

# **INTRODUCTION TO BIOCHEMISTRY (THEORY)**

**Course Code- BP202T**

*As per the new syllabus of Pharmacy Council of India 2026 (NEP 2020)*

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## Preface

“Biochemistry is where life's smallest molecules tell its greatest stories”

This book has been written for the students of the second semester of the Bachelor of Pharmacy programme, intending to cover the subject of Biochemistry (BP 202T) as set out in syllabus as per NEP implemented by the Pharmacy Council of India. Its goal is to cover the subject comprehensively, precisely, and in a way that supports the examination while always keeping in mind the reasons a pharmacist needs to understand biochemistry: because many drugs act on the enzymes and follow the pathways discussed here and metabolic diseases are encountered on a daily basis in practice.

Four ideas run through the whole book and unify its many topics. The first is that the structure of a biomolecule determines its function and its fate. The second is that metabolism is regulated, reciprocal, and compartmentalised, so that opposing pathways are not run at once and the cell makes and spends its fuels under careful control. The third is that energy is the currency of the cell, so that every pathway is read as a transaction in ATP and reducing power. The fourth is that biochemistry both explains and detects disease, so that each pathway, when it fails, produces a named disorder and a measurable marker. The diagnostic and clinical thread that follows from this fourth idea is woven through every unit rather than confined to one, because that is how a pharmacist meets the subject.

Each chapter opens with clear learning outcomes traceable to the official Course Outcomes, develops the topic from definition through classification and mechanism to application and clinical significance, and closes with a summary and a full self-assessment of short-answer questions with model answers, long-answer questions, and multiple-choice questions in the standard university pattern. The figures have been drawn afresh for clarity and print in black and white. Where a precise clinical value depends on the method or the laboratory, this is stated, and current reference values have been used throughout.

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## **COURSE OBJECTIVES**

The objectives of this course are to:

1. Know about enzymology and various tests in clinical chemistry
2. Understand the biochemical pathways and clinical relevance of carbohydrate, lipid and protein metabolism.
3. Describe energetics and biological oxidation.
4. Explain amino acid and protein metabolism
5. Understand Nucleic acid metabolism and genetic information.

## **Course Outcomes (CO):**

Upon successful completion of this course, the students will be able to:

CO1 Explain the principles of enzymology and various tests in clinical chemistry

CO2 Describe the classification, the classification, structure, and functions of major biomolecules such as carbohydrates, lipids, proteins, nucleic acids, enzymes, and vitamins.

CO3 Explain the principles of bioenergetics, biological oxidation, and the overview of metabolic pathways of biomolecules, along with their clinical significance.

CO4 Understand metabolism of lipid and its significance.

CO5 Understand metabolism of proteins & its significance and monitoring of metabolic and organ-specific disorders.

## Syllabus

| Unit No.   | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | No. of lectures |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>I</b>   | <b>Enzymology</b><br>a. Introduction, properties, nomenclature, and IUB classification of enzymes and coenzymes. Enzyme kinetics (Michaelis plot, Lineweaver– Burk plot). Enzyme inhibitors with examples. Regulation of enzymes: enzyme induction and repression, allosteric enzyme regulation<br>Therapeutic and diagnostic application of enzymes and isoenzymes. Factors affecting enzyme activity. Digestion, absorption function of dietary Macro and Micronutrients, including Vitamins and Minerals, Biochemical functions of vitamins and associated diseases.<br>b. Clinical Chemistry: Liver function tests (routinely performed tests based on liver function). Renal function tests (routinely performed tests based on kidney function, ELISA test)                                                                                                                                                                                       | <i>10 hours</i> |
| <b>II</b>  | a. Introduction about biomolecules – Introduction of carbohydrate, lipids, nucleic acids, amino acids and proteins.<br>b. Bioenergetics: Concept of free energy; relationship between free energy, enthalpy, and entropy; redox potential; energy-rich compounds (ATP, GTP, etc.) and their biological significance.<br>c. Carbohydrate Metabolism and their role in diabetes mellitus: Overview and significance of major pathways: Glycolysis, Citric Acid Cycle (TCA), Gluconeogenesis, Hexose Monophosphate (HMP) shunt, and Glycogen metabolism; regulation of blood glucose levels; metabolic adaptations during fed state, fasting, and prolonged starvation; metabolic derangements in diabetes mellitus and related disorders.<br>d. Biological Oxidation: Electron Transport Chain (ETC), oxidative phosphorylation, and mechanisms of ATP synthesis; regulation and clinical implications of mitochondrial dysfunction and oxidative stress. | <i>10 hours</i> |
| <b>III</b> | <b>Lipid metabolism</b><br>a. Classification, functions, and properties of lipids and lipoproteins (HDL, LDL, VLDL, chylomicrons)<br>b. $\beta$ -oxidation and de-novo synthesis of fatty acids: Ketone bodies: synthesis, utilization, and clinical significance<br>c. Biological significance of cholesterol, lipid profile, and its clinical significance<br>d. Disorders associated with lipid metabolism: Hyperlipidaemias and hypercholesterolemia, lipid storage diseases, atherosclerosis, fatty liver                                                                                                                                                                                                                                                                                                                                                                                                                                          | <i>7 hours</i>  |

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|           | disease, and obesity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |
| <b>IV</b> | <p><b>Amino acids and protein metabolism</b></p> <p>a. Classification and Biological Functions: Classification and physiological roles of amino acids. Structure and functions of proteins and plasma proteins</p> <p>b. General Metabolism of Amino Acids: Transamination, oxidative and non-oxidative deamination, decarboxylation. Urea cycle – nitrogen disposal and detoxification. Fate of carbon skeletons of amino acids (glucogenic vs ketogenic).</p> <p>c. Catabolism of Specific Amino Acids and Related Disorders: Catabolism of phenylalanine and tyrosine and their metabolic disorders (Phenylketonuria, Albinism, Alkaptonuria, Tyrosinemia) and Inborn errors of branched chain and aromatic amino acids</p> <p>d. Biochemical significance of neurotransmitters and hormones derived from amino acids: 5-HT (serotonin), melatonin, dopamine, noradrenaline, adrenaline</p> <p>e. Catabolism of heme and related disorders (jaundice)</p> | <i>10 hours</i> |
| <b>V</b>  | <p><b>Nucleic acid metabolism and genetic information transfer</b></p> <p>a. Nucleotide Metabolism and their related disorders: Biosynthesis of purine and pyrimidine nucleotides. Catabolism of purine nucleotides (uric acid formation). Clinical significance of Hyperuricemia and Gout.</p> <p>b. Genome Structure and Central Dogma: Organization of the mammalian genome. Introduction to DNA replication, Transcription, and Translation.</p> <p>c. Genetic Code and Regulation of Protein Synthesis: Properties of the genetic code: Inhibitors of transcription and translation (antibiotics, toxins)</p> <p>d. DNA Repair and Related Disorders: DNA damage types, Repair mechanisms. Overview of clinical disorders associated with faulty DNA repair.</p>                                                                                                                                                                                        | <i>8 hours</i>  |

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