

7

B.Sc. Microbiology (CBCS PATTERN) – Proposed curriculum

**Semester-3**

**MB-301: BIOCHEMISTRY  
(THEORY)**

TOTAL HOURS: 60

CREDITS: 3

Unit 1

**A. Bioenergetics**

No. of Hours: 10

First and second laws of Thermodynamics. Definitions of Gibb's Free Energy, enthalpy, and Entropy and mathematical relationship among them, Standard free energy change and equilibrium constant. Coupled reactions and additive nature of standard free energy change, Energy rich compounds: Phosphoenolpyruvate, 1,3-Bisphosphoglycerate, Thioesters, ATP

**B. Carbohydrates**

No. of Hours: 10

Families of monosaccharides: aldoses and ketoses, trioses, tetroses, pentoses, and hexoses. Stereo isomerism of monosaccharides, epimers, Disaccharides; concept of reducing and non-reducing sugars, occurrence and Haworth projections of maltose, lactose, and sucrose, Polysaccharides, storage polysaccharides, starch and glycogen.

Unit 2

**A. Lipids**

No. of Hours: 10

Definition: and major classes of storage and structural lipids. Storage lipids. Fatty acids structure and functions. Essential fatty acids. Triacyl glycerols structure, functions and properties. Saponification. Phosphoglycerides: Sphingolipids: sphingosine, ceramide. Lipid functions: cell signals, cofactors, prostaglandins, Introduction of lipid micelles, monolayers, bilayers

**B. Proteins**

No. of Hours: 10

Functions of proteins, Primary structures of proteins: Amino acids, the building blocks of proteins. General formula of amino acid and concept of zwitterion. Classification, biochemical structure and notation of standard protein amino acids. Structure levels of structure of proteins: Peptide unit and its salient features. The alpha helix, the beta pleated sheet and their occurrence in proteins, Tertiary and quaternary structures of proteins. Forces holding the polypeptide together. Human haemoglobin structure, Quaternary structures of proteins

Unit 3

**Enzymes**

No. of Hours: 20

Structure of enzyme: Apoenzyme and cofactors, prosthetic group-TPP, coenzyme NAD, metal cofactors, Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis, and Induced Fit hypothesis. Significance of hyperbolic, double reciprocal plots of enzyme activity, Km, and allosteric mechanism. Definitions of terms – enzyme unit, specific activity and turnover number, Multienzyme complex: pyruvate dehydrogenase; isozyme: lactate dehydrogenase, Effect of pH and temperature on enzyme activity. Enzyme inhibition: competitive- sulfa drugs; non-competitive-heavy metal salts

**SUGGESTED READING**

1. Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
2. Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
3. Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H. Freeman
4. Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H. Freeman and Company
5. Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company,
6. Willey MJ, Sherwood, LM & Woolverton C J (2013) Prescott, Harley and Klein's Microbiology by. 9th Ed., McGrawHill
7. Biochemistry by JL Jain (S chand P.)

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**Semester-3**

MIB-302: Cell Biology  
(THEORY)

CREDITS: 3

TOTAL HOURS: 60

No. of Hours: 20

**Unit 1 Structure and organization of Cell,**

**Cell Organization** – Eukaryotic (Plant and animal cells) and prokaryotic Plasma membrane: Structure and transport of small molecules, Cell Wall: Eukaryotic cell wall, Extra cellular matrix and cell matrix interactions, Cell-Cell Interactions - adhesion junctions, tight junctions, gap junctions, and plasmodesmata (only structural aspects) Mitochondria, chloroplasts and peroxisomes Cytoskeleton: Structure and organization of actin filaments, association of actin filaments with plasma membrane, cell surface protrusions, intermediate filaments, microtubules

No. of Hours: 20

**Unit 2 Protein Sorting and Transport**

**Ribosomes, Endoplasmic Reticulum** – Structure, targeting and insertion of proteins in the ER, protein folding, processing and quality control in ER, smooth ER and lipid synthesis, export of proteins and lipids Golgi Apparatus – Organization, protein glycosylation, protein sorting and export from Golgi Apparatus Lysosomes

**Unit 3**

**A. Nucleus**

No. of Hours: 07

Nuclear envelope, nuclear pore complex and nuclear lamina Chromatin – Molecular organization Nucleolus

**B. Cell Cycle, Cell Death and Cell Renewal**

No. of Hours: 07

Eukaryotic cell cycle, Mitosis and Meiosis

**C. Cell Signalling**

No. of Hours: 06

Signalling molecules and their receptors Function of cell surface receptors Pathways of intra-cellular receptors – Cyclic AMP pathway, cyclic GMP and MAP kinase pathway



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**Semester-3**

9

TOTAL HOURS: 60

SEMESTER -3 (PRACTICALS)

CREDITS: 4

**BIOCHEMISTRY**

- 1 Properties of water, Concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts
- 2 Qualitative/Quantitative tests for carbohydrates, reducing sugars, non reducing sugars
- 3 Qualitative/Quantitative tests for lipids and proteins
- 4 Study of protein secondary and tertiary structures with the help of models
- 5 Study of enzyme kinetics – calculation of  $V_{max}$ ,  $K_m$ ,  $K_{cat}$  values
- 6 Study effect of temperature, pH and Heavy metals on enzyme activity

**Cell Biology**

- 7 Study a representative plant and animal cell by microscopy.
- 8 Cytochemical staining of DNA – Feulgen method
- 9 Identification and study of cancer cells by photomicrographs.
- 10 Study of different stages of Mitosis.
- 11 Study of different stages of Meiosis.

Ref: Voet, D. and Voet J.G (2004) Biochemistry 3<sup>rd</sup> edition, John Wiley and Sons,