

OUTLINE OF BIOCHEMISTRY SYLLABUS FOR ENTRANCE EXAMINATION – June 2022

Unit I

Classification of carbohydrates, stereoisomerism and optical isomerism of sugars, anomeric forms and mutarotation. Structure, function and biological importance of carbohydrate derivatives such as chitin, pectin, heparin, proteoglycans, sialic acid, blood group polysaccharides, bacterial cell wall polysaccharides and glycoproteins. Different types of classification of amino acids and structure of amino acids. Physical and chemical properties of amino acids. Protein- classification. Denaturation and renaturation of proteins. Structure of peptide bonds. Chemical synthesis of polypeptides- solid phase peptide synthesis. Determination of amino acid sequence of a polypeptide chain, specific chemical and enzymatic cleavage of polypeptide chain. Biologically important peptides- structure and functions. Protein structure- primary, secondary, tertiary and structures of proteins. Forces stabilizing the secondary, tertiary and quaternary structure of proteins. Composition of RNA and DNA. Structure of purine and pyrimidines, nucleosides and nucleotides. Physical and chemical properties of nucleic acids. Structure and role of different types of DNA – A, B and Z and RNA. Fatty acids – Classification, nomenclature, structure and properties. Classification, structure and function of lipids, prostaglandins. Chemical properties of fatty acids, phospholipids isoprenoids sterols and steroids. Biological significance of fats.

Unit II

pH, pOH, Henderson – Hesselbalch equation, buffers, pH of body fluids, buffers in body fluids, red blood cells and tissues. Measurement of pH by various methods. General principles of chromatography. Principles, operational procedure and applications of Column chromatography, Thin layer chromatography (TLC), Adsorption chromatography, Partition chromatography: Liquid-liquid chromatography, Countercurrent chromatography. Principles, operational procedure and applications of Gas-liquid chromatography (GLC) Ion-exchange chromatography Exclusion (permeation) chromatography Affinity chromatography High performance (pressure) liquid chromatography (HPLC). Basic principles of centrifugation. Differential, density gradient, isopycnic and equilibrium centrifugation. Preparative and analytical ultracentrifugation techniques. Determination of molecular weight by centrifugation method. Basic principles of electromagnetic radiation. Beer – Lambert law, Principles, instrumentation and applications of spectrophotometry, spectrofluorimetry, flame photometry and atomic absorption spectrophotometry. Atomic structure, radiation, types of radioactive decay, half life, units of radio activity. Detection and measurement of radioactivity – methods based upon ionization (GM counter), methods based upon excitation (Scintillation counter). Autoradiography and isotope dilution techniques. Applications of radioisotopes in the elucidation of metabolic pathways, clinical scanning and radio dating. Biological hazards of radiation and safety measures in handling radio isotopes.

UNIT III

Introduction, general characteristics, nomenclature, IUB system of enzyme classification and enzyme units. Exoenzymes, endoenzymes, zymogens, isoenzymes and multienzyme complex, coenzymes, metalloenzymes and metal activated enzymes. Enzyme specificity, active site, lock and key model, induced fit model, kinetics of single substrate enzyme catalyzed reaction. Michaelis Menten equation, transformation of Michaelis Menten – Lineweaver Burk plot and Eadie Hofstee plot. Factors affecting enzyme action – pH, temperature, activators and cofactors. Enzyme inhibition – competitive, non – competitive, uncompetitive and irreversible inhibition (derivation not needed). Regulation of enzymes – allosteric interactions and product inhibition. Enzyme extraction, isolation – by various methods. Immobilized enzymes- introduction, method of immobilization, applications.

UNIT IV

Role of high energy compounds – Electron transport chain - components and reactions of ETC. Role of ETC – Oxidative phosphorylation – Chemi osmotic hypothesis. P/O ratio, uncouplers of oxidative phosphorylation Glucose and Glycogen metabolism and Photosynthesis – light and dark reactions. Lipid metabolism – Introduction. Fate of absorbed dietary lipids, Oxidation of fatty acids – Biosynthesis of saturated fatty acids and unsaturated fatty acids. Biosynthesis and degradation of triacyl glycerol and phospholipids. Biosynthesis and degradation of cholesterol. Protein metabolism – Introduction. Fate of dietary proteins, catabolism of amino acids – transamination, oxidative and non-oxidative deamination, decarboxylation – urea cycle and its regulation. Biosynthesis of creatinine. Interrelationship of carbohydrates, protein and fat metabolism – role of acetyl CoA and TCA cycle in interrelationship. Inter conversion of major food stuffs.

Introduction, fate of dietary nucleic acids, catabolism of purine and biosynthesis of purine nucleotides – Denovo synthesis and salvage pathways, regulation of purine biosynthesis. Catabolism of pyrimidines and biosynthesis of pyrimidine nucleotides - Denovo synthesis and salvage pathways, regulation of pyrimidine synthesis.

UNIT V

DNA as the vehicle of inheritance – experimental evidence of DNA replication in prokaryotes and eukaryotes. Repair of DNA and types of damages. Mutation – types and causes. Transcription and post transcriptional modification in prokaryotes. Post transcriptional modifications of mRNA, rRNA and tRNA. Inhibitors of transcription. Genetic code – Basic features of genetic code. Deciphering of genetic code. Wobble hypothesis. Protein biosynthesis- activation of amino acids, initiation, elongation and termination of translation in prokaryotes. Post translational modifications. Inhibitors of translation. Regulation of gene expression in prokaryotes, Operon concept – Positive and negative regulation of lac operon.

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Unit VI

Introduction and definition of food and nutrition. Basic food groups- energy yielding, body building and protective foods. Basic concepts of energy expenditure, unit of energy, measurement of food stuffs by Bomb calorimeter. Basal metabolism - definition, BMR, factors affecting BMR. Calorific value of proteins, carbohydrates and fats, RQ of foods. SDA- definition and determination. Nutritive value and physiological role of carbohydrates and lipids. Nutritive value of proteins, essential amino acids, essential fatty acids, biological value of animal and plant proteins. Evaluation of proteins by nitrogen balance method - DC, BV, NPU and NAP of animal and plant proteins, protein sparing action of carbohydrates. Protein malnutrition (Kwashiorkor) and under nutrition (Marasmus), their preventive and curative measures. Composition of balanced diet and RDA for infants, children, adolescents, adult male and female, pregnant, lactating women and old age. Diet for disease states- Diabetes mellitus, Hyper tension, Atherosclerosis, Jaundice, Peptic ulcer Source, dietary allowance, biochemical role, physiological role and deficiency states of vitamins and minerals.

UNIT VII

Disorders of carbohydrate, protein and lipid metabolism - diabetes, atherosclerosis and inborn errors of metabolisms. **Liver Function Tests** - Metabolism of bilirubin, Jaundice - types, clinical features and test based on bile pigments level in blood and urine, Plasma changes, PT, Differentiation of three types of jaundice. **Gastric Function Tests** - Collection of gastric contents, examination of gastric residium, FTM, stimulation tests, tubeless gastric analysis **Renal Function Tests** - Clearance tests - Urea, Creatinine, Inulin, PAH test, concentration and dilution test. **Tumor Markers** - Definition, markers produced by various tissues, classification and clinical applications. **Clinical Enzymology** - Definition of functional and non-functional plasma enzymes. Isozymes and diagnostic tests, enzyme patterns in acute pancreatitis, liver damage, bone disorders, myocardial infarction and muscle wasting.

UNIT VIII

Immunity and its types. Innate immunity, determinants of innate immunity, peptides, Acquired immunity, active and passive immunity. Commonly used toxoid vaccines, killed vaccines, live attenuated vaccines, bacterial polysaccharide vaccines. **Immunity** - Humoral and Cellular immunity, Immunoglobins - structure and function, types of antibodies **Antigens** - Nature, Immunogens, haptens. Cells involved in antibody formation, differentiation of lymphocyte, clonal selection theory, co-operation of T-cell with B-cell, secretion of antibody, genetic basis of antibody diversity. Antigen-antibody reactions in vivo and in vitro. Complement fixation reaction, monoclonal antibody - preparation and application in biology. Immunological tolerances and immunosuppression, hypersensitivity and allergy, histocompatibility antigens - elementary knowledge, auto-immune diseases, transplantation immunology

UNIT IX

Muscles-Types of muscles, structure and their functions: myofilamentation and contraction and relaxation of skeletal muscles. **Respiratory system**: Outline of various components of respiratory system- organs involved in respiration and their structure, types of respiration- external and internal, transport of respiratory gases by the blood, gaseous exchange in lungs, at tissue level, mechanism of breathing. **Digestive system**: Structure and function of different components of digestive systems, digestion of carbohydrates, lipids and proteins, Mechanism of HCl formation in stomach, role of various enzymes and hormones involved in digestive processes, absorption of monosaccharides, aminoacids, fatty acids, role of bile salt in digestion and absorption, structure of microvilli and its role in absorption **Excretory system**: Overall design of urinary system: Kidney structure and its organization. Nephron- structure and its role, Mechanism of urine formation - function of glomerular filtration, GFR, selective reabsorption, active and passive transport of various substances and secretion. **Circulatory system**: Structure and function of different components of circulatory system- arterial and venous blood vessels, types of circulation- pulmonary and systemic. Blood composition and function, types of blood cells, morphology and function. Blood groups - ABO and Rhesus system. Composition and function of lymph and lymphatic system. Structure of heart, cardiac cycle **Brief outline of nervous system** - Brain (Parts and ventricles), Spinal cord, nerve fibres, synapses, chemical and electrical synapses, nerve impulses, action potential and neurotransmitters

UNIT X

Biotechnology- scope, features and importance of biotechnology, Recombinant DNA technology- role of restriction endonucleases, plasmid and cosmid cloning vectors. Brief outline of molecular cloning- genomic DNA libraries, cDNA, PCR, applications of recombinant DNA technology.

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SAMPLE QUESTION PAPER

M.SC. MEDICAL BIOCHEMISTRY ENTRANCE EXAMINATION

Select the MOST appropriate answer

Total Number of Questions 50

Time: 1.30hours

1. Fumarase belongs to
 - a. Lyases
 - b. Hydrolase
 - c. Ligases
 - d. Dehydrogenases

2. If on addition of ammonium sulfate, the protein of your interest gets precipitated, it is called as
 - a. Salting out
 - b. Salting in
 - c. Salting bridging
 - d. Desalting

3. In lac operon, which of the following happens
 - (i). Inducer binds to the promoter
 - (ii). Repressor binds to the promoter
 - (iii). Inducer binds to repressor
 - (iv). Repressor binds to operator
 - a. (i) and (ii)
 - b. (ii) and (iii)
 - c. (iii) and (iv)
 - d. (iv) and (i)

4. Labelled bacteriophages were used by
 - A Messlson and Stahl
 - b. Hershey and Chase
 - c. Watson and Crick
 - d. Fredrick Griffith

5. Centromeres are
 - a. proteins involved in cell division
 - b. sequences of DNA present at the end of the chromosomes
 - c. DNA sequences that get attached to the proteins in mitotic spindle
 - d. RNA present in centrosomes

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