

B.Sc., Biotechnology: Choice based credit system

B.Sc., I Semester W.E.F. 2020-21

BT-101: Bio-molecules, Analytical Techniques, Bioenergetics & Biostatistics

Course Objectives:

To ensure students gain knowledge about the structure, properties and functions of bio-molecules and characterization of bio-molecules using analytical techniques. To learn the basics of Bioenergetics & Biostatistics.

Unit-I-Carbohydrates and Lipids

Classification, structure and functions of carbohydrates. Fischer and Haworth projection of Glucose, Isomers in monosaccharides (Optical isomers, Enantiomers, Diastereomers, Epimers and Anomers), Glycosidic bond, Reducing and non-reducing sugars. Classification of lipids based on structural complexity. Classification, Nomenclature and structure of saturated and unsaturated fatty acids. Isomers of fatty acids and its significance. Structure and functions of glycolipids, phospholipids, and cholesterol.

Unit-II- Nucleic acid and Proteins

Composition of nucleic acids. Structural units of nucleic acids- Nucleoside, Nucleotide and Oligonucleotide. Watson and Crick structure of DNA. Structure and types of RNA. Structure and properties of amino acids (amphoteric nature, absorbance, isomerism), Classification of amino acids (R group & Nutrition), peptide bond. Structural organization of proteins (primary, secondary, tertiary, quaternary). Renaturation and denaturation of DNA and proteins.

Unit-III-Centrifugation, Chromatography and Electrophoresis

Basic principles of sedimentation, Concept of RCF. Principle & applications of Differential and Density gradient centrifugations. Partition principle, Partition coefficient, Brief account of Paper and TLC. Principle, instrumentation and application of ion exchange, gel permeation, and affinity chromatography. Basic principles of electrophoresis, factors affecting electrophoretic migration. Principle and applications of Agarose gel electrophoresis and SDS PAGE.

Unit - IV-Spectroscopy, Microscopy and Laser Techniques

Beer-Lambert law, light absorption and transmission. Extinction coefficient, Principle and application of photoelectric calorimeter and UV-visible spectrophotometer. Basic principles of microscopy – Numerical aperture, resolution and magnification. Principle and applications of compound, confocal and electron microscopy (TEM, SEM). Radioactive and stable isotopes, rate of radioactive decay, units of radioactivity, measurement of radioactivity (scintillation counter and autoradiography)

Unit –V- Bioenergetics and Biostatistics

Free energy, entropy, enthalpy and redox potential. High energy compounds (ATP, PEP)

Glycolysis, TCA cycle, Electron-Transport System and Oxidative Phosphorylation. Mean, median, mode, standard deviation, One-way and Two-way Anova.

List of Practicals:

1. Introduction to basic instruments (Principle standard operation procedure) demonstration and record
2. Calculation of molarity, normality and molecular weight of compounds.
3. Qualitative analysis of carbohydrates (sugars)
4. Quantitative analysis of carbohydrates
5. Quantitative estimation of protein - Lowry / Biuret method
6. Estimation of DNA by diphenylamine reagent
7. Estimation of RNA by orcinol reagent
8. Assay of protease /amylase activity
9. Preparation of starch from potato and its hydrolyses by salivary amylase
10. Preparation of standard buffer and pH determination
11. Titration curve of Glycine
12. Separation of amino acids by paper chromatography
13. Agarose gel electrophoresis
14. Calculation of mean, median and mode

Mandatory 10 Practicals.*SCHEME OF VALUATION FOR PRACTICALS -50 M**

1. Major Experiment I- 20M
2. Major Experiment II – 20 M
3. Record – 10M

Textbooks for Biomolecules and Analytical Techniques

1. Outlines of Biochemistry, 5th Edition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA
2. Principles of Biochemistry, 4th edition, (1997), Jeffery Zubey; McGraw-Hill College, USA
3. Principles of Biochemistry, 5th Edition (2008), Lehninger, David Nelson & Michael Cox; W.H. Freeman and Company, NY
4. Fundamentals of Biochemistry, 3rd Edition (2008), Donald Voet& Judith Voet; John

Wiley and Sons, Inc. USA

5. Biochemistry, 7th Edition, (2012), Jeremy Berg & Lubert Stryer; W.H. Freeman and Company, NY
6. An Introduction to Practical Biochemistry, 3rd Edition, (2001), David Plummer; Tata McGraw Hill Edu. Pvt.Ltd. New Delhi, India
7. Biochemical Methods, 1st Edition, (1995), S. Sadashivam, A. Manickam; New Age International Publishers, India
8. Textbook of Biochemistry with Clinical Correlations, 7th Edition, (2010), Thomas M. Devlin; John Wiley and Sons, USA
9. Proteins: biotechnology and biochemistry, 1st edition, (2001), Gary Walsch; Wiley, USA
10. Biochemical Calculations, 2nd Ed., (1997), Segel Irvin H; John Wiley and Sons, NY
11. Biophysical Chemistry Principles & Techniques Handbook, (2003), A. Upadhyay, K. Upadhyay, and N. Nath
12. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001), Palmer Trevor, Publisher: Horwood Pub. Co., England.
13. Analytical Biochemistry, 3rd edition, (1998), David Holmes, H. Peck, Prentice-Hall, UK
14. Introductory Biostatistics, 1st edition, (2003), Chap T. Le; John Wiley, USA.
15. Methods in Biostatistics, (2002), B. K. Mahajan –Jaypee Brothers.
16. Statistical methods in biology, (1995), Bailey, N. T.; Cambridge university press

Web Links for Additional information:

1. <https://nptel.ac.in/courses>
2. <http://illl.du.ac.in/>
3. <http://epgp.inflibnet.ac.in>
4. <https://www.biologysimulations.com/cell-energy>
5. <https://www.onlinebiologynotes.com/>
6. <https://www.youtube.com/watch?v=9f34MaHVy-E>
7. <https://youtu.be/P12K4hn7N9Y>
8. <https://youtu.be/wvTv8TqWC48>
9. <https://www.youtube.com/ricochetscience>

Virtual Lab Links

1. <https://libguides.cmich.edu/biology/multimedia>
2. <https://library.csi.cuny.edu/oer/virtuallabs-simulations>
3. <https://li.wsu.edu/teaching-tool-boxes/options-for-virtual-labs-and-simulationsfor-laboratory-based-courses/>
4. <https://www.labster.com/new-products/>
5. <https://www.labster.com/simulations/>
6. <https://www.vlab.co.in/>
7. <https://praxilabs.com/>
8. <https://digitalllearning.ucf.edu/ilab/remote-labs/college-of-sciences-remote-labresources/>
9. <https://vlab.amrita.edu/index.php>
10. <https://sites.dartmouth.edu/teachremote/remote-lab-activities-and-experiences>