

## COURSE PROFILE: M.Phil Chemistry

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|---|----|----------|
| Core 1 -Scientific Research Methodology             | 5  | 6M15/SRM |
| Core 2-Some Select Instrumental Methods of Analysis | 5  | 6M15/IMA |
| Elective – Internal Paper                           | 5  | 6M15/INT |
| Core 3 - Dissertation                               | 21 | 6M15/PRO |

### Title of the Course: Core 2-Some Select Instrumental Methods of Analysis

Teaching hours: 60 Hrs

Credits: 5

Course Code: 6M15/IMA

#### Objectives:

1. To understand the principle and applications of optical, magnetic and mass spectroscopy
2. To learn to interpret the above spectral data
3. To know the significance of Thermo and Electro analytical methods in research

#### COURSE OUTLINE

**UNIT I: Spectroscopy:** Optical Spectroscopy: UV, Visible and IR Spectroscopy with reference to radiation source , Optical materials, monochromators and detectors-principles of design of single beam and double beam spectrophotometers-application of optical spectroscopy in qualitative and quantitative analysis. **12 hrs**

**UNIT II: Magnetic Resonance Spectroscopy:** Nuclear magnetic and electron magnetic resonance spectroscopy-Basic features of the NMR and EMR spectrometers. NMR: chemical shift, spin-spin coupling, double resonance, NMR shift reagents-Applications of NMR spectroscopy in qualitative and quantitative analysis-wide line and FT NMR, C<sup>13</sup> NMR. EMR: Hyper fine splitting-g value – factors affecting the magnitude of g value – zero field splitting. EMR spectra of organic radicals and transition metal complexes. **12 hrs**

**UNIT III: Mossbauer Spectroscopy:** The Mossbauer effect-Nuclei exhibiting Mossbauer effect experimental techniques) isomer shift, Quadrapole splitting, applications. Mass Spectroscopy: Mass spectrometer instrumentation – The ion sources, mass analyzers, detectors and vacuum system data processing and sample handling-applications of mass spectrometry in qualitative and quantitative analysis. Photo electron spectroscopy: X ray photo electron Spectroscopy (XPS) and UV photoelectron

spectroscopy (UPS) Instrumentation: radiation sources energy analyzers and detectors-use of XPS and UPS as analytical tools. **12 hrs**

**UNIT IV: Thermo Electric methods:** Thermogravimetric analysis (TGA) Thermobalances-derivative thermogravimetric analysis (DTG) – Differential Thermal Analysis (DTA) The DTA apparatus-Scanning calorimetric DTA, Thermometric titrations. Potentiometry: Ion selective membrane electrode (the glass electrode, liquid membrane electrodes, double membrane electrodes, solid state membrane electrodes and reference electrodes, constant potential titration. **12 hrs**

**UNIT V: Electro analytical methods:** Voltammetry: The Dropping Mercury Electrode (DMG), Polarographic analysis-the shape of the polarographic wave-the Ilkovic equation for diffusion current-significance of half wave potentials, polarographic maxima and their elimination-Instrumentation for polarography-applications in qualitative and quantitative analysis cyclic voltammetry-amperometric titrations. Coulometry: The Coulometric analysis- types of coulometric methods- coulometric methods at constant electrode potential: Coulometric titrations involving neutralization, precipitation and complex formation reactions-electrolytic pre concentration -stripping analysis. **12 hrs**

#### **REFERENCE BOOKS:**

1. Instrumental methods of analysis (5<sup>th</sup> edition) H.H. Willard, L.L Merrit- Jr.. and J.A. Dean affiliated east west press (1974).
2. Instrumental methods of chemical analysis (4<sup>th</sup> edition), G. W. Ewing, MC Graw – Hill International students edition (1975).
3. Chemical instrumentation: A systematic approach to instrumental analysis, H.A. Strobel, Addison – Wesley publishing Co., Inc (1960).
4. Principles of Instrumental Analysis (2<sup>nd</sup> edition) D.M.Skoog and D.M.West, Holt-Saunders, Japan (1980).
5. Physical methods in chemistry, R.S. Drago.

#### **PERIODICALS:**

1. Resonance- Journal of science education
2. Span
3. Indian academy of sciences-proceedings- Chemical Sciences
4. Current Science
5. Journal of Indian chemical education
6. Journal of American chemical society
7. Bulletin of material science

#### **WEBSITES & e-LEARNING SOURCES:**

1. [www.acs.org](http://www.acs.org)
2. [www.virtlab.com](http://www.virtlab.com)
3. Internet chemistry resources
4. [nptel.ac.in](http://nptel.ac.in)

