

SYLLABUS – MEDICAL CHEMISTRY

(GEN. MED.)

Nature of chemistry, matter, mass and weight, substances and mixtures, atoms and molecules, isotopes, atomic number, mass number, Bohr's theory of the atom, elements and compounds, periodic table, types of bonding, naming of inorganic compounds; principles of English and Latin nomenclature of inorganic compounds.

Unique properties of water, aqueous solutions, electrolytes and nonelectrolytes, acids and bases; Arrhenius theory, Brønsted-Lowry theory, Lewis theory. Autoionization of water, ion product of water, pH, strengths of acids and bases, salts hydrolysis, buffer solutions, Henderson-Hasselbach equation, acid-base titrations, acid-base indicators.

Heat of reaction, exo- and endothermic processes. Reaction rate, collision theory, transition state theory, potential energy diagrams, reaction order, molecularity, catalysis, chemical equilibrium, Le Chatelier's principle.

Redox reactions, oxidation numbers, displacement reactions, activity series, disproportionation, redox reactions involving oxoanions, balancing of redox equations, oxidizing and reducing agents, equivalent, colloid solutions, adsorption.

Main group elements (IA-VIIA), transition elements, complex and coordination compounds, biological and toxicol. properties of elements, diseases related to metals, oxygen radicals. Detoxification with chelating agents.

Special properties of carbon, hydrocarbons, alkanes, alkenes and alkynes series, aromatic hydrocarbons, reactions of hydrocarbons, alkyl - halides, derivatives of hydrocarbons - alcohols, phenols, quinones, ethers, oxo-derivatives of hydrocarbons - aldehydes, ketones, ethers, carboxylic acids (carboxylic acid derivatives, substituted carboxylic acids), basic reactions of oxygen-group containing compounds; biologically important compounds.

Nomenclature of amines, physical properties and reactions of amines, biologically important amines, diamines and polyamines, nitro compounds - reaction and properties, diazo-, azo-compounds. Urea, barbituric acid, barbiturates. PABA and local anesthetics.

Nomenclature of thiols and sulfides, sulfonic acids. Organic phosphorus and arsenic compounds. Heterocyclic compounds - nomenclature, nonaromatic heterocycles, aromatic heterocycles, five and six- membered ring containing heterocycles with one and more heteroatom(s), Heterocycle derivatives of biochemical and medical importance, drugs.

Carbohydrates (saccharides): general description, projection systems in the carbohydrates, isomerism of saccharides, monosaccharides, chemical properties of sugars. Disaccharides (reducing and non reducing), polysaccharides (homo- and heteropolysaccharides). Biologically important mono-, di- and polysaccharides.

Lipids in living systems: simple and complex lipids; fatty acids, fats, oils, waxes; phospholipids, sphingolipids, glycolipids, lipoproteins, isoprenoids, terpenes. Steroids - anabolics, sex hormones, bile salts; prostaglandins and leukotriens; examples of disorder in lipid synthesis and degradation. Lipid bilayer - biological membranes.

Amino acids and peptides - structure and symbols of individual amino acids, chirality and configuration, chemical and biological properties, isoelectric point, acid-base properties, isolation and fractionation techniques, peptide bond, peptides, oligopeptides and polypeptides, amino acid composition and sequence, biologically important peptides and polypeptides.

Proteins - biomedical importance, size of protein molecules, four levels of protein structure (primary, secondary, tertiary, quaternary), architecture of proteins, denaturation, fibrous and globular proteins (examples), structure and function, classification of proteins according to biol. function; myoglobin and hemoglobin - molecular principles of biological effect; blood plasma proteins and diagnostic application, isolation and purification of proteins.

Nucleic acids, purine and pyrimidine bases, nucleosides, nucleotides, polynucleotides and their conformation, complementary bases, biologically important nucleotides, DNA, RNA, structure, genetic code, transmission of the genetic code, major types of RNA.

Vitamins – general properties, classes structure, chemical and biological properties. Water soluble vitamins. Lipid soluble vitamins. Vitamins as antioxidants. Vitamins as coenzymes.

Enzymes - definition, history, structure, general catalytic properties, active site, substrate binding, classification and nomenclature, activation of enzymes, optimal reaction conditions, isoenzymes (isozymes), allosteric enzymes, inhibition of enz. activity. Cofactors, coenzymes (transporting H, transporting group of atoms), enzyme kinetics (Michaelis-Menten equation, Michaelis constant K_M , Lineweaver-Burk plots, regulation of enz. activity, enzymes in clinical diagnosis, enzymes in industry, nonenzymatic catalysis (catalytic RNA - ribozymes).

Basic laboratory methodology, volumetric analytical methods, acid-base titrations, acid-base indicators, redox titrations, principle and applications of spectrophotometry, preparation of complex compounds, principles and applications of chromatography methods, basic analytical reactions of biologically important compounds.