basic procedures and techniques involved in recombinant DNA technology and genetic engineering, applications of recombinant technology, DNA hybridization techniques, DNA sequencing.
3. **DNA organisation, replication and repair** – chromatin, higher order organisation, chromosomes, human mitochondrial DNA, cell cycle, DNA recombination, mechanism of replication in prokaryotes and eukaryotes, inhibitors, DNA repair mechanisms, diseases associated with defective repair mechanisms.
4. **RNA synthesis** - Mechanism of synthesis in prokaryotes and eukaryotes, inhibitors, modifications, reverse transcription.
5. **Protein synthesis and the genetic code**- Characteristics of genetic code, mutations, Wobble hypothesis, mechanism of protein synthesis in prokaryotes and eukaryotes, inhibitors , post-translational processing.
6. **Regulation of gene expression**- Regulation of gene expression in prokaryotes and eukaryotes, gene amplification, epigenetic modifications, motifs.

#### **UNIT XI : INBORN ERROR OF METABOLISM**

1. Molecular basis of genetic disease, consequences of genetic disease, diagnosis and treatment of inborn error of metabolism.
2. Prenatal diagnosis, genetic counselling.

#### **UNIT XII : ORGAN FUNCTION TESTS**

1. Liver, renal, gastric, adrenal, thyroid, pancreatic function tests , clinical aspects.

#### **UNIT XIII : SPECIAL TOPICS A**

1. **The extracellular matrix (ECM)** - Structural and functional properties of collagen, elastin, and other important proteins of ECM, bone and cartilage, associated diseases of ECM.
2. **Immunochemistry** – Antigen, immune response, antibody diversity, structure , classes and functions of immunoglobulins, transposition of genes, monoclonal antibodies, Major histocompatibility complex (MHC), complement system, vaccines, Paraproteinemias.
3. **Muscle biochemistry** - Protein composition of Skeletal muscle, Mechanism of Muscle Contraction, Source of Energy in Muscle Contraction, Muscle Disorders.
4. **Metabolism of xenobiotics** - Phases of xenobiotic metabolism, effects of xenobiotics.
5. **Body fluids**- Milk, colostrum, cerebrospinal fluid, amniotic fluid, ascitic fluid, pleural fluid, aqueous humor.
6. **Environmental biochemistry** - Air pollutants, toxic substances in food stuffs, neurotoxins, heavy metal poisoning, occupational and industrial hazards, corrosives and irritants, effect of extreme climate conditions on health, diseases associated with environmental pollutants.
7. **Radioisotopes in medicine**- Use of radioisotopes in diagnosis, treatment and research.

#### **UNIT XIV : SPECIAL TOPICS B**

1. **Biochemistry of cancer**- Growth characteristics of cancers cells, carcinogenesis, causes of genetic damage, oncogenes, tumor suppressor genes, apoptosis, biochemical basis of cancer therapy, tumour markers, anticancer drugs, epigenetic mechanisms involved in cancer, clinical aspects.
2. **Biochemistry of AIDS** - Laboratory diagnosis of AIDS.
3. **Biochemistry of aging**- Theories of aging
4. **Free radicals and antioxidants**– Sources of oxygen radicals in the body, free radical scavenger systems, antioxidants as prooxidants, lipid peroxidation, free radicals and diseases.
5. **Bioinformatics and computational biology**- Genomics, human genome project, bioinformatic and genomic resources, identification of proteins.

6. **Evidence based laboratory medicine (EBM)** - Concept, definition and objectives of EBM, applying principles of EBM in routine practice.
7. **Acid base balance** - Acids and bases, Henderson-Hasselbalch equation, Buffer systems, regulation of pH, Anion gap, disturbances in acid base balance, clinical aspects.

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Pattern of Question Papers:

1. Objective Type Paper
2. Maximum Marks : 180
3. Number of Questions : 180
4. Duration of Paper : Three Hours
5. All Questions carry equal marks
6. There will be Negative Marking

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