

**JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

Programme: B.Sc.

Semester: III

**BIOTECHNOLOGY PAPER III
BIOCHEMISTRY AND ENZYMOLOGY**

Course Code: 18IIIBT3

No. of Hours: 60

COURSE OBJECTIVES:

- To enable an integrated approach to understanding various biochemical processes in Life Science.

LEARNING OUTCOMES: After successful completion of the course the students will be able to

- Understand the basic concepts/functions of solutes, chemical bonding.
- Discuss the overall concept of cellular metabolism – anabolic and catabolic pathways, energy storage and release, production of building blocks for macromolecule synthesis.
- Gain knowledge about occurrence, physiological functions and clinical manifestations caused due to vitamins, minerals and hormones.
- Distinguish the fundamentals of enzyme properties, nomenclatures, characteristics and mechanisms along with enzyme kinetical studies.

UNIT I INTRODUCTION TO BIOCHEMISTRY

12 HRS

Importance of water in life, **Solutions:** Stock and standard. Concentration terminologies (*molarity, molality, normality, ppm, percentage, Isotonic, hypotonic and hypertonic solutions*), Concept of pH, Henderson-Hasselbalch Equation. Buffer: Definition, buffer capacity and buffer range. Biological buffering systems (*Phosphate and Carbonate buffer*).

Introduction to Bioenergetics, types of bonds, high energy compounds (*ATP and NAD*) and their role.

UNIT II METABOLISM OF BIOMOLECULES

16 HRS

Introduction and types (anabolism, catabolism and significance), Glycolysis, Krebs cycle, Gluconeogenesis and Glycogen metabolism (*both anabolic and catabolic metabolism*). Hexose Monophosphate shunt, Lactic acid and alcoholic fermentation, Transamination, Deamination and Decarboxylation of amino acids, Oxidation of fatty acids (*β oxidation*), fatty acid biosynthesis (Palmitic acid). Oxidative phosphorylation (*Electron Transport Chain*), Chemiosmotic hypothesis.

UNIT III HORMONES, VITAMINS AND MINERALS

08 HRS

Hormones – General characteristics, types, classification, mode of action and physiological role (Insulin, Glucagon, Somatostatin and Thyroid). A brief note on Phytohormones (Auxins, Cytokinin, Gibberellins, Abscisic Acid and Ethylene).

Vitamins – Definition, Classification and Properties. Physiological function of Water-soluble vitamins (Folic acid, Vitamin B complex and Vitamin C) and Fat-soluble vitamins (Vitamin A, D, E and K).

Minerals – Introduction to essential minerals, occurrence, role and deficiency symptoms of Macro elements (N, P, K, Ca and Mg) and Microelements (B, Zn, Mn and Fe)

UNIT IV CHROMATOGRAPHIC TECHNIQUES

08 HRS

Definition, General principle (Adsorption and Partition). Rf value. Principle, operation and applications of Paper Chromatography, TLC and Column Chromatography (Gel permeation, Affinity, ion exchange),

UNIT V ENZYMES

08 HRS

Definition, Nomenclature, IUB Classification, Chemical nature of an enzyme (*Apo and holoenzyme*, Coenzymes and cofactors, *Active site and Allosteric site*). Characteristics and Properties of enzymes, Types of enzymes (*Exo, Endo, Zymogen, Zymase, Isozymes*), Ribozymes and Abzymes (*Definition, properties, and applications*).

UNIT VI ENZYME KINETICS

08 HRS

Mode of enzyme action - *Lock and Key model, Induced fit theory*. Michaelis – Menten equation, significance of K_m and V_{max} value, Lineweaver - Burk plot. Factors affecting enzyme activity (*temperature, time, pH and substrate concentration*). Enzyme inhibition (*competitive, uncompetitive, non – competitive inhibition and End product inhibition, with examples under each*).

REFERENCES:

1. Principles of Biochemistry and Biophysics by Dr. B.S. Chauhan University Science Press, New Delhi, (2008).
2. Biophysics: Tools and Techniques by Mark C. Leake, CRC Press, (2016).
3. Lehninger's Principles of Biochemistry by David L. Nelson and Michael M. Cox., 7th edition, W. H. Freeman Publishers. (2017).
4. Principles of Medical Biochemistry by Gerhard Meisenberg, William H. Simmons, 4th edition, Elsevier publishers. (2016).
5. Text-book of Biochemistry with clinical correlations by Thomas M. Devlin, 7th Edition, J. Wiley and Sons. (2015).
6. Harper's Illustrated Biochemistry: Lange medical book by Robert K. Murray, Victor W. Rodwell, David Bender, Kathleen M. Botham, P. Anthony Weil, Peter J. Kennelly, 28th Edition, McGraw Hill Professional publishers. (2009).

7. Guyton and Hall Textbook of Medical Physiology E-Book by John E. Hall, 12th Edition, Elsevier Health Sciences. (2010).
8. Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins, Nicholas C. Prince, Lewis Stevens, 3rd Edition, Oxford University Press. (2005).

PRACTICALS – PAPER III – BIOCHEMISTRY AND ENZYMOLOGY 15 UNITS

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| 1. Preparation of Solution and Buffer (tabular and HH equation method) | 02 UNITS |
| 2. Estimation of Reducing sugars by Benedict's quantitative method. | 01 UNIT |
| 3. Estimation of amino acids by formal titrimetric method. | 01 UNIT |
| 4. Colorimetric estimation of reducing sugars by DNS method | 01 UNIT |
| 5. Quantitative estimation of protein by biuret method. | 01 UNIT |
| 6. Enzyme Assay (<i>Amylase</i>) | 01 UNIT |
| 7. Effect of temperature and time on enzyme activity | 02 UNITS |
| 8. Effect of pH on enzyme activity | 01 UNIT |
| 9. Separation of biomolecules by paper chromatography | 02 UNITS |
| 10. Separation of biomolecules TLC and column chromatography | 02 UNITS |
| Tests and Repetition. | |