

AMLT14 INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

UNIT-1 GENERAL STUDY

- 1.1 Relationship between wavelength, frequency & energy of radiation, waveparticle duality, Schrödinger's wave equation, normalisation & orthogonality of wave function.
- 1.2 Molecular orbital theory, Valence bond theory, Particle-in-box theory,
- 1.3 Chemistry of excited states,
- 1.4 Vibrational energies of a diatomic molecule, molecular electronic energy levels.

UNIT-2 UV-VIS SPECTROPHOTOMETRY

- 2.1 Instrumental brief details- radiation sources, H or D discharge lamps, incandescent filament lamps,
- 2.2 Detectors- photovoltaic cells, photoemissive tubes, photomultiplier tubes, photodiodes, Filters- Absorption filters, Monochromators, slits, thin film coatings,
- 2.3 Monochromator performance, dispersion, resolution, light gathering power, prism as dispersive device, dispersion by diffraction grating, grating monochromator system Elbert mounting,
- 2.4 Czerny- Turner mounting, Littrow mounting, Seya- Namioka mounting, Rowland circle mounting, single beam spectrophotometer, scanning double-beam spectrophotometer.
- 2.5 Beer Lambert's law, deviation from Beer's law. Quantitative methodology, character of valence shell electronic transition $\sigma \rightarrow \sigma^*$; $\pi \rightarrow \pi^*$; $n \rightarrow \sigma^*$; $n \rightarrow \pi^*$, d-d transition, charge transfer, solvent effect.
- 2.6 Shifts of λ_{max} - hypsochromic, bathochromic, hyperchromic, hypochromic shifts, solvent effect.
- 2.7 Signal to noise ratio, Sources of noise, S to N enhancement.

UNIT-3 IR SPECTROPHOTOMETRY

- 3.1 Correlation of IR spectra with molecular structure;
- 3.2 Near infrared region, mid infrared region, far infrared region.

UNIT-4 STRUCTURAL ANALYSIS INSTRUMENTATION

- 4.1 Detectors, Thermal detectors, photon detectors,
- 4.2 Spectrophotometers, FT interferometer.

UNIT-5 SAMPLE HANDLING SYSTEM

- 5.1 Solid samples,
- 5.2 Liquid samples, films,
- 5.3 Outline of quantitative analysis.

UNIT-6 AAS SPECTROPHOTOMETRY

- 6.1 Principles of Atomic Absorption Spectroscopy, Nebulization, flames & flame temperatures,

- 6.2 Disadvantages of flame atomisation, burners,
6.3 Interference: - background absorption, spectral line interference, vaporisation interference, ionisation effects.
6.4 Sources of atomic absorption, Hollow cathode lamps,
6.5 Electro thermal atomisation, Chemical vaporisation.

UNIT-7 GENERAL PRINCIPLES OF CHROMATOGRAPHY

- 7.1 Classification of chromatographic methods, Nature of partitioning forces, dispersion interaction, dipole-dipole interaction, H-bond interaction,
7.2 Chromatographic behaviour of solutes, retention behaviour, partition coefficient, partition ratio,
7.3 Column efficiency & resolution: - plate height & plate number, peak asymmetry, resolution, Solvent delivery system, reciprocating pumps, syringe type pumps, .
7.4 Constant pressure pumps, applicability of pumps.

UNIT-8 SAMPLE INTRODUCTION

- 8.1 Syringe injection, sampling valves and loops.
8.2 Detectors:- photometric detectors, IR detectors, differential refractrometers.
8.3 Solvent programming, flow programming, effect of temperature,

UNIT-9 COLOR MEASUREMENT

- 9.1 Theory of colour formation, theory of instrumental gloss measurement,
9.2 Colour measurement, CIE XYZ, LAB system, RGH values, and computer aided colour matching theory.

Reference Books:

1. G.M. Barrow:- Introduction to Molecular Spectroscopy, Mc-Graw Hill Book Co. N.Y.
2. J.D. Graybeal:- Molecular Spectroscopy, Mc-Graw hill book Co, N.Y.
3. C.N. Banwell:- Fundamentals of Molecular Spectroscopy, Tata Mc-Graw Hill Co. Ltd. N.D.