

Syllabus of H.N.B. Garhwal University Based on NEP-2020

Program: B Sc

Subject: Biochemistry

(Note: The Department has decided to offer only Additional Inter-Disciplinary course for the time being)

First Year- (Semester I)

1. Additional Interdisciplinary-1 Theory

Title of Paper: MOLECULES OF LIFE (THEORY)

Code: SOLS/BIOCHEM/ ADD-ID -1 (T)

(MM: 30+70)

Total No. of Lectures: 40

(Credits: 2)

UNIT I :

Cellular and chemical foundations of life, Water: unique properties, Water as a biological solvent, weak interactions in aqueous systems, ionization of water, buffering action in biological system, water as a reactant and fitness of the aqueous environment. Henderson -Hasselbalch equation.

UNIT II:

Carbohydrates: Structure, occurrence and biological importance of monosaccharides, disaccharides, oligosaccharides and polysaccharides (Cellulose, glycogen and starch, chitin, agar). Fatty acids: Classification, structure and functions. Essential fatty acids. Triacylglycerols, saponification, halogenation, Acetyl number, Rancidity of fats.

UNIT III

Amino acids: Structure and classification of amino acids, physical and chemical properties. Protein structure: Classification of proteins, primary, secondary and tertiary structure of proteins

UNIT IV:

Nucleotides - structure and properties of bases, pentoses, nucleosides; Nucleic acid structure – Watson-Crick model of DNA, forms of DNA; Structure of major species of RNA - mRNA, tRNA and rRNA

Suggested Reading:

1. Lehninger's Principles of Biochemistry (2nd Ed 2000) D.L Nelson and M.M. Cox, Macmillan Worth Pub. Inc. NY.
2. Biochemistry (4th edn. 1992) by Lubert Stryer WH Freeman & Co., NY.
3. Biochemistry; Voet , D. and Voet, J.G. [Eds.] (1999) 3 Ed. Jhon Wiley and sons.

2 Additional Interdisciplinary-1 Practical

Title of Paper: AID- MOLECULES OF LIFE (PRACTICAL) (Credits: 2)
Code: SOLS/BIOCHEM/ ADD-ID -1 (P) (MM: 30+70)

Syllabus:

1. Safety measures in laboratories.
2. Preparation of normal and molar solutions.
3. Calibration of glass wares - pipettes, burettes and volumetric flasks (demonstration)
4. Preparation of buffers, phosphate and acetate buffers.
5. Qualitative tests for carbohydrates.
6. Qualitative test for lipids.
7. Qualitative test for amino acids, proteins.
8. Qualitative test for nucleic acids.
9. Separation of amino acids/ sugars/ bases by thin layer chromatography/paper chromatography.
10. Any other practical as per the facility in the department

First Year- (Semester II)

1. Additional Interdisciplinary-2 (Theory)

Title of Paper: AID- CELL BIOLOGY (THEORY)
Code: SOLS/BIOCHEM/ ADD-ID -2 (T) (MM: 30+70)
Total No. of Lectures: 40 (Credits: 2)

UNIT I

Morphology of cell, prokaryotic and eukaryotic cell structure, differences in plant and animal cell, structure and composition of plant and bacterial cell wall. Detailed structure and function of cell organelles i.e. nucleus, mitochondria and chloroplast, ribosomes, endoplasmic reticulum, golgi apparatus, peroxisomes, lysosomes and cytoskeleton.

UNIT II

The Cell Cycle. Overview and control. Cyclins, CDKs and Checkpoints.

UNIT III

Apoptosis and Necrosis, Development and causes of Cancer; Oncogenes, Tumor Viruses;

UNIT IV

Membrane lipids. Physical properties of lipids, Concept of fluidity and factors causing variations in fluidity. Micelles, liposomes, Lipid rafts. Membrane asymmetry.

Membrane transport: Channels, transporters and pumps (Na + K +). Active and passive transport.

Suggested Reading:

1. Molecular Biology of the Cells (3rd ed. 1994) by Alberts et al., Garland Publications Inc. NY and London
2. Cell biology (1993) by E.S. Sedava, Jones and Barlett Publishers Boston, London.

3. Cell and Molecular Biology (8th ed. 2001) by E.D.P. de Robertis & E.M.F. de Robertis (Jr)
Lippincott Williams & willkins, Philadelphia.
4. Principles of Cell Biology (1988) by Klein Smith and M. Kish, Harper-Cellins PUb. Inc.
New Delhi.

2. Additional Interdisciplinary-2 (Practical)

Title of Paper: AID- CELL BIOLOGY (PRACTICAL)

(Credits: 2)

Code: SOLS/BIOCHEM/ ADD-ID -1 (P)

(MM: 30+70)

Syllabus:

1. Study of mitosis and meiosis
2. Fractionation of Cell organelles
3. Extraction of Proteins from biological materials
4. Estimation of Proteins by Lowry's method
5. Protein separation methods: Precipitation, Chromatographic, Electrophoretic
6. Extraction and estimation of RNA
7. Extraction and estimation of DNA
8. Any other practical as per the facility in the department

Second Year- (Semester III)

1. Additional Interdisciplinary-3 (Theory)

Title of Paper: AID- CONCEPTS OF MOLECULAR BIOLOGY (THEORY)

Code: SOLS/BIOCHEM/ ADD-ID -3 (T)

(MM: 30+70)

Total No. of Lectures: 40

(Credits: 2)

UNIT I

Basic Concepts of genome and its organisation: Nucleic acid as the genetic material (Griffith's experiment, Avery, MacLeod and McCarty's experiment, Hershey-Chase experiment), Central Dogma of Molecular Biology, DNA, denaturation and renaturation of DNA, melting temperature (T_m), hyperchromic effect.

UNIT II

Replication of DNA in prokaryotes: Features of DNA Replication, Proof of semiconservative nature of DNA replication, Features of bidirectional DNA replication. Transcription: Transcription in prokaryotes with E. Coli as model system: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains.

UNIT III

Translation: Genetic code, properties of genetic code, Wobble hypothesis, Components of Protein synthesis machinery: Messenger RNA, tRNA structure and function, Charging of tRNA, aminoacyl tRNA synthetases, ribosome structure and assembly, Mechanism of protein synthesis in prokaryotes: initiation, elongation and termination.

UNIT IV

Gene regulation: Principles of gene regulation, negative and positive regulation, concept of operons, Regulation of gene expression in bacteria: lac operon concept.

Suggested Readings

1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R, Molecular Biology of the Gene, 7th edition, Cold Spring Harbour Laboratory Press, Pearson Publication.
2. Biochemistry, by Donald Voet and Judith Voet.
3. Genes xii Benjamin Lewin, Oxford Univ Press. London.
4. Biochemistry, by Lubert Stryer WH Freeman & Co., NY.

2. Additional Interdisciplinary-3 Practical

Title of Paper: AID- CONCEPTS OF MOLECULAR BIOLOGY (PRACTICAL) Credits: 2
Code: SOLS/BIOCHEM/ ADD-ID -3 (P) (MM: 30+70)

Syllabus:

1. Determination of absorption spectra of DNA and protein using UV-Visible spectrophotometer.
2. Estimation of DNA by diphenylamine reaction.
3. Estimation of RNA by orcinol method.
4. Using turbidometry (light scattering) to estimate microbial growth.
5. Measure the OD ratio at 260 and 280 nm for supplied DNA and protein samples.
6. Estimate purity of DNA sample.
7. Agarose gel electrophoresis of DNA Sample.
8. Any other practical as per the facility in the department

Second year - Semester IV

1. Additional Interdisciplinary-4 (Theory)

Title of Paper: AID-4: ENZYMOLOGY (THEORY)
Code: SOLS/BIOCHEM/ ADD-ID -4 (T) (MM: 30+70)
Total No. of Lectures: 40 (Credits: 2)

UNIT I

Introduction to enzyme catalysis: Features of enzyme catalysis, General mechanisms of catalysis, Nomenclature, IUB enzyme classification.

UNIT II

Enzyme kinetics: Concept of ES complex, active site, specificity, Michaelis-Menten equation. Significance of K_m and V_{max} . Enzyme activity, international units, specific activity, turnover number, Factors affecting enzyme activity, Allosteric enzymes.

UNIT III

Mechanisms of enzyme action and regulation: Mechanism of action of chymotrypsin. Enzyme inhibition: Competitive, noncompetitive and uncompetitive inhibition. Inhibitors of enzymes - antibiotics. Regulation of enzyme activity and its importance – aspartate transcarbamoylase.

UNIT IV

Enzymes in medicine and industry: Commercial application of enzymes in food, pharmaceutical and other industries, immobilized enzymes, Biosensors - glucose oxidase.

Suggested Reading:

1. Enzymes by M. Dixon, E.C. Webb, CJR Thorne and K.F. Tipton, Longmans, London.
2. Fundamentals of Enzymology, by Price, N. C. and Stevens, L. 3rd Edn. Oxford University Press, London.
3. Immobilized enzymes by inhiro Chibata, Halsted Press Book.
4. Enzyme structure and function by S. Blackburn , Marcel Dekker, Inc., NY

2. Additional Interdisciplinary-4 (Practical)

Title of Paper: AID-4: ENZYMOLOGY (PRACTICAL)

Code: SOLS/BIOCHEM/ ADD-ID -4 (P)

(Credits: 2)

(MM: 30+70)

Syllabus:

1. To Study Effect of amylase activity on Starch.
2. Determination of α -amylase of saliva.
3. Effect of substrate concentration on enzyme activity.
4. Effect of Salt concentration on enzyme activity.
5. Effect of pH, temperature, Time on enzyme activity.
6. Effect of different metal ions on enzyme activity,
7. Immobilization of enzyme in sodium alginate matrix
8. Any other practical as per the facility in the department