CREDIT DISTRIBUTION, ELIGIBILITY, AND PRE-REQUISITES OF THE COURSE

DISCIPLINE SPECIFIC ELECTIVE COURSE – 03

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Analytical Techniques in Pesticide analysis	**4**	**2**	**0**	**2**	**-**	**NIL**

Course objectives

The Learning Objectives of this course are as follows:

- To understand the principles behind preparing standard solutions, analytical reagents, qualitative reagents, and indicators.
- To Learn to construct standard curves essential for titrimetric and analytical applications.
- To learn the fundamentals and practical applications of separation methods including solvent extraction, thin layer chromatography (TLC), paper chromatography, and column chromatography.
- To gain insight into the applications of instrumental techniques like Ultraviolet-visible (UV-Vis) spectroscopy, infrared (IR) spectroscopy, atomic absorption spectroscopy (AAS), and mass spectrometry (MS)
- To understand how these methods are applied in pesticide formulation analysis and quality control.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Learn chromatography (TLC, paper, and column methods) to effectively isolate and identify agrochemical compounds from environmental and food samples.
- Critically Evaluate Analytical Methods
- Independently prepare reliable standard solutions and reagents required for a variety of analytical and titrimetric analyses in pesticide assessment.
- Analyze complex data sets, making informed decisions about method suitability and analytical outcomes.

SYLLABUS OF DSE- 03

THEORY COMPONENT-

UNIT 1: (6Hours)

Preparation of Solutions for Analytical and Titrimetric Applications:

Preparation of solutions for standard curves, analytical reagents, qualitative reagents, indicators and standard solutions for acid-base, oxidation- reduction and complexometric titration.

UNIT 2: (8 Hours)

Chemical analysis in Pesticide formulation: Titrimetric Methods: Acid-base,non-aqueous, iodimetric titration, oxidation-reduction (redox), precipitation and complexometric titrations

UNIT 3: (6 Hours)

General methods of characterization, separation and purification: Agrochemical compounds from soil, food stuff etc, Solvent extraction, Thin layer chromatography, paper chromatography and column chromatography

UNIT 4: (10Hours)

Instrumental analysis in Agro-chemistry:Applications of gas chromatography and liquid chromatography. Applications of Ultraviolet-visible spectroscopy, infrared spectroscopy, Atomic absorption spectroscopy, Mass spectrometry.

PRACTICAL COMPONENT (60Hours)

1. Extraction of pesticides from water samples using immiscible organic solvents.
2. Extract pesticide residues from soil using a solvent mixture.
3. Extraction from Leafy Vegetables (Spinach/Cabbage)
4. Extract Cleanup using Solid Phase Extraction (SPE)
5. To identify and compare multiple pesticides by determining their **$R_f$values** using **TLC** with suitable **mobile phases** and **visualization methods**. (e.g., Malathion, Carbaryl, Atrazine,
   2,4-D, Endosulfan)
6. Quantitative analysis of Pesticides using UV-Vis spectroscopy
7. To verify Beer-Lambert's law and prepare a calibration curve for a pesticide that absorbs in the UV-visible range (e.g., malathion**,** carbaryl**,** 2,4-D**, or** glyphosate**).**

8. To identify the functional groups**,** present in pesticide samples using Fourier Transform Infrared (FTIR) spectroscopy by analyzing their characteristic absorption bands.
9. To identify the structure of a pesticide for which mass spectra data is provided.

ESSENTIAL/RECOMMENDED READINGS

1. R.J Cremlyn, Agrochemicals: Preparation and mode of Action, 2nd Edition, Wiley Blackwell publishers, New Jersey (1991).
2. S.M Khopkar, Concepts in Analytical Chemistry, 3rd Edition, New Academic Science, New York (2008).
3. Willard, Merittee and Dean, Instrumental methods of Analysis, 5th Edition, Van Nostrand Publishers, Newyork (1974).

KEYWORDS: Analytical Applications, Titrimetric Applications, Chemical analysis in Pesticide formulation, Separation and purification techniques, Instrumental analysis in Agro-chemistry

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