

HEMCHANDRACHARYA NORTH GUJARAT UNIVERSITY

NAAC A (3.02) State University

PATAN- 384265

Faculty of Science

B. Sc. Microbiology

Syllabus/ scheme

Sem. – 3



Sem./CBCS/Grading pattern

w. e. f. June-2020



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.)

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

Semester-3

MB-302: Cell Biology
(THEORY)

TOTAL HOURS: 60

CREDITS: 3

Unit 1 Structure and organization of Cell,

No. of Hours: 20

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

Unit 2 Protein Sorting and Transport

No. of Hours: 20

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

Semester-3

3

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 3rd edition, John Wiley and Sons,

Semester-3

SUBJECT ELECTIVE

MB-SE-301 : INSTRUMENTATION AND BIOTECHNIQUES (THEORY)

TOTAL HOURS: 30

CREDITS: 2

Unit 1.

A. Chromatography

No. of Hours: 8

Principles and applications of paper chromatography (including Descending and 2-D), Thin layer chromatography, Column packing and fraction collection. Gel filtration chromatography, ion-exchange chromatography and affinity chromatography, GLC, HPLC.

B. Electrophoresis

No. of Hours: 7

Principle and applications of native polyacrylamide gel electrophoresis, SDS- polyacrylamide gel electrophoresis, 2D.gel electrophoresis, Isoelectric focusing, Agarose gel electrophoresis.

Unit 2

A. Spectrophotometry

No. of Hours: 8

Principle and use of study of absorption spectra of biomolecules. Analysis of biomolecules using UV and visible range. Colorimetry and turbidometry.

B. Centrifugation

No. of Hours: 7

Preparative and analytical centrifugation, fixed angle and swinging bucket rotors. RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and ultracentrifugation.

SUGGESTED READINGS

1. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.
2. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.
3. Willey MJ, Sherwood LM & Woolverton C J. (2013). Prescott, Harley and Klein's Microbiology. 9th Ed., McGraw Hill.
4. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
5. De Robertis EDP and De Robertis EMF. (2006). Cell and Molecular Biology. 8th edition. Lipincott Williams and Wilkins, Philadelphia.
6. Cooper G.M. and Hausman R.E. (2009). The Cell: A Molecular Approach. 5th Edition. ASM Press & Sunderland, Washington D.C., Sinauer Associates, MA.
7. Nigam A and Ayyagari A. 2007. Lab Manual in Biochemistry, Immunology and Biotechnology. Tata McGraw Hill.