

JYOTI NIVAS COLLEGE AUTONOMOUS
PROGRAMME: B.SC.
SEMESTER: II - ZOOLOGY - II
BIOCHEMISTRY AND PHYSIOLOGY

COURSE CODE: 21IIZO2
CREDITS: 4

NO. OF HOURS: 60

COURSE OBJECTIVES (COS):

- Describe the structure and function of biomolecules
- To relate the metabolism of different biomolecules like lipids, proteins and carbohydrates
- To gain knowledge on different physiological mechanisms
- To compare endocrine, nervous and muscular systems and understand their functions

LEARNING OUTCOMES:

The student at the completion of the course will learn:

- To differentiate different biomolecules and to understand their functional roles
- Evaluate the mechanisms of energy production at cellular and molecular levels.
- To correlate physiological mechanisms in the human body
- To comprehend the regulatory mechanisms for maintenance of function in the body

CHAPTER 1. STRUCTURE AND FUNCTION OF BIOMOLECULES:

08 HRS

- Structure and Biological importance of carbohydrates
Monosaccharides (Glucose, fructose, ribose, deoxyribose) Disaccharides (Lactose, Maltose, Sucrose, Trehalose)
Polysaccharides (Homopolysaccharides—Starch, Glycogen, Chitin)
Heteropolysaccharides – Heparin, Hyaluronic acid, Keratan sulphate).
Saturated (Palmitic acid) and unsaturated Fatty acids - Omega 3 and omega 6 fatty acid
- Lipids (saturated and unsaturated Fatty acids, Tri-acyl glycerols, Phospholipids, Glycolipids and Steroids)
- Structure, Classification and General Properties of α -amino acids; Essential and non-essential amino acids
- Levels of organization in proteins- An overview
- Simple, Conjugated and derived Proteins, Peptide linkages

CHAPTER 2. ENZYME ACTION AND REGULATION

07 HRS

- Nomenclature and classification of enzymes; Cofactors; Specificity of enzyme action
- Mechanism of Enzyme Action- Key and Lock method and Induced fit model
- Isozymes and Clinical use of Isozymes.
- Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Equation of Michaelis-Menten, Concept of K_m and V_{max} , Enzyme inhibition.

CHAPTER 3. METABOLISM OF CARBOHYDRATES AND LIPIDS

08 HRS

- Metabolism of Carbohydrates: Glycolysis, citric acid cycle, gluconeogenesis, pentose phosphate pathway, Glycogenolysis and Glycogenesis
- Lipids- Biosynthesis of palmitic acid; Ketogenesis
- β -oxidation and ω -oxidation of saturated fatty acids with even and odd number of carbon-atoms

CHAPTER 4. METABOLISM OF PROTEINS AND NUCLEOTIDES

07 HRS

- Metabolism of amino acids: Transamination, Deamination, Ureacycle, Nucleotides -Biosynthesis of Purines and Pyrimidines.

CHAPTER 5. DIGESTION AND RESPIRATION IN HUMANS

08 HRS

- Structural organization and functions of gastrointestinal tract and associated glands.
- Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins
- Physiology of trachea and Lung.
- Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood, Respiratory pigments.

CHAPTER 6. CIRCULATION AND EXCRETION IN HUMANS

07 HRS

- Components of Blood and their functions; Hemopoiesis
- Mechanism of Blood clotting (Briefly)
- Structure of mammalian heart
- Cardiac cycle; Cardiac output and its regulation, Electrocardiogram,
- Blood pressure and its regulation
- Structure of kidney and its functional unit; Mechanism of urine formation

CHAPTER 7. NERVOUS SYSTEM AND ENDOCRINOLOGY IN HUMANS

08 HRS

- Structure of Neuron, resting membrane potential (RMP)
- Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers. Synaptic Transmission
- Endocrine glands - Pineal, pituitary, thyroid, parathyroid, pancreas and adrenal, hormones secreted by them.
- Classification of hormones; Mechanism of Hormone action.

CHAPTER 8. MUSCULAR SYSTEM IN HUMANS

07 HRS

- Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction- Sliding filament theory
Characteristics of muscle twitch, Motor unit, summation and tetany

PRACTICAL – II BIOCHEMISTRY AND PHYSIOLOGY

CREDITS: 02

NO. OF HOURS: 56

1. Preparation of models of nitrogenous bases- nucleosides and nucleotides.
2. Preparation of models of amino acids and dipeptides.
3. Preparation of models of DNA and RNA.
4. Qualitative analysis of Carbohydrates, Proteins and Lipids.
5. Qualitative analysis of Nitrogenous wastes – Ammonia, Urea and Uric acid.
6. Separation of amino acids or proteins by paper chromatography.
7. Determination of the activity of enzyme (Salivary amylase)-Effect of [S] and determination of K_m and V_{max} .
8. Determination of the activity of enzyme (Urease) - Effect of temperature and time.
9. Action of salivary amylase under optimum conditions.
10. Quantitative estimation of Oxygen consumption by fresh water Crab.

11. Quantitative estimation of salt gain and salt loss by fresh water.
12. Estimation of Hemoglobin in human blood using Sahli's haemoglobinometer.
13. Counting of RBC in blood using Hemocytometer.
14. Counting of WBC in blood using Hemocytometer.
15. Differential staining of human blood corpuscles using Leishman stain.
16. Recording of blood glucose level by using glucometer.

Virtual Labs (Suggestive sites)

<https://www.vlab.co.in>

<https://zoologysan.blogspot.com> www.vlab.iitb.ac.in/vlab www.onlinelabs.in www.powershow.com

<https://vlab.amrita.edu> <https://sites.dartmouth.edu>

SUGGESTED READINGS:

1. Nelson & Cox: Leininger's Principles of Biochemistry: McMillan (2000)
2. Zubay et al: Principles of Biochemistry: WCB (1995)
3. Voet & Voet: Biochemistry Vols 1 & 2: Wiley (2004)
4. Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003)
Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
5. Guyton, A.C. & Hall, J.E. Textbook of Medical Physiology, XI Edition, Harcourt Asia PTE Ltd. / W.B. Saunders Company. (2006).
6. Tortora, G.J. & Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).
7. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).
8. Hill, Richard W., et al. Animal physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
9. Chatterjee CC Human Physiology Volume 1 & 2, 11th edition, CBS Publishers (2016).
10. Nelson & Cox: Leininger's Principles of Biochemistry: McMillan (2000)
11. Zubay et al: Principles of Biochemistry: WCB (1995)
12. Voet & Voet: Biochemistry Vols 1 & 2: Wiley (2004)
13. Murray et al: Harper's Illustrated Biochemistry: McGraw Hill (2003)
Elliott and Elliott: Biochemistry and Molecular Biology: Oxford University Press
14. Tortora, G.J. & Grabowski, S. Principles of Anatomy & Physiology. XI Edition John Wiley & sons (2006).
15. Christopher D. Moyes, Patricia M. Schulte. Principles of Animal Physiology. 3rd Edition, Pearson Education (2016).
16. Hill, Richard W., et al. Animal physiology. Vol. 2. Sunderland, MA: Sinauer Associates, (2004).
17. Chatterjee CC Human Physiology Volume 1 & 2, 11th edition, CBS Publishers (2016).
18. Text Book of Biochemistry with clinical correlations edited by Thomas M Delvin
19. **Web References:** Mammalian Physiology – www.biopac.com