

Course Code	Course Name	Credits
26BT004	ANALYTICAL TECHNIQUES	04

Course Objectives

- Gain knowledge in preparing samples and selecting appropriate techniques for qualitative and quantitative analysis.
- Gain the knowledge on modern instrumental techniques, the principles underlying them and their applications in the characterization of materials.
- Develop the skills to understand the theory and practice of bio analytical techniques.
- Provide scientific understanding of analytical techniques and detail interpretation of results.
- Gain hands-on skills in operating, calibrating, and maintaining analytical equipment.

Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Understand the principles, applications, and limitations of analytical techniques like HPLC, spectroscopy, microscope and Electrophoresis.
- Familiarity with working principals, tools and techniques of analytical techniques.
- Understand the strengths, limitations and creative use of techniques for problem-solving
- Develop experimental skills to perform, monitor and analyse the reactions.
- Choose appropriate analytical techniques for analyzing specific sample complexities

Unit 1 - Importance of Analytical Techniques in Biotechnology (10 Hrs.)

Protein extraction and quantitation, modern approaches in bioanalysis and bioassays, radioisotope techniques, concepts, autoradiography, RIA, applications in biological sciences.

Unit 2 - Principles and applications of microscopy (12 Hrs.)

Bright and dark-field, phase contrast, fluorescence microscopy, confocal microscopy; atomic force microscopy; scanning tunneling microscopy, electron microscopy: TEM and SEM

Unit 3 - Spectrometry (13 Hrs.)

UV-Visible spectrometry, fluorescence spectrometry, IR spectrometry, CD spectrometry, Fourier transform infrared spectrometry (FTIR), principles and applications of different chromatographic techniques, mass spectrometry (LCMS), gas chromatography–mass spectrometry (GCMS), atomic absorption spectrometry (AAS)

Unit 4 - General principles of electrophoretic techniques (15 Hrs.)

Poly Acryl amide Gel Electrophoresis. Isoelectric focusing. Isotachopheresis. 2-D Electrophoresis. Capillary electrophoresis. Agarose gel electrophoresis of DNA and RNA. Blotting techniques. DNA fingerprinting.

Unit 5 - Diffraction Technique (10 Hrs.)

Crystal geometry and structure: Introduction to lattice and lattice systems, Bragg's plane, miller indices. Principle of diffraction and X-ray diffraction: X-rays production, X- ray spectra, Bragg's law and intensity of X- rays, single crystal XRD, macromolecular XRD (protein crystallization, data collection and structure solution).

Reference Books:

1. I. D. Campbell, Biological spectroscopy (Benjamin/Cummings Pub. Co, Menlo Park, Calif, 1984), Biophysical techniques series.
2. K. Wilson, J. M. Walker, Eds., Principles and techniques of biochemistry and molecular biology (Cambridge University Press, Cambridge, UK : New York, 7th ed., 2009).
3. R. F. Boyer, Biochemistry laboratory: modern theory and techniques (Prentice Hall, Boston, 2nd ed., 2012).
4. R. Katoch, Analytical techniques in biochemistry and molecular biology (Springer, New York, 2011).
5. D. L. Spector, R. D. Goldman, Eds., Basic methods in microscopy: protocols and concepts from cells: a laboratory manual (Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y, 2006).
6. R. L. Switzer, Experimental biochemistry (W. H. Freeman and Co, New York, 3rd ed., 1999).
7. R. F. Boyer, Modern experimental biochemistry (Benjamin Cummings, San Francisco, 3rd ed., 2000).
8. J. R. Lakowicz, Principles of fluorescence spectroscopy (Springer, New York, 2006; <http://site.ebrary.com/id/10229235>).
9. B. Fultz, Transmission electron microscopy and diffractometry of materials (Springer, Berlin ; New York, 2nded., 2002).
10. D. B. Williams, C. B. Carter, Transmission electron microscopy a textbook for materials science (Springer, New York, 2009; <http://dx.doi.org/10.1007/978-0-387-76501-3>).
11. R. M. Silverstein, Spectrometric identification of organic compounds (John Wiley & Sons, Hoboken, NJ, 7thed., 2005).
12. D. Harvey, Modern analytical chemistry (McGraw-Hill, Boston, 2000).