

# Biochemistry

B.Sc.: Elective

## Outlines of Tests

<u>Paper</u>	<u>Title of Course</u>	<u>Marks</u>
A:	Structure and Functions of Biomolecules	75
B:	Metabolism and Bioenergetics	75
C:	Practical	25
D:	Practical	25
<b>Total:</b>		<b>200</b>

## Syllabi and Courses of Reading

### PAPER A: STRUCTURE AND FUNCTIONS OF BIOMOLECULES

#### **1. Principles of Biochemistry**

A general introduction to the science of biochemistry, nature of organic matter and review of organic reaction mechanisms; chemical structure and biological function; properties of water and aqueous solution; chemical equilibria, review of thermodynamic principles.

Prebiotic molecular evolution and origin of life, a review of the variety and ecology of the living world; biochemical basis of structural and functional variations in the living being. Basic cell biology, prokaryotic and eukaryotic cells, structure and functions of cell organelles, Evolution of life.

#### **2. Amino Acids and Proteins**

Amino acids, peptides and proteins, their properties; general methods of fractionation and characterization of proteins; covalent structure of proteins; secondary; structure; fibrous proteins; tertiary structure and globular proteins; quaternary structure; protein folding; protein stability.

#### **3. Enzymes**

General characteristics of enzyme reactions; enzymes nomenclature and classification; substrate specificity; co-enzymes; regulation of enzymes activity; chemical kinetics and enzymes kinetics, Michaelis Menten equation; effect of pH and other factors on rates of reactions; inhibition of enzymatic reactions and kinetics; catalytic mechanism; structure and mechanism of chymotrypsin.

#### **4. Carbohydrates**

Classification; structure of monosaccharides; sugar derivatives; oligo- and polysaccharides; carbohydrate analysis; structural polysaccharides; storage polysaccharides; other carbohydrates of biological interest; proteoglycans and glycoproteins structure and function.

#### **5. Lipids**

Lipid classification; structure and functions of different types of lipids; micelles; bilayers and liposomes and functions of lipoproteins, Structure and function of cell membrane.

#### **6. Nutrition**

Chemical composition and function of nutrients and their requirement. Biological evaluation of proteins. Energy value of foods, calorimetry. RQ. BMR. Assessment of nutritional status. A discussion of the occurrence, chemistry, metabolism, physiological, functions, deficiency symptoms and requirements of vitamins A,B-complex, C,D,L, and K. Bulk and trace minerals. Role of nutrition in growth, development and diseases, function of major and trace minerals.

### PAPER B: METABOLISM AND BIOENERGETICS

#### **1. Carbohydrate Metabolism**

Experimental study of metabolic pathways; glycolytic pathway and its significance; fermentation; glycogen breakdown and synthesis pathways regulation of glycogen metabolism and blood glucose levels; citric acid cycle and energy balances gluconeogenesis; mechanism and regulation of pentose phosphate pathways; mechanisms of light reactions and dark reaction in photosynthesis

2. **Electron Transport Chain and Oxidative Phosphorylation**  
Role of ATP and other high energy compounds. Mechanism of electron transport chain; oxidative phosphorylation and regulation of ATP production.
3. **Lipid Metabolism**  
Lipid digestion, absorption and transport; fatty acid oxidation; ketone bodies; fatty acid and triglyceride synthesis; biosynthesis. Transport and utilization of cholesterol; phospholipid and glycolipid metabolism.
4. **Amino acid, Purine and Pyrimidine Metabolism**  
Amino acid deamination and transamination, mechanism; urea cycle and its regulation; a review of biosynthesis and breakdown of amino acids, nitrogen fixation. Chemical nature and synthesis of purine and pyrimidine ribonucleotides formation of deoxyribonucleotides; nucleotide degradation; synthesis of nucleotide coenzymes. Controls and disorders of metabolic pathways.
5. **Basic Molecular Biology**  
DNA as a carrier for genetic information; double-helical structure of DNA; forces stabilizing nucleic acid structure; supercoiled DNA nucleic acid fractionation; DNA replication general aspects and enzymes involved; prokaryotic and eukaryotic replication mechanisms; repair of DNA.
6. **Physiological Chemistry**  
Endocrine system, chemistry, metabolism and biological functions of pancreatic pituitary, gonadal adrenal, thyroid, parathyroids, intestinal and renal hormones. General composition of blood, blood plasma, blood proteins, formed elements of blood. Biosynthesis and metabolism of hemoglobin and porphyrin. Gaseous transport. Coagulation of blood.

### **PRACTICAL I : BIOCHEMISTRY**

1. **Carbohydrates**  
Qualitative tests for carbohydrates. Distinction between pentoses and hexoses, aldoses and ketoses, reducing and nonreducing sugar, mono-and-polysaccharides. Estimation of glucose in a mixture of monosaccharides. Quantitative paper chromatography of sugars. Preparation of glycogen from liver. Acid and enzymic hydrolysis of glycogen.
2. **Lipids**  
Lipid separation from calf brain tissue. Tests for fats, sterols and phospholipids. Estimation of cholesterol. Acid, saponification and iodine values of fats. Extraction and TLC of what lipids.
3. **Proteins and Amino Acids**  
Hydrolysis of proteins and qualitative tests for amino acids. Estimation of proteins by dye-binding and kjeldahl methods. Isoelectric point determination of amino acids.
4. **Vitamins**  
Estimation of vitamins A, B1, B2, B6, C and D, in food materials

### **PRACTICAL II : BIOCHEMISTRY**

1. **Enzyme**  
Preparation and assay of peroxidase, effect of substrate, pH and temperature on activity.
2. **Urine Analysis**  
Estimation of organic and inorganic constituents in normal and abnormal human urine, ketosteroids in urine.
3. **Blood Analysis**  
Assay of inorganic constituents like sodium, potassium, calcium, chloride, phosphate, sulphate, iron, magnesium, etc. Assay of organic constituents such as sugar urea, creatinine, uric acid, lipoprotein, bilirubin, triglycerides, cholesterol, haemoglobin fibrinogen, etc. Assay of some of the clinically important enzymes like alkaline and acid phosphatases, amylases, etc. Glucose tolerance test.
4. Get filtration of proteins. Ion-exchange chromatography of amino acids and proteins. Electrophoresis of plasma proteins. Agarose gel electrophoresis of DNA.

#### **Recommended Books**

1. Fundamentals of Bio-chemistry, D. Voet, J.G. Voet, C.W. Pratt, Johan Wiley & Sons.
2. Harper's Biochemistry, Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell 24<sup>th</sup> edition, Prentice Hall International Jnc.
3. Outlines of Biochemistry, Eric E. Conn, Paul, K. Stumpf, 5<sup>th</sup> edition, John Wiley.
4. Lippmcott's Biochemistry, Pamela C. Champe, Richard A. Harvey, 2<sup>nd</sup> edition Lippmcott-Raven
5. Lehninger Principles of Biochemistry (4<sup>th</sup> Ed) 2005, worth publishers New York. USA