

BODOLAND UNIVERSITY

Choice Based Credit System

Bachelor of Science Biotechnology



DEPARTMENT OF BIOTECHNOLOGY

Bodoland University

Kokrajhar – 783 370

Assam, India

LIST OF PAPERS:

Semester I	C1	Biochemistry & Metabolism	4 credits
	C1	Practical	2 credits
	C2	Cell Biology	4 credits
	C2	Practical	2 credits
	AECC1	English communication	2 credits
	GE1	Biotechnology & Human Welfare	4 credits
	GE1	Practical	2 credits

CONTENT:

SEMESTER 1

C-1: BIOCHEMISTRY AND METABOLISM

UNIT I: Introduction to Biochemistry: (20 Periods)

Acids, bases, weak acids, pH, K_a , biological buffers, biological significance of normality, molarity, osmosis, diffusion and other phenomena involved in maintaining cellular morphology, cellular structure and dimension.

Amino acids & Proteins: Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape. Different Levels of structural organization of proteins, Protein Purification. Denaturation and renaturation of proteins. Fibrous and globular proteins.

Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides.

UNIT II (10 Periods)

Lipids: Structure and functions –Classification, nomenclature and properties of fatty acids, essential fatty acids. Phospholipids.

Nucleic acids: Structure and functions: Nitrogen, physical & chemical properties of Nucleic acids, Nucleosides & Nucleotides, purines & pyrimidines. Double helical model of DNA structure, Forces stabilizing DNA structure. Forms of DNA. DNA denaturation and renaturation. Introduction to nucleic acid metabolism.

UNIT III (15 Periods)

Carbohydrates Metabolism: Reactions, energetics and regulation. Glycolysis: Fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway, Gluconeogenesis, Glycogenolysis and glycogen synthesis. TCA cycle, Electron Transport Chain, Oxidative phosphorylation. β -oxidation of fatty acids. Calvin Cycle.

UNIT IV (15 periods)

Bioenergetics and thermodynamics, Laws of thermodynamics and biology, concepts of free energy, Gibb's free energy, entropy, phosphoryl group transfer and ATP synthesis.

C1: PRACTICALS

1. Preparation of buffers.
2. Principles of Colorimetry:
3. Verification of Beer's law, estimation of protein.
4. To study relation between absorbance and % transmission.
5. Concept of standard curve, preparation of standard curve of Glucose.
6. Estimation of blood glucose by glucose oxidase method.
7. Quantification of proteins, carbohydrates and fats.
8. To study activity of any enzyme under optimum conditions.
9. To study the effect of pH, temperature on the activity of salivary amylase enzyme.
10. Separation of Amino acids by paper chromatography/TLC

SUGGESTED READING

1. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
2. Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.
3. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.
4. Hopkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology. John Wiley and Sons.
5. Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.

C2: CELL BIOLOGY

UNIT I

(10 Periods)

Cell: Introduction and classification of organisms by cell structure, compartmentalization of eukaryotic cells. Cell Membrane, its organization (Fluid Mosaic Model) and permeability. Transport across membrane, Signal transduction, Apoptosis.

UNIT II

(15 Periods)

Membrane Vacuolar system, cytoskeleton, cytoplasmic streaming and cell motility: Structure and function of microtubules, Microfilaments, Intermediate filaments.

Endoplasmic reticulum: Structure & function. Golgi complex: Structure and functions

UNIT III

(15 Periods)

Lysosomes: Structure and functions Ribosomes: Structures and function. Mitochondria: Structure and function, Genomes, biogenesis. Chloroplasts: Structure and function, genomes, biogenesis

UNIT IV

(10 Periods)

Nucleus: Structure and function.

UNIT IV

(10 Periods)

Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors, receptor ligand interactions and their function.

C2: PRACTICALS

1. Demonstration of dialysis/plasmolysis/de-plasmolysis and the effect of temperature and organic solvents on semi permeable membrane.
2. Demonstration of different stages of mitosis in onion root tip.
3. Study of structure of any phytoplankton, zooplankton, diatom, blue green algae, algae and yeast.
4. Microtomy: Fixation, block making, section cutting, staining of animal tissues/plant tissue.
5. Preparation of Nuclear, Mitochondrial & cytoplasmic fractions.

SUGGESTED READING

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition.
4. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
5. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
6. T. Devasena 2012. Cell Biology. Oxford University Press.

GE 1: BIOTECHNOLOGY AND HUMAN WELFARE

UNIT I

(10 Periods)

Protein engineering for industry: food, pharmaceutical, beverage.

UNIT II

(10 Periods)

N₂ fixing microbes for sustainable agriculture. Plant-microbe interaction, stress response in plants,

UNIT III

(15 Periods)

Polyaromatic hydrocarbons, polycyclic biphenyls, bioremediation, bioplastics, biopolymers and biosurfactants.

UNIT IV

(12 Periods)

Biotechnology in forensic science, paternity determination using various methods of DNA finger printing.

UNIT V

(13 Periods)

Biotechnology in modern medicine- overview, therapeutic agents, vaccines.

GE 1: PRACTICALS

(Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos/virtual labs etc.)

1. Ethanol fermentation using yeast.
2. Isolation of Rhizobium/Azotobacter/Azospirillum, etc from soil/plant parts.
3. Microscopic observation of infected plant parts (sugarcane/rice/brinjal/legumes).
4. Estimation of residual halogens (chlorine/fluorine) in waste water/effluent.
5. Human DNA isolation from buccal swab/hair/urine using isolation kit.
6. Visit to advanced laboratory/Universities.

SUGGESTED READING

1. Sateesh MK (2010) Bioethics and Biosafety, I. K. International Pvt Ltd.
2. Sree Krishna V (2007) Bioethics and Biosafety in Biotechnology, New age international Publishers