Course Code	Course Title	L	T	P	C
1151BT101	**Analytical Techniques and Instrumentation**	3	0	0	3

Course Category : *Program Core*

a. Preamble : *To study various analytical techniques and instrumentation involved in identifying the physical and chemical makeup or characteristics of a particular sample.*

b. Prerequisite Courses : *None*

c. Related Courses : *None*

d. Course Outcomes : *Upon the successful completion of the course, students will be able to:*

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	To explain the principles of various spectrometric techniques	K2
CO2	To comprehend the basic principles of general instrumentation and calibration	K2
CO3	To distinguish between different types of microscope with their underlying principles, applications.	K3
CO4	To choose separation techniques appropriately	K3
CO5	To demonstrate knowledge in radioisotope techniques and instrumentation.	K3

		PROGRAMME OUTCOMES											
COs		1	2	3	4	5	6	7	8	9	10	11	12
CO1	To explain the principles of various spectrometric techniques	L	L	H	L	H	L	L	L	L	M	L	M
CO2	To comprehend the basic principles of general instrumentation and calibration	M	H	L	H	M	L	L	L	L	L	L	L
CO3	To distinguish between different types of microscope with their underlying principles, applications.	L	L	L	L	H	L	L	L	L	L	L	M

CO4	To choose separation techniques appropriately	H	H	H	L	L	L	L	L	L	L	L	L
CO5	To demonstrate knowledge in radioisotope techniques and instrumentation.	H	L	M	L	M	H	L	L	L	L	L	L

e. ***Course Content:***

UNIT I **INTRODUCTION TO SPECTROMETRY**

Properties of electromagnetic radiation–wave properties–components of optical instruments–Sources of radiation wavelength selectors–sample containers – radiation transducers-Signal process and read outs – signal to noise ratio – sources of noise – Enhancement of signal to noise- types of optical instruments – Principle of Fourier Transform optical Measurements.

UNIT II **MOLECULAR SPECTROSCOPY**

Molecular absorption spectrometry – Measurement of Transmittance and Absorbance–Beer's law – Instrumentation –Applications –Theory of fluorescence and Phosphorescence – Instrumentation – Applications – Theory of Infrared absorption spectrometry – IR instrumentation – Applications – Theory of Raman spectroscopy – Instrumentation – applications.

UNIT III **MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY**

Theory of NMR – environmental effects on NMR spectra – chemical shift- NMR spectrometers - Molecular mass spectra – Ion sources – Mass spectrometer. Applications of molecular mass – Electron paramagnetic resonance–*g* values – instrumentation.

UNIT IV **SEPARATION METHODS**

General description of chromatography – Band broadening and optimization of column performance- Liquid chromatography – Partition chromatography – Adsorption chromatography – Ion exchange chromatography -size exclusion chromatography- Affinity chromatography- principles of GC and applications – HPLC- Capillary electrophoresis – Applications.

UNIT V **ELECTRO ANALYSIS AND SURFACE MICROSCOPY**

Electrochemical cells–Electrode potential cell potentials – potentiometry – reference electrode – ion selective and molecular selective electrodes – Instrument for potentiometric studies – Voltametry – Cyclic and pulse Voltametry– Applications of voltametry. Study of surfaces – Scanning probe microscopes – AFM and STM.

TEXT BOOKS

1. Skoog, D.A. F. James Holler, and Stanky, R.Crouch "Instrumental Methods of Analysis". Cengage Learning, 2007.
2. Willard, Hobart, et al., "Instrumental Methods of Analysis". 7th Edition, CBS, 1986.
3. Braun, Robert D. "Introduction to Instrumental Analysis". Pharma Book Syndicate, 1987.
4. Ewing,G.W. "Instrumental Methods of Chemical Analysis", 5th Edition, McGraw- Hill,1985.

REFERENCES

1. Sharma, B.K. "Instrumental Methods of Chemical Analysis: Analytical Chemistry" Goel Publishing House, 1972.
2. Haven, Mary C., et.al. "Laboratory Instrumentation ". 4th Edition, John Wiley, 1995.