

Course No.	Course Name	L-T-P-Credits
CY 409	Analytical and Environmental Chemistry	3-0-0: 03
Prerequisite: NIL		
Course Objectives:	The main objective of the course is to provide a basic knowledge and understanding of essential chemical and physical principles for analytical chemistry and to introduce basic analytical techniques and practical aspects of classical chemical analysis. Another important objective of the course is to solve problems related to environmental pollution by interpreting the analytical results obtained in chemical analysis.	
Course Outcomes:	After successful completion of the course, students will be able to:	
	<ol style="list-style-type: none"> 1. Explain the theoretical aspects of important analytical techniques and instruments. 2. Carry out the correct sample preparation as well as characterization before analysis by the selected techniques or instruments. 3. Understand the key concepts analytical and physical chemistry and will apply them to environmental issues. 	
SYLLABUS		
Module	Contents	Hours
I	Errors in Chemical Analysis Significant figures, types of error, sources of errors and their effect upon the analytical results, precision, accuracy, mean deviations and standard deviation, statistical treatment of analytical data, method of least squares and methods for reporting analytical data.	06
II	Chromatographic Techniques Ion exchange chromatography, separation by adsorption-affinity techniques, affinity elution from ion exchangers and other adsorbents, electrophoresis, polyacrylamide gel electrophoresis, capillary electrophoresis in rotation-stabilized media, electrophoresis in stabilized salts. HPLC: Theory and instrumentation, adsorption chromatography, liquid-liquid partition techniques, microbore and capillary chromatography, affinity techniques, size exclusion, ion pair separations, chiral and isotope separations, applications and problems. Gas chromatography: Theory and instrumentation, column types, solid/liquid stationary phases, column switching techniques, basic and specialized detectors, elemental detection, chiral separations.	08
III	Thermal Methods Theory, instrumentation and applications of thermogravimetric	06

	analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC), thermometric titrations.	
IV	<p>Optical Methods</p> <p>Atomic absorption and flame emission spectroscopy, fluorescence spectrometry - theory, instrumentation and applications, circular dichroism, X-ray methods: X-ray absorption and X-ray diffraction, photoelectron spectroscopy, scanning electron microscopy (SEM), transmission electron microscopy (TEM).</p>	08
V	<p>Environmental Pollution</p> <p>Environment and it's segments, Ecosystems, Biogeochemical cycles of carbon, nitrogen and sulphur.</p> <p><i>Air Pollution:</i> Major regions of atmosphere, Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical Smog: its constituents and photochemistry, Environmental effects of Ozone, Major sources of Air pollution. Effects of air pollution on living organisms and vegetation, Controls of air pollution, Climate change, Green house effect, global warming.</p> <p><i>Water Pollution:</i> Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems.</p> <p><i>Energy and Enviornment:</i> Sources of energy: Coal, petrol and Natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel etc.</p>	08

Essential Readings:

1. Colin Baird and Michael Cann, Environmental Chemistry, 4th Edition, 2008.
2. D. A. Skoog, F. J. Holler and S. R. Crouch, "Principles of Instrumental Analysis", Cengage Learning, 6th Edition, 2014.

Supplementary Readings:

1. J. Mendham, R. C. Denney, M. J. K Thomas and D. J. Barnes, "Vogel's Quantitative Chemical Analysis", Pearson, 6th Edition, 2009.
2. G. D. Christian, "Analytical Chemistry", Wiley India, 6th Edition, 2004.
3. H. H. Willard, L. L. Merritt and J. A. Dean, "Instrumental methods of analysis", CBS Publishers & Distributors Pvt. Ltd, 7th Edition, 1986.