Semester-VI
ELECTRONIC SCIENCE

DEPARTMENT OF INSTRUMENTATION
Category I

(B.Sc. Honours in Instrumentation)

DISCIPLINE SPECIFIC CORE COURSE – 16: Analytical Instrumentation II (INDSC6A)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Analytical Instrumentation II (INDSC6A)	04	03	-	01	Class XII passed with Physics + Mathematics/Applied Mathematics + Chemistry/ Computer Science/Informatics Practices	Understanding of electronics and Chemistry till class XII

Learning Objectives

- To understand the perspective of different advanced analytical methods
- To understand the principle, instrumentation, and application of various electro analytical instruments
- To disseminate with principle and instrumentation of thermo analytical instruments along with their applications for analysing products of different origin
- To familiarize with detail principle, instrumentation, operation and applications of IR spectroscopy
- To differentiate between principle, instrumentation and operation of Atomic absorption and atomic emission spectroscopy.
- To understand the principle, instrumentation, and applications of Gas Chromatography (GC) and High-Performance Liquid Chromatography (HPLC)

Learning outcomes

At the end of this course, students will be able to

- Appreciate the potential of different analytical methods for resolving various scientific challenges.
- Describe the principle, instrumentation and application of electro analytical instruments.
- Understand the principle and instrumentation of thermo analytical instruments along with their applications for analyzing products of different origin.
- Understand the different terms, principle, instrumentation, operation, and applications of IR spectroscopy.
- Differentiate between principle, instrumentation and operation of atomic absorption spectroscopy and atomic emission spectroscopy.

SYLLABUS OF DSC-16

Unit-1 **(14 hours)**

Infrared Spectroscopy: Theory, diatomic molecule as a simple harmonic oscillator, instrumentation, sample handling techniques. Fourier Transform Infrared Spectroscopy (FTIR): instrumentation and advantages.

Atomic Spectroscopy: Principle, comparison of atomic and molecular spectroscopy, Atomic emission spectroscopy (AES): Flame photometer and its instrumentation, atomization process, types of flames- fuel/ oxidant combinations, instrumentation, Interferences and applications. Introduction to Atomic absorption spectroscopy (AAS).

Unit-2 **(10 hours)**

Electro analytical Methods of Analysis: Potentiometry: Introduction, reference electrode, indicator electrodes, ion-selective electrodes: glass electrode and liquid membrane electrode and their applications, potentiometric titrations.

Unit-3 **(12 hours)**

Gas Chromatography (GC): Principle, Carrier gasses, different types of injection systems, columns, stationary phases, and detectors. Isothermal mode, temperature-programming mode, applications.

Unit-4 **(9 hours)**

High Performance Liquid Chromatography (HPLC): mobile phase, isocratic and gradient elution, pumps, injection systems, columns, stationary phases, normal phase and reverse phase chromatography, detectors, and applications.

Practical component: **(30 hours)**

1. Determination of concentrations of sodium/calcium/lithium/potassium in sample using Flame Photometer.

2. Determination of concentration of sodium/calcium/lithium/potassium ions in sample by standard addition method using flame photometer
3. Spectrum interpretation using FTIR.
4. Qualitative/Quantitative analysis of samples using Gas chromatography.
5. Qualitative/Quantitative analysis of samples using High Performance Liquid Chromatography
6. Potentiometric titrations: (i) Strong acid with strong base (ii) weak acid with strong base and (iii) dibasic acid with strong base
7. Potentiometric titration of Mohr's salt with potassium dichromate
8. pH metric titrations of (i) strong acid and strong base (ii) weak acid and strong base

Essential/recommended readings

1. Skoog & Lerry, Instrumental Methods of Analysis, Saunders College Publications, New York, 4th edition, 1970.
2. H.H. Willard, L.L Merrit, J.A. Dean, F. A. Settle, Instrumental Methods of Analysis, CBS Publishers, 7th edition, 1988.
3. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 6th edition, 2007
4. James W. Robinson, Eileen Skelly Frame, George M. Frame II, Undergraduate Instrumental Analysis, CRC Press, 7th edition, 2014
5. Vogel's Textbook of Qualitative Chemical Analysis, ELBS, 4th edition 1978.

Suggestive readings

1. W. Kemp, Organic Spectroscopy, ELBS, 3rd Edition, 1996.
2. R.S Khandpur, Handbook of Analytical Instruments, Tata McGraw-Hill, 3rd Edition 2006.
3. B.K Sharma, Instrumental Methods of Chemical Analysis, Krishna Prakashan Media, 1st Edition, 2011

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.