BIO- CHEMISTRY

Semester I

MBC-101: Introductory Biological Chemistry
(M.Sc.; Paper-I)

M.M. 100 (70+30)

Unit-I

Properties of Water, pH, Henderson-hasselbalch equation, Buffer, Significance of physiological buffer.

Carbohydrates: Classification and properties of simple carbohydrates, monosaccharides, disaccharides and polysaccharides, reducing and non reducing sugar, enantiomers, Structural polysaccharides: cellulose, Storage polysaccharides: starch and glycogen, glycoproteins and glycolipids, biological importance of carbohydrates.

Unit-II

Enzymes: Classification and nomenclature of enzymes, active site, factors affecting enzymatic catalysis, prosthetic groups and cofactors, structure and properties of important coenzymes, abzymes and ribozymes, biological importance of enzymes.

Unit-III

Lipids: Classification, structure, chemistry and biological significance of lipids, steroids, prostaglandins and eicosanoids, chylomicrons, LDL, HDL and VLDL.

Unit-IV

Proteins: General properties and configuration of amino acids, peptide bond formation and its characteristics, different types of protein structures, protein denaturation, biological importance of amino acids and proteins.

Unit-V

Nucleic Acids: Structure and properties of purines and pyrimidines, nucleosides and nucleotides, structure of DNA (A, B, & Z) and RNA, DNA as genetic carrier, physico-chemical properties nucleic acids, Chargaff's rule, DNA denaturation, Genetic code.

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MBC-102: Tools and Techniques in Biochemistry
(M.Sc.; Paper-II)

M.M. 100 (70+30)

Unit I

Spectroscopy– Concepts of spectroscopy, Visible and UV spectroscopy, Beer-Lambert's law, Principles and applications of colorimetry, Principles and biological applications of NMR, ESR, Raman, Mass, atomic absorption and atomic emission spectroscopy and X-ray crystallography.

Unit II

Chromatography & Microscopy – Principles of partition chromatography, paper, thin layer, ion exchange and affinity chromatography, gel permeation chromatography, HPLC and FPLC.Transmission and scanning, freeze fracture techniques, specific staining of biological materials.

Unit III

Centrifugation & Radioactive techniques – Principles of centrifugation, concepts of RCF, different types of instruments and rotors, preparative, differential and density gradient centrifugation, analytical ultra-centrifugation, determination of molecular weights and other applications, subcellular fractionation. Introduction to radiations and their uses in biology, safety measures, principles and applications of liquid scintillation counting (LSC), Gamma counting and autoradiography.

Unit IV

Electrophoretic techniques & Viscosity– Principles of electrophoretic separation. Continuous, zonal and capillary electrophoresis, different types of electrophoresis including paper, cellulose, acetate/nitrate and gel. Electroporation, pulse field gel electrophoresis. **Viscosity**– Viscosity of macromolecules, relationship with conformational changes.

Unit V

Biostatistics, Computers and Bioinformatics-Statistical analysis of biochemical data: standard deviation, variance, mean, median, mode. Basics of common application software packages for Word processing (MS Word), spreadsheets (MS Excel) and presentation (MS Powerpoint). Introduction to internet, Medline and Pubmed for accessing biological information. **Introduction to Bioinformatics-** Accessing and retrieving sequence information from genome sequence databases, use of genomic data. Overview of comparative and functional genomics, Introduction to protein modeling and proteomics.

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MBC-103: Bioenergetics
(M.Sc.; Paper-III)

M.M. 100 (70+30)

Unit I

Metabolism, living organism participate in the cycling of carbon and oxygen, nitrogen cycle, metabolism consists of catabolic pathways and anabolic pathways. Energy relationships between catabolic and anabolic pathways.

Unit II

Principle of bioenergetics, bioenergetics and thermodynamics – biological energy transformation obey the Laws of Thermodynamics, first law of thermodynamics, second law of thermodynamics; Gibbs free energy, enthalpy, entropy and their relationships; the change in free energy determines the direction and spontaneity of a chemical reaction. Free energy change and directly related to equilibrium constant; generation of concentration gradients and in understanding enzymes. Unfavourable chemical reactions can be driven by coupling to an energetically favourable reaction.

Unit III

Energy cycle and specialized role of ATP as universal currency in biological system; free energy change for ATP hydrolysis is large and negative; ATP hydrolysis drives metabolism by shifting the equilibrium of coupled reactions. Other phosphorylated compounds and thioesters – have large free energies of hydrolysis- but not suitable as currency of energy. ATP provide energy by group transfer; ATP donate phosphoryl, pyrophosphoryl and adenylyl groups. ATP drives many cellular process; trans-phosphorylation, Inorganic phosphate as a potential phosphoryl donor.

Unit IV

Flow of electrons can do biological work; oxidation- reductions as half reactions; oxidation-reduction involves dehydrogenation; reduction potential; standard reduction potentials and free energy change; certain coenzymes and proteins serve as universal electron carriers; NADH and NADPH with dehydrogennases serve as soluble electron carriers; Flavin nucleotides tightly bounds with flavorprotein also serve as electron carriers, coenzyme Q as lipid soluble electron carrier.

Unit V

Chemiosmotic theory of Peter Mitchell and its justifications. Electron transport chain; proton motive force. Oxidative phosphorylation and ATP synthesis uncouplers,

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