Syllabus for the Course for Biochemistry as one subject in the B. Sc Revised 2011 session

B. Sc. PART I:

PAPER I: Cell Biology and the physico- chemical basis of life

The molecular basis of life: The identifying characteristics of living matter: Simplicity underlying the complexity.

Cellular Basis of Life: The cell as the structural and functional unit of life. Prokaryotes versus Eukaryotes. Cellular architecture of prokaryotic cells and eukaryotic cells.
Ultrastructure of the Eukaryotic Cell. Subcellular Organization of Cell. Ultracentrifugation, Marker enzymes.

The chemical unity of life. Elements. Carbon based life. Molecular components. Dimensions of biomolecules, assemblies and cells. Macromolecules. Informational macromolecules. Molecular asymmetry. Molecular interactions and bonds present in biomolecules: The significance of weak interactions.

Living cells and the Laws of thermodynamics: Living organisms in dynamic steady state. Living organisms as open systems. Entropy.

Bioenergetics. Energy transformations in living cells, Energy coupling of reactions. Free energy Introduction to high-energy bonds , Low-energy and High-energy compounds, Importance of ATP in integrating metabolic pathways. Feedback inhibition.

Evolutionary foundations of life: How life began. Morphological diversity, phylogeny and differentiation. An overview of biological organization.

Enzymes: The biological catalysts: the chemical and physical characteristics of enzymes - How enzymes accelerate reactions, Effect of pH, temperature,and other factors on enzyme action, Allosteric enzymes, enzyme-substrate interaction and the Michaelis-Menten constant, Inhibition of enzymes - General principles. Enzymes acting in sequence. Enzymes and Ribozymes.
Co-enzymes and co-factors: Brief introduction

PAPER II: Chemistry of Biomolecules

Water as a biological solvent: Weak acid and bases, types of bonds in biological systems, physiological buffers

Biomolecules: Their meaning and importance in the functional organization of the cell.

Carbohydrates: Structure of monosaccharide, stereoisomerism and optical isomerism of sugars, reaction of aldehyde and ketone groups , ring structure and anomeric form, mutarotation,

reaction of sugar due to hydroxyl groups , important derivatives of monosaccharide, disaccharides and trisaccharides (structure, occurrence and functions of important ones), structure, occurrence and biological importance of monosaccharides, oligosaccharides and polysaccharides e.g. cellulose, chitin, agar, algenic acids, pectins, proteoglycans, sialic acids, blood group polysaccharides, glycogen and starch.

Lipids: Definition and classification, fatty acids : Introduction, classification, nomenclature, structure and properties pf saturated and unsaturated fatty acids, essential fatty acids, prostaglandins. Triacyglyderols : nomenclature, physical properties, chemical properties and characterization, of fats- hydrolysis, saponification value, rancidity of fats, Reichert Meissel number and reaction of glycerol, Biological significance of fat, Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidylserine, phosphatidyl inositol, plasmalogens), sphingomyelins, glycolipids, cerebrosides, gangliosides, proerties and functions of phospholipids, isoprenoids and sterols

Proteins: Introduction, functional diversity of proteins, classification based on solubility, shape, composition and functions. Amino acids : common structural features, stereoisomerism, classification and structures of standard amino acids, as zwitterions in aquesous solutions, physical and chemical properties, titration of amino acids, Essential amino acids.
Peptides : Structure of peptide bond, determination of the amino acid sequence of a polypeptide chain, specific chemical and enzymatic cleavage of a polypeptide chain and separation of peptides. Protein structure : levels of structure in protein architecture, primary structure of proteins, secondary structure of proteins- helix and pleated sheets, tertiary structure of proteins, forces stabilizing the tertiary structure and quaternary structure of proteins, denaturation and renaturation of proteins,, behavior of proteins in solutions, salting in and salting out of proteins. Structure and biological functions of fibrous proteins, (keratin, collagens and elastin), globular proteins (hemoglobin and myoglobin), lipoproteins, metalloproteins, glycoproteins and nucleoproteins. Colour reactions of proteins and amino acids. Protein folding & function.

Nucleic acids: Structure and function of DNA and RNA. Structure of nucleotides and formation of polynucleotide chain. Watson Crick model of DNA. Forms of DNA; DNA stability over RNA.

PAPER III: Tools and techniques in Biochemistry

Preparation of solutions: Concept of molar, molal, and normal solutions. Physiological saline.

pH and Buffers: Importance and measurement of pH. Buffer strength, Buffer capacity. Biological Buffers.

Centrifugation: Principles :- Centrifugal force, Sedimentation coefficient. Types of Centrifuges. Ultracentrifugation. Low speed vs. High speed vs. ultracentrifugation.

Chromatographic techniques: General principles. Partition and adsorption chromatography. Paper, thin layer, gas liquid, ion exchange and affinity chromatography. Gel filtration. High Performance Liquid Chromatography

Electrophoretic techniques: General principles. Paper and gel electrophoresis. Polyacrylamide Gel electrophoresis. SDS-PAGE Agarose gel electrophoresis, Zone electrophoresis.

Colorimetry: Laws of Absorption, Beer's Law and Lambert's Law. Extinction coefficient. General principles of Colorimeters and spectrophotometers.

Immunological Techniques: Immunodiffusion, Immunoelectrophoresis, radioimmunoassay, ELISA, Immunofluorescence.