DISCIPLINE SPECIFIC CORE COURSE – 7: Analytical Instrumentation I (INDSC3A)

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 I (INDSC3A)	**04**	**02**	**0**	**02**	**Course admission eligibility**	**Basic knowledge of chemistry**

Learning Objectives

The Learning Objectives of this course are as follows:

- To familiarize with the classification of analytical methods
- To understand the fundamentals of qualitative and quantitative analysis concepts.
- To categorize and understand the principle behind various separation techniques (planar and columns) and their instrumentation.
- To understand the principle, instrumentation and applications of visible and ultraviolet molecular spectroscopy

Learning outcomes

The Learning Outcomes of this course are as follows:

- Understand the classification of analytical methods
- Comprehend fundamentals of qualitative and quantitative analysis
- Differentiate between principle, instrumentation and operation of PaperChromatography and Thin layer chromatography
- Identify various Column Chromatographic techniques and their instrumentation
- Understand the concept of UV-Visible spectroscopy

SYLLABUS OF DSC-7

UNIT – I **(8 hours)**

Introduction to Analytical methods: Classification of Analytical Methods: Classical and Instrumental, Types of Instrumental Methods, Various sample extraction techniques. Instruments for analysis, Calibration of instrumental methods, Selecting an analytical method

UNIT – II **(7 hours)**

Chromatographic Separation methods: Planar Chromatographic methods: Principle and applications of Paper Chromatography, Thin layer chromatography (TLC) and High-Performance Thin Layer Chromatography (HPTLC).

UNIT – III **(8 hours)**

Column Chromatography: General Description of column chromatography, Classification of Chromatographic Methods, Elution in Column Chromatography, Migration rate of solutes, Band Broadening and column efficiency, Optimization of Column Performance.
Gel Permeation Chromatography (GPC): Principle, Instrumentation and Applications.

UNIT – IV **(7 hours)**

Molecular Spectro-analytical Methods of Analysis: Colorimetry and Spectrophotometry: Introduction, theory: molecular energy levels, types of molecular transitions, Lambert-Beer's Law and limitations, Instrumentation of single beam and double beam instrument.

Practical component: **(60 hours)**

1. Preparation of solutions and buffers.
2. Introduction to the use of Analytical Equipment (Analytical Balance, Volumetric Glassware, pH meter).
3. To extract the spinach pigments using liquid-liquid extraction.
4. Separation of plant pigments by paper chromatography.
5. Separation of food colours by paper chromatography.
6. Separation of pharmaceutical sample mixture using thin layer chromatography.
7. Separation of amino acids/sugar/carbohydrates by Thin Layer Chromatography.
8. Separation of cobalt chloride and Blue Dextran mixture by Gel Permeation Chromatography.
9. To study the effect of various solvents on membrane permeability of beetroot using visible spectroscopy
10. Determination of pKa value for a dye using visible spectroscopy.
11. Spectrometric determination of iron in water samples using double beam spectrophotometer.
12. To identify the given unknown colourless samples using UV spectrophotometer.

Essential/recommended readings

1. H.H. Willard, L.L Merrit, J.A. Dean, F. A. Settle, Instrumental Methods of Analysis, CBS Publishers, 7th edition, 2004.
2. Skoog, Holler and Crouch, Principles of Instrumental Analysis, Cengage Learning, 7th edition, 2016.
3. James W. Robinson, Eileen Skelly Frame, George M. Frame II, Undergraduate Instrumental Analysis, CRC Press, 7th edition, 2014
4. Vogel's Textbook of Qualitative Chemical Analysis, ELBS, 6th edition 2009.

Suggestive readings

1. W. Kemp, Organic Spectroscopy, ELBS, 3rd Edition, 2019.
2. R.S Khandpur, Handbook of Analytical Instruments, Tata McGraw-Hill, 3rd Edition 2015.
3. B.K Sharma, Instrumental Methods of Chemical Analysis, Krishna Prakashan Media, 1st Edition, 2011