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DETAILED SYLLABUS

FOR

DISTANCE EDUCATION

M.Sc. (Biochemistry)

(SEMESTER SYSTEM)

M.Sc.Biochemistry

COURSE TITLE: B.Sc. (BIO CHEMISTRY)
DURATION : 6 SEMESTERS
MODE : SEMESTERS

FIRST SEMESTER

COURSE TITLE	Paper Code	MARKS				
		THEORY		PRACTICAL		TOTAL
		INTERNAL	EXTERNAL	INTERNAL	EXTERNAL	
Biomolecules-1	Paper I	40	60			100
Biomolecules – 2	Paper II	40	60			100
Lab Course-1	Paper III	40	60			100

SECOND SEMESTER

COURSE TITLE	Paper Code	MARKS				
		THEORY		PRACTICAL		TOTAL
		INTERNAL	EXTERNAL	INTERNAL	EXTERNAL	
Enzymology-1	Paper IV	40	60			100
Enzymology-2	Paper V	40	60			100
Lab Course-2	Paper VI	40	60			100

B.Sc. - I (Biochemistry) Semester-I
Paper – I (Biomolecules-1)
SECTION -A

Water and Buffers: Structure, hydrogen bonding, solvent properties, and ionization. Fitness of the aqueous environment for living organisms. Weak acids and bases, pH, buffers, Henderson-Hasselbalch equation and physiological buffers.

Carbohydrates: Definition and classification. Monosaccharides: Structure, occurrence and biological importance of common monosaccharides; Stereoisomerism of sugars; Mutarotation; Reactions: oxidation, reduction, periodic acid oxidation, reactions with hydrazine, hydroxylamine, action of acids & alkalies, formation of glycosides and esters. Important derivatives of monosaccharides: deoxy sugars and amino sugars. Structure, occurrence and functions of important di- and trisaccharides. Polysaccharides: Structure, occurrence and biological importance of starch, glycogen, cellulose, chitin, pectins & proteoglycans.

SECTION – B

Lipids: Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids. Triacylglycerols: physical and chemical properties. Characterization of fats: Saponification values, iodine value, rancidity of fats, Reichert-Meissel number, peroxide value. Reactions of glycerol. Biological significance of fats. Structure & biological functions of glycerophospholipids (lecithin, cephalin, phosphatidylserine, phosphatidylinositol, plasmalogens), sphingolipids and glycolipids (cerebrosides and gangliosides). Structure, properties and functions of isoprenoids (β-carotene, α-carotene), bile acids, sterols and prostaglandins.

B.Sc. - I (Biochemistry) Semester-I

Paper – II (Biomolecules - 2)
SECTION – A

Proteins: Introduction, classification based on solubility, shape, composition and functions. Amino acids: common structural features, stereoisomerism and RS system of designating optical isomers, classification and structures of standard amino acids as Zwitter ion in aqueous solutions, physical and chemical properties, titration of amino acids, essential amino acids and non protein amino acids. Peptides: structure of peptide bond, Merrifield solid-phase synthesis of polypeptides. Determination of the amino acid sequence of a polypeptide chain. Protein structure: levels of structure in protein architecture (Primary, secondary, tertiary and quaternary structures of proteins) and forces stabilizing these structures. . Denaturation and renaturation of proteins. Salting-in and salting-out of proteins.

SECTION – B

Nucleic acids: Structures of purines pyrimidines,nucleosides and nucleotides in RNA and DNA, generalized structural plan of nucleic acids, nomenclature used in writing structure of nucleic acids, features of DNA double helix and forces stabilizing DNA double helix. A, B and Z-DNAs. Chargaffs rules. Denaturation (T_m and buoyant density and their relationship with G-C content in DNA) and annealing of DNA. Structure and roles of different types of RNA. Central dogma of molecular biology.

Porphyrins: Porphyrin nucleus and classification of porphyrins. Important metalloporphyrins occurring in nature. Bile pigments- chemical nature and their physiological significance.

B.Sc. –I (Biochemistry) Semester-I
Paper- III (Lab Course-1)

Time allowed: 3 hours (one session)

1. Preparation of normal, molar and percent solutions.
2. Preparation of buffer solutions and determination of their pH.
3. Qualitative tests for Carbohydrates
4. Qualitative tests for lipids
5. Determination of acid value
6. Determination of saponification value
7. Qualitative tests for amino acids and Proteins
8. Preparation of casein from milk and determination of its isoelectric point.
9. Verification of Beer- Lambert's Law.

B.Sc. - I (Biochemistry) Semester-II

Paper – IV (Enzymology-1)

SECTION - A

Enzymes: Historical perspectives, general characteristics, nomenclature & classification, significance of numbering system, holoenzyme, apoenzyme, coenzymes, cofactors, activators, inhibitors, active site, metallo-enzymes, isoenzymes, monomeric enzymes, oligomeric enzymes, multifunctional enzyme and multi-enzyme complexes. Enzyme specificity. Measurement and expression of enzyme activity: Enzyme assay, enzyme units, enzyme turn over number and specific activity.

Role of cofactors in enzyme catalysis: NAD/NADP, FMN/FAD, coenzyme A, biocytin, Vitamin B_{12} Coenzyme, lipoamide, TPP, pyridoxal phosphate, tetrahydrofolate and metal ions with special emphasis on coenzyme functions

SECTION - B

Enzyme catalysis: Reaction co-ordinate diagram, transition state, Acid-base catalysis, covalent catalysis, proximity and orientation effects, strain and distortion theory. Mechanism of action of chymotrypsin, carboxypeptidase,and ribonuclease.

Enzyme Purification: Methods of isolation of enzymes, purification of enzymes - ammonium sulfate precipitation, molecular-sieving, ,ion-exchange chromatography, affinity chromatography, criteria of homogeneity and determination of molecular weight of enzyme.

BSc. - I (Biochemistry) Semester-II
Paper – V (Enzymology-2)

SECTION-A

Enzyme Kinetics: Factors affecting enzyme activity- enzyme concentration, substrate concentration, pH and temperature. Derivation of Michaelis - Menten equation for uni-substrate reactions. K_m and its significance. Lineweaver-Burk plot. Importance of K_{cat}/K_m. Bi-substrate reactions- brief introduction of sequential and ping-pong mechanisms with examples. Reversible (competitive, non-competitive and uncompetitive inhibitions) and irreversible inhibition. Determination of K_m & V_{max} in the presence and absence of inhibitor.

SECTION-B

Enzyme regulation: Feed back inhibition, Allosteric enzymes. Covalently modulated enzymes. Zymogen activation.

Immobilized enzymes: Advantages, methods of immobilization - Adsorption, ionic binding, covalent coupling, cross-linking, entrapment, microencapsulation etc. Applications of immobilized enzymes (A brief account).

Industrial applications of enzymes (Production of glucose from starch, cellulose and dextran; use of lactase in dairy industry; production of glucose-fructose syrup from sucrose; use of protease in food, detergent and leather industry).

B.Sc. –I (Biochemistry) Semester-II

Paper – VI (Lab Course-2)

1. Estimation of protein by biuret / Lowry method
2. Assay of acid phosphatase activity from germinating mungbean seeds.
3. Calculation of specific activity of acid phosphatase .
4. Effect of enzyme concentration on enzyme activity.
5. Effect of substrate concentration on acid phosphatase activity and determination of its Km value.
6. Effect of pH on enzyme activity and determination of optimum pH.
7. Effect of Temperature on Enzyme acti.vity.
8. Partial purification of enzyme by ammonium sulphate fractionation.
9. Inhibition of Acid phosphatase by EDTA.