

## DISCIPLINE-SPECIFIC ELECTIVE COURSE - 21 (DSE-21)

### Advanced Analytical Techniques for Inorganic Compounds

#### 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		
Advanced Analytical Techniques for Inorganic Compounds (DSE-21)	4	2	--	2	--	--

#### Learning Objectives

This course is to equip students in handling advanced analytical instruments and techniques important for analysing inorganic compounds.

#### Learning outcomes

- By the end of the course, the students will be able to:
- To apply the fundamentals of various types of spectroscopic techniques like UV, IR, EPR and Mossbauer spectroscopy and applications of these techniques to interpret data.
- To describe the advancement in spectroscopic methods like IR, UV, EPR and Mossbauer and can recognize necessity of these techniques in the field of analytical science.
- To perform quantitative and qualitative measurements of samples by IR, UV.
- To use different techniques like liquid-liquid extraction, counter current extraction, digestion and solid phase extraction for sample preparation
- To be able to identify, recognize and compare principle, instrumentations and application of Atomic Absorption Spectroscopy (AAS), inductively coupled plasma atomic emission spectroscopy (ICP-AES),

#### SYLLABUS OF DSE-21

##### Unit 1:

(04 Hours)

Purification and drying of solvent. Reagents used in undergraduate laboratory: preparation, purification and handling.

**Unit 2:****(10 Hours)**

Introduction, Physical and Chemical Principles, Spectrometers, Detection, Calculation, and Output, Analytical Information: Qualitative and Quantitative, Applications

Instrumental techniques in laboratory: Infrared spectrophotometer, UV-Visible spectrophotometer. Column chromatography and metal ions separation through ion exchange chromatography.

**Unit 3:****(10 Hours)**

Atomic Absorption and Emission Spectrometry: Introduction, hollow cathode lamp as a source and its working, premix chamber burner and total consumption burner, Flame atomizer - principle and working mechanism of electrothermal atomizers, line width, different interferences observed in AAS. Inductively Coupled Plasma Atomic Emission Spectroscopy.

**Unit 4:****(06 Hours)**

Introduction to EPR and Mossbauer spectroscopy and their Applications.

**Keywords:** Solvent, Reagents Infrared spectrophotometer, UV-Visible spectrophotometer. Column chromatography, Ion exchange chromatography, AAS, ICP-AES, EPR and Mossbauer spectroscopy

**Practical Component:**

1. Preparation of VO(acac)<sub>2</sub> and its characterisation by determining magnetic moment, UV-Visible and IR spectroscopy.
2. Separation of Ni<sup>2+</sup> and Zn<sup>2+</sup> in the given mixture through column chromatography.
3. Preparation of [Co(en)<sub>3</sub>]Cl<sub>3</sub>, *cis*- and *trans*- [Co(en)<sub>2</sub>Cl<sub>2</sub>]Cl by oxidation of Co<sup>2+</sup> and measurement of their optical activity.
4. Spectrophotometric estimation of Cr<sup>3+</sup> in the given solution by 1,5-diphenylcarbazide
5. Estimation of Cu<sup>2+</sup>-Fe<sup>3+</sup>/Cu<sup>2+</sup>-Bi<sup>3+</sup> in the mixture solution with EDTA spectrophotometrically.
6. Synthesis of any ligand of choice (for example- carboxylate, ester, Schiff base, amides, amines etc.).
7. Synthesis of a transition metal complex using above ligand
8. Characterisation of above complex using suitable analytical technique
9. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.

Recommended Textbooks and references (For Theory)

1. Fundamentals of Analytical Chemistry by Crouch, West and Skoog, 9th edition, Brooks/Cole (2013)
2. Analytical Chemistry, Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey, 2007.
3. Instrumental Methods of Chemical Analysis, by Galen W. Ewing, 4th Edition, International Student Edition, 1969.
4. Instrumental methods of analysis, 7<sup>th</sup> Ed, Willard, Merritt, Dean, Settle CBS Publishers & Distributors 2004.

#### Recommended Textbooks and references (For Practical)

- 1 Advanced practical inorganic chemistry, D.M. Adams, J.B. Raynor John Wiley & Sons Ltd 1965
- 2 Advanced practical organic chemistry, 2<sup>nd</sup> Ed. Leonard, Lygo, Procter. CRC Press; 3rd edition 2013
- 3 Inorganic experiments, J.D. Woollins, Wiley VCH 2009
- 4 General Chemistry Experiments. Anil J. Elias, universities press, 2016.
5. Fundamentals of Analytical Chemistry, Skoog and West's, 9<sup>th</sup> Edition, Cengage Learning Publisher, 2014.
6. Analytical Chemistry-An Indian Adaption, Gary D Christian, Purnendu K Dasgupta, Kevin A Schug, Wiley India Pvt. Ltd, 2020.
7. Spectrochemical Analysis by Atomic Absorption and Emission, Lajunen L H J, Cambridge, UK: The Royal Society of Chemistry, 1992.
8. Advances in Atomic Spectroscopy, Sneddon J, CT: JAI Press, Greenwich, 1992.
9. CRC Handbook of Inductively Coupled Plasma Atomic Emission Spectrometry, Varma A, FL: CRC Press, Boca Raton, 1991.

### **GE (2+2) Credit**

**The existing pool of GE papers of Chemistry can be extended to VII and VIII semesters.**