



# HUBANDHRA UNIVERSITY

## TRANS-DISCIPLINARY RESEARCH HUB

### ADVANCED INSTRUMENTAL METHODS FOR CHEMICAL CHARACTERIZATION AND ANALYSIS

#### **Unit-1: UV-Visible Spectroscopy:**

Introduction; Absorption Laws-Beer-Lambert law; Types of Electronic Transitions; Instrumentation of single beam and double beam spectrophotometer. Estimation of ligand- metal ratio in complexes; Qualitative and quantitative Applications.

#### **Unit-2: Atomic Absorption Spectroscopy:**

Introduction. Atomization; Flame atomization; Graphite furnace atomization; Instrumentation; Hollow cathode lamp, Detectors. Interferences - Chemical & Spectral; Qualitative and Quantitative Applications of Atomic Absorption Spectroscopy.

#### **Unit-3: Atomic Emission Spectroscopy:**

Introduction, Flame emission spectroscopy; Plasma emission spectroscopy; Direct current plasma; Inductively coupled plasma, ICP instrumentation; Applications; Determining alkali metals by flame photometry.

#### **Unit-4: Polarography and Amperometry:**

Introduction; Dropping Mercury Electrode; Measurement; Polarographic wave; Half wave potential; Quantitative and Qualitative analysis; Inorganic applications; Organic applications; Amperometric titrations.

#### **Unit-5: Magnetic resonance spectroscopy**

Principle and theory of High resolution NMR, Instrumentation, chemical shift- Spin-spin coupling, double resonance- applications of proton NMR – quantitative analysis – qualitative analysis.

#### **Unit-6: Gas Chromatography:**

Introduction and importance; Instrumentation - sample injection, carrier gas, capillary columns, bonded phase, Types of detectors, Qualitative analysis; Quantitative analysis; Applications.

#### **Unit-7: HPLC:**

Principle and theory, Instrumentation: Sample injection, Types of columns, Detectors, Qualitative analysis; Quantitative analysis; Applications.

#### **Unit-8: Electron Spin Resonance Spectroscopy:**

Introduction; Instrumentation; Quantitative analysis; Study of free radicals; Structure determination; Analytical applications.

### Recommended Books:

- “*Vogel’s Text Book of Quantitative Chemical Analysis*”, by J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, Pearson Education Pvt. Ltd., New Delhi, (2002).
- “*Instrumental Methods of Chemical Analysis*”, by G.Chatwal & S.Anand, HimalayaPublishing House, New Delhi, (2000).
  - “*Instrumental Methods of Chemical Analysis*”, by B.K. Sharma, Goel Publishing
- “*Organic Analytical Chemistry*”, by Jag Mohan, Narosa Publishing House Pvt. Ltd.,New Delhi, (2003).
- “*Analytical Chemistry – Problems & Solutions*”, by S.M.Khopkar, New AgeInternational Pvt. Ltd., New Delhi, (2002).
  - “*Analytical Chemistry*” by G.L. David Krupadanam, D. Vijaya Prasad, K.VaraprasadaRao, K.L.N Reddy and C.Sudhakar, University Press (India) Ltd., Hyderabad (2001).
  - “*Applications of Absorption Spectroscopy of Organic Compounds*” by John R.Dyer,Prentice-Hall of India Pvt. Ltd., New Delhi (1969).
    - “*Molecular Spectroscopy- Principles and Chemical Aplications*” by P.R. Singh and S.K. Dikshit, S. Chand & Co., New Delhi (1988).



# ANDHRA UNIVERSITY

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### MODEL QUESTION PAPER

#### ADVANCED INSTRUMENTAL METHODS FOR CHEMICAL CHARACTERIZATION AND ANALYSIS

Max. Marks: 100

Answer any five questions (5 x 20)

1. Describe the instrumentation of double beam spectrophotometer and explain the function of each part.
2. (a) Explain the principle of Hollow cathode lamp in AAS.  
(b) Explain the principle of graphite furnace atomiser.
3. (a) Explain the principle of Inductively coupled Plasma.  
(b) How are alkali metals determined by flame photometry
4. (a) Describe the working of dropping mercury electrode  
(b) Discuss the principle of amperometric titrations
5. Define chemical shift in NMR? What are factors affecting it.
6. Discuss the different types of detectors used in Gas chromatography.
7. Explain the principle and instrumentation of HPLC.
8. Discuss a few applications of ESR Spectroscopy.