Marwadi University
Faculty of Pharmacy

Subject code: 13PH0701
Subject name: **Instrumental Methods of Analysis**

Scope: This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart fundamental knowledge on the principles and instrumentation of spectroscopic and chromatographic technique. This also emphasizes theoretical and practical knowledge of modern analytical instruments that are used for drug testing.

Objective: Upon completion of the course the student shall be able to

1. To understand the interaction of matter with electromagnetic radiations and its applications in drug analysis
2. To understand the chromatographic separation and analysis of drugs
3. Perform quantitative & qualitative analysis of drugs using various analytical instruments.

Teaching and assessment scheme:

Teaching Scheme (Hours)			Credits	Theory/ Tutorial Marks			Practical Marks		Total Marks
Theory	Tutorial	Practical		CSE	IA (I)	ESE (E)	TW	Viva (V)	
3	1	4	6	10	15	75	15	35	150

Theory syllabus: **Teaching hours: 45 Hours**

Unit-1 **10 Hours**

UV Visible spectroscopy: Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Beer and Lambert's law, Derivation and deviations. Instrumentation: Sources of radiation, wavelength selectors, sample cells, detectors: Photo tube, Photomultiplier tube, Photovoltaic cell, Silicon Photodiode. Applications: Spectrophotometric titrations, Single-component and multi-component analysis. Fluorimetry Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications.

Unit-2 **10 Hours**

IR spectroscopy Introduction: Fundamental modes of vibrations in polyatomic molecules, sample handling, factors affecting vibrations Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermistor, Pyroelectric detector and applications. Flame Photometry-Principle, interferences, instrumentation and applications. Atomic absorption spectroscopy- Principle, interferences, instrumentation and Applications. Nepheloturbidometry- Principle, instrumentation and applications.

Unit-3 **10 Hours**

Introduction to chromatography: Adsorption and partition column chromatography - Methodology, advantages, disadvantages and applications. Thin-layer chromatography - Introduction, Principle, Methodology, Rf values, advantages, disadvantages and applications. Paper chromatography-Introduction, methodology, development techniques, advantages, disadvantages and applications. Electrophoresis – Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications.

Unit-4 8 Hours

Gas chromatography: Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications. High-performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.

Unit-5 7 Hours

Ion-exchange chromatography: Introduction, classification, ion exchange resins, properties, mechanism of the ion exchange process, factors affecting ion exchange, methodology and applications. **Gel chromatography:** Introduction, theory, instrumentation and applications. Affinity chromatography - Introduction, theory, instrumentation and applications.

Tutorials will be based on the above syllabus. **Teaching hours: 15 Hours**

Practical syllabus: **Teaching hours: 04 Hours/week**

1. Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds.
2. Estimation of dextrose by colourimetry.
3. Estimation of sulphanilamide by colourimetry.
4. Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy.
5. Assay of paracetamol by UV- Spectrophotometry.
6. Estimation of quinine sulphate by fluorimetry.
7. Study of quenching of fluorescence.
8. Determination of sodium by flame photometry.
9. Determination of potassium by flame photometry.
10. Determination of chlorides and sulphates by nephelo turbidometry.
11. Separation of amino acids by paper chromatography.
12. Separation of sugars by thin-layer chromatography.
13. Separation of plant pigments by column chromatography.
14. Demonstration experiment on HPLC.
15. Demonstration experiment on Gas Chromatography.

Recommended References (Latest edition):

1. Instrumental Methods of Chemical Analysis by B.K Sharma.
2. Organic spectroscopy by Y.R Sharma.
3. Textbook of Pharmaceutical Analysis by Kenneth A. Connors.
4. Vogel's Textbook of Quantitative Chemical Analysis by A.I. Vogel.
5. Practical Pharmaceutical Chemistry by A.H. Beckett and J. B. Stenlake.
6. Organic Chemistry by I. L. Finar.
7. Organic spectroscopy by William Kemp.
8. Quantitative Analysis of Drugs by D. C. Garrett.
9. Quantitative Analysis of Drugs in Pharmaceutical Formulations by P. D. Sethi.
10. Spectrophotometric Identification of Organic Compounds by Silverstein.