Programme: M. Sc. Part-II (Analytical Chemistry)
Course Code: ACC-504
Title of the Course: Spectral methods of analysis
Number of Credits: 3 **Effective from AY:** 2019-20

Prerequisites for the course:	Students should have studied the theory/ instrumentation and application of some of the basic analytical techniques at B. Sc. or M. Sc. Part I level for better understanding of the course content	
Course Objectives:	1. Introduction of various spectral methods for analysis. 2. Evaluate the utility of various analytical techniques as a qualitative and quantitative tool.	
Course Outcomes:	1. Students should be in a position to understand theory and instrumentation of various spectral methods of analysis. 2. Understanding application of studied methods for qualitative and quantitative estimation at trace level.	
Content:	**1. Automation of Analytical Method**: An overview of automated system; definition; distinction between automatic and automated system; advantages and disadvantages by automation; types of automated techniques. Discrete and continuous automation, Introduction to Flow injection analysis. **2. X-ray Absorption, Diffraction; Neutron Diffraction and Fluorescence Spectroscopy:** Introduction; origin of X-rays; interaction of X-ray with matter; X-ray spectrometer; theory of X-ray absorption; X-ray diffraction by crystal; comparison of X-ray absorption with X-ray diffraction; Bragg's law; interpretation of X-ray diffraction powder pattern; calculation of lattice parameters; neutron diffraction introduction; theory; instrumentation and applications; X-ray fluorescence- introduction; applications. Introduction to Mossbauer spectroscopy; theory and application. **3. Molecular Fluorescence, Phosphorescence and Chemiluminescence Spectroscopy**: Introduction; meaning of luminescence and chemiluminescence; principles of fluorescence, chemical structure and fluorescence; theory of molecular fluorescence; instrumentation- single and double beam filter fluorimeters, relationship between intensity of fluorescence and concentration; spectrofluorometer; phosphorimeter; factors influencing fluorescence and phosphorescence; basic differences in measurement of fluorescence and phosphorescence; advantages; limitations and precautions; selection of excitation wavelength for analysis; reporting fluorescence spectra; applications of fluorimetric analysis. Chemiluminescence: Introduction; principle; types; chemiluminescence with Luminol, instrumentation; measurement of chemiluminescence; quantitative chemiluminescence; Introduction to gas phase chemiluminescence analysis, chemiluminescence titrations and electro-chemiluminescence. **4. Microscopy:** Chemical microscopy- microscope; parts and optical path; numerical aperture and significance; applications and qualitative and quantitative study;	5 hrs 10hrs 12hrs 9 hrs

	Electron microscopy- principle, operation, sample preparation, replicas, shadowing, application to analysis; electron probe analyzer, ion microscope; metallography- metallurgy, microscopic examination; specimen preparation and examination; interpretation of micrographs; SEM, TEM, AFM. Introduction to Magnetic resonance imaging (MRI) technique and Photo acoustic spectroscopy ; theory and applications	
Pedagogy:	lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
Text Books/ References / Readings	1. D. A. Skoog, *Principles of Instrumental Analysis*, Sounders, 1997, 5th Ed. 2. B. D. Cullity, *Elements of X- ray Diffraction*4, Addison Wisley, 1967 3. J. Wormald, *Diffraction Method*, Oxford University, Press, 1973 4. Baun, G.E. Butleworth, *Neutron Scattering in Chemistry,* London, 1971 5. N.N. Greenwood, T.C. Gibbs, *Mossbauer Spectroscop,* Chapmann Hall; 1971 6. V. I. Goldanski, R. H. Harber, *Chemical Application of Mossbauer Spectroscopy,* Academic Press, 1968 7. C.N.R. Rao, G.R Ferraro, *Spectroscopy in Inorganic Compounds,* Academic Press, 1970 8. R. Cheney, *Basic Principles of Spectroscopy,* Mac Grows Hill, 1971 9. M. A. Brown, R. C. Semelka; *MRI: Basic Principles and Applications*, Wiley, Chichester, 1995 10. K. burger, London, Butterworth group Coordination Chemistry: Experimental Methods; CRC Press, 1973 11. R.S. Drago, *Physical Principles in Inorganic Chemistry*, Reinhold Publishing Corp., New York, 1965 12. R. D. Broun, *Introduction to Instrumental Analysis,* Mc Graw Hill, 1987 13. A. M. Garcia-Campana, *Chemiluminescence in Analytical Chemistry,* CRC Press; 2001	