

## **ELI- 601: Analytical Instrumentation II**

**48 Periods**

### **UNIT 1**

Spectro-analytical Methods of Analysis: Nuclear magnetic resonance: Theory, chemical shift and spin-spin splitting, coupling constant, environmental effects- shielding deshielding effects due to electronegativity on NMR spectra, instrumentation of NMR, FT-NMR and its advantages, applications.

Mass Spectroscopy: Theory, fragmentation modes, instrumentation: inlet systems, magnetic and electrostatic analysers, detectors. Isotopic abundances, metastable ions and applications

14 Periods

### **UNIT 2**

Thermo-analytical Methods: Thermal detectors. Thermo-gravimetry, Differential Thermal analysis, Differential scanning calorimetry . Principle, Instrumentation: thermobalance.

Interpretation of thermograms. Applications. Comparison and advantages of each technique

10 Periods

### **UNIT 3**

Radiochemical methods: X-ray spectroscopy- Principle, absorption ,emission and diffraction of X-rays, Bragg's Law, Instrumentation: sources, X –ray tube, crystal monochromators , X-ray detectors (Ionization, proportional and GM counter,  $\gamma$  camera), applications 10 Periods

### **UNIT 4**

Advanced Chromatographic methods: Principle, process of elution through a column, chromatogram, band broadening, capacity factor, selectivity factor (definition and formulae), numerical based on them. Column efficiency- number of plates, plate height, column resolution (definition and formulae), numerical based on them.

Instrumentation of Gas Chromatography (GC): carrier gases,different type of injection systems, columns, stationary phases and detectors. Isothermal mode and temperature programming, analysis by internal standard method, applications.

Instrumentation of High Performance Liquid Chromatography (HPLC): mobile phase, isocratic and gradient elution, pumps, injection systems, columns, stationary phases, normal phase and reverse phase chromatography, detectors. Applications 14 Periods

### **UNIT 1**

Chapter 19, 20- Skoog, Holler and Crouch, Instrumental Analysis, Cengage Learning

Chapter 15, 16 - H.H.Willard, Instrumental Methods of Analysis, CBS Publishers

### **UNIT 2**

Chapter 31- Skoog, Holler and Crouch, Instrumental Analysis, Cengage Learning

Chapter 25- H.H.Willard, Instrumental Methods of Analysis, CBS Publishers

### **UNIT 3**

Chapter 32- Skoog, Holler and Crouch, Instrumental Analysis, Cengage Learning

Chapter 14- H.H.Willard, Instrumental Methods of Analysis, CBS Publishers

## **UNIT 4**

Chapter 27, 28, 33- Skoog, Holler and Crouch, Instrumental Analysis, Cengage Learning  
Chapter 18, 19, 20, 26- H.H. Willard, Instrumental Methods of Analysis, CBS Publishers

### **Essential Books:**

1. Skoog, Holler and Crouch, Instrumental Analysis, Cengage Learning .
2. H.H. Willard, Instrumental Methods of Analysis, CBS Publishers

### **Suggested Books:**

1. D.C. Harris, Quantitative Chemical Analysis, W.H. Freeman
2. Vogel's Textbook of Qualitative Chemical Analysis, ELBS
3. S.E. Manahan, Fundamentals of Environmental Chemistry, Lewis Publishers
4. J.A. Dean, Analytical Chemistry Notebook, McGraw Hill
5. R.A. Day and A.L. Underwood, Quantitative Analysis, Prentice Hall of India
6. John H. Kennedy, Analytical Chemistry: Principles, Saunders College Publications
7. W. Kemp, Organic Spectroscopy, ELBS

### **Practicals based on Analytical Instrumentation II**

1. Qualitative Analysis of organic compounds using Gas chromatography
2. Quantitative Analysis of organic compounds using Gas chromatography
3. Qualitative Analysis of organic compounds using HPLC.
4. Quantitative Analysis of organic compounds using HPLC.
5. Study of NMR (Simulation based/Demo).
6. Study of Mass spectrometer (Simulation based/Demo).
7. Study of X ray spectrometer (Simulation based/Demo).
8. Study of the X-ray fluorescence (Simulation based/Demo).
9. Study of DTA, TGA and DSC.

