

Programme Name	Pre-Ph.D. Course Work	Programme Code	23
Course Code	DSE704	Credit	3
Year/Sem	1/1	L-T-P	3-0-0
Course Name	Applied Analytical & Instrumental Techniques in Research		
Objectives of the Course:			
<ol style="list-style-type: none"> 1. To understand the fundamental principles, instrumentation, and applications of major spectroscopic techniques including UV-Visible and Infrared spectroscopy for structural and qualitative analysis of chemical compounds. 2. To develop conceptual and practical knowledge of chromatographic and volumetric analytical methods for separation, identification, and quantitative estimation of chemical species. 3. To acquire knowledge of advanced microscopic and diffraction techniques such as XRD, SEM, and TEM for characterization of molecular and material structures. 			
UNIT I (Total Topics-12 and Hrs-12)			
UV-Visible spectroscopy			
Basic principle, Various electronic transitions, Beer-Lambert law, instrumentation and working UV spectrophotometer, Effect of solvent on electronic transitions, Molar extinction coefficient, maximum wavelength(λ_{max}), Concept of chromospheres and auxochromes, Bathochromic, Hypsochromic, Hyperchromic and Hypochromic, Woodward-Fiesher rule and its application for identification of chemical species			
UNIT- II (Total Topics- 12 and Hrs-12)			
Infrared spectroscopy			
Basic principle, Instrumentation, Selection rules, Fundamental modes of vibration, overtones, combination bands, Fermi resonance, Factors affecting IR spectra, Effect of hydrogen bonding, Solvent effect on IR of gaseous, solids and polymeric interactions with molecules, Means of excitation (light sources), Detection of the signal, Advantages of FTIR, Interpretation of IR spectra of aliphatic, aromatic hydrocarbons, amines, amides, carbonyl compounds etc.			
Unit-III (Total Topics-10 and Hrs-10)			
Chromatography and Analytical Techniques			
Types of Chromatography, TLC, Paper, HPLC and GC. Applications of chromatographic techniques, Instrumentation of HPLC and GC, Rf Value Measurement of pH, Buffer solutions, Conductivity, Volumetric Analysis, Types of Volumetric Analysis: Acid Base, Precipitation, Complexometric and Redox Titrations, Advantages, applications			
Unit-IV (Total Topics-8 and Hrs-6)			
Microscopic & Xray Techniques			
Principle, Different Microscopic Techniques, X- ray Diffraction: Interaction of X-ray with matter, Absorption, Scattering and Miller indices, Reciprocal lattice, Bragg's law, Instrumentation and applications. Introduction, principle and applications of SEM and TEM.			
CO1: Demonstrate understanding of spectroscopic principles and interpret UV-Visible and IR spectra for molecular characterization.			
CO2: Perform separation and quantitative analysis using chromatographic and volumetric analytical techniques.			
CO3: Evaluate crystalline and surface morphology characteristics using XRD, SEM, and TEM techniques.			