

YVUCET - 2015: SYLLABUS
TEST - 01: ADVANCED LIFE SCIENCES
COMMON ENTRANCE EXAMINATION – 2015 FOR ADMISSION INTO
M.Sc. BIOCHEMISTRY/BIOTECHNOLOGY/GENETICS & GENOMICS/
MICROBIOLOGY

Section – A

Structure and reactivity: Structural theory of organic chemistry – Principles underlining chemical bonding – covalent bonds and covalent character of carbon compounds single and multiple bonds. Types of organic reagents and reactions, fission of electrophilic mesophilic and free radical reagents. Explanation of substitution, addition and elimination reactions with examples. Bond polarisation, Electromeric, Inductive, conjugative, Hyper conjugative and mesomeric effects.

Nomenclature: IUPAC and CA systems of names based on functional substitutive, additive, conjugative and radio – functional characteristics.

Alkanes: Isomerism including conformational Isomerism, chemical reactivity free radical halogenations (mechanism).

Alkenes: Preparation, Dehydrohalogenation of alkyl halides and dehydration of alcohols (Mechanism of E1 and E2 eliminations) Mechanism of electrophilic addition reactions.

Alkynes: Preparation and properties, mechanism of electrophilic addition, Acidity of acetylenic hydrogens, nucleophilic addition of acetylide.

Arenes: Coal, source of aromatic compounds, structure of benzene, concept of aromaticity – mechanism of electrophilic substitution reactions effects. Alkyl benzenes, Naphthalene, Anthracene.

Hydroxyl compounds: Preparation of alcohols and phenols, Physical properties and hydrogen bonding, chemical properties, comparison of reactivity of alcohols and phenols. Polyhydroxy compounds: Ethylene glycol and glycerol.

Ethers: Preparation, Properties, Properties, functional isomerism – cyclic ethers.

Aldehydes and Ketones: Preparation and properties, mechanism of nucleophilic addition, alcohol condensation, Cannizzaro, benzoin condensation Grignard reaction condensation, Perkin reaction, addition of NaHSO_3 and HCN differences in the reactivity of aliphatic and aromatic aldehydes and ketones.

Monocarboxylic acids: Preparation, properties, acidic nature of carboxylic group, mechanism of esterification and ester hydrolysis, preparation and reactivity of acid chlorides, acid anhydrides, esters and amides.

Section - B

Carbohydrates: Classification, monosaccharides, D and L designation, open chain and cyclic structures, epimers and anomers, mutarotation, reactions of carbohydrates. Structure and biological importance of disaccharides, structural polysaccharides and storage polysaccharides.

Proteins and Amino Acids: Classification, structure, stereochemistry, chemical reactions of amino acids. pKa values. Peptide bond -nature and conformation. Proteins: Classification based on solubility, shape and function. General properties of proteins, denaturation and renaturation of proteins. Structural organization of proteins-primary, secondary, tertiary and quaternary structures, forces stabilizing the structure of protein.

Lipids: Classification, saturated and unsaturated fatty acids, structure and properties of fats and oils (acid, saponification and iodine values, rancidity). General properties and structures of phospholipids, sphingolipids and cholesterol. Prostaglandins-structure and biological role of PGD₂, PGE₂ and PGF₂ α .

Nucleic acids: Nature, Structure of purines and pyrimidines, nucleosides, nucleotides. Stability and formation of phosphodiester linkages. Effect of acids, alkali and nucleases on DNA and RNA. Structure of Nucleic acids-Watson-Crick DNA double helix structure, Types of RNA and DNA.

Enzymes: Nomenclature and classification of enzymes. Enzyme specificity. Active site. Principles of energy of activation, transition state. Interaction between enzyme and substrate-lock and key, induced fit models. Definition of holo-enzyme, apo-enzyme, coenzyme, cofactor. Fundamentals of enzyme assay, enzyme units.

Metabolism: Glycolytic pathway, energy yield. Citric acid cycle, regulation, energy yield, Glycogenolysis and glycogenesis. Pentose phosphate pathway. Gluconeogenesis. Photosynthesis- Light and Dark reactions, Calvin cycle, C₄ Pathway. General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Urea cycle. Inborn errors of aromatic and branched chain amino acid metabolism.

Microbiology: Introduction to brief history of microbiology. Classification of microorganisms- prokaryotic and eukaryotic microorganisms. Isolation and cultivation of bacteria. Selective media and enriched media. Bacterial growth curve and kinetics of growth. Batch, continuous and synchronous cultures. Nutritional groups of microorganisms. Gram's staining- Gram positive and Gram negative bacteria, motility and sporulation. Sterilization and disinfection techniques Principles and methods of sterilization. Microorganisms of industrial importance.

Immunology: Organs and cells of immune system. Innate and acquired immunity. Cell mediated and humoral immunity. Classification of immunoglobulins, structure of IgG. Epitopes / antigenic determinants. Concept of haptens. Adjuvants. Theories of antibody formation- clonal selection theory. Monoclonal antibodies.

Molecular Biology: DNA replication- models of replication, Meselson-Stahl's experimental proof for semi-conservative model. DNA polymerases I, II and III of *E.coli*, helicase, topoisomerases, primase, ligase. Bidirectional replication model. Okazaki fragments, leading and lagging strands of DNA synthesis. Inhibitors of DNA replication. Transcription - RNA synthesis, RNA polymerases. Promoters, Initiation- sigma factors and their recognition sites. Termination- rho dependent and rho independent. post-transcriptional modifications. Inhibitors of RNA synthesis. Translation - Ribosome structure. Initiation, elongation and termination of protein synthesis. Post- translational modifications, signal hypothesis. Inhibitors of protein synthesis.

Section – C

Mendelian principles of inheritance; non - mendelian inheritance. Sex determination, Sex linked inheritance. Meiosis, chromosomal basis of inheritance, Linkage and crossing over with reference to 2 point and 3- point cross, chromosome maps (outlines). Inheritance of Blood groups. General account of mutations and their significance, physical and chemical mutagens. General account of polyploidy, Somatic hybrids and cybrids, chromosomal aberrance and human diseases.

Elementary idea of prokaryotic and eukaryotic cell. Ultra structure of animal cell. Structure and function of cell organelles. Nutrition, types of nutrition in animals, autotrophic, heterotrophic. Definition of digestion and types of digestion - extra and intracellular. Respiration; Brief accounts of types of respiratory mechanism, respiratory pigments, gas transport with reference to mammals. Circulation; composition and functions of blood, Coagulation of blood. Mammalian heart – structure and function, blood pressure and its role and exchange of materials in capillaries. Osmoregulation; aquatic and terrestrial animals. Excretion: classification of animals based on excretory end products. Formation of nitrogen waste, Kidney structure and function. Nerve transmission: Structure of neuron, action potential, production and propagation of nerve impulse and synaptic transmission.

Endocrinology: Classification of hormones. Outlines of chemistry, physiological role and disorders of hormones. Gastrointestinal hormones. Endocrine control of mammalian reproduction - Male and female hormones. Spermatogenesis, Oogenesis and Fertilization.

Section - D

Mendelian and Non-mendelian inheritance, Modern concept of gene, Fine structure of gene, gene interactions, gene transfer, operon concept, muton, recon, cistron. DNA repair mechanisms. General concepts of genetic engineering and biotechnology, Recombinant DNA technology, Gene cloning, Gene transfer, Transformation and selection of recombinants. Blotting techniques, RFLP, RAPD, PCR and its applications in biotechnology. Plant

Biotechnology - Invitro methods – culture media, Micropropagation, Embyo culture. Application of biotechnology in relation to agriculture, medicine and human welfare.

Salient features of algae, fungi, bryophytes, pteridophytes, angiosperms and gymnosperms. Biological Macromolecules- Carbohydrates, Lipids, Aminoacids-Proteins, Enzymes, Nucleic acids, Porphyrins and vitamins. An outline of enzyme action and enzyme kinetics. Elementary account of bioenergetics and entropy, Concept of free energy and thermodynamic principles. Photosynthesis – ultra structure of chloroplasts, photo phosphorylation, diversity in carbon reduction pathways – C3, C4 and CAM, photorespiration.

Plant Physiology and Ecology: Glycolysis, krebs cycle, oxidative phosphorylation, anerobic respiration and fermentation, Nitrogen metabolism – biological nitrogen fixation, nitrate reduction, aminoacids, protein synthesis. Elementary stress physiology, concepts of water potential and physiology of stomatal and transpiration. Growth and development – patterns of growth, phyto hormones, auxins, gibberellic acid, cytokinins, growth inhibitors, phytochromes. Physiology of fruit ripening and storage. Concepts of Ecology- definitions, Cycles of elements, food pyramids, Ecosystem.