

Introduction to Pharmaceutical Analysis (Theory)

BP605T

A Textbook for B. Pharm Semester VI

*As per the new Pharmacy Council of India (PCI)
Syllabus 2026 (NEP 2020)*

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Preface

Pharmaceutical analysis is the discipline that decides whether a medicine is what its label claims, in the amount the label claims, and free of harmful impurity. The instrumental methods that carry out this work, from the potentiometric measurement of pH to the chromatographic separation of a drug from its degradation products, are the subject of the BP605T course and of this book.

This book is written for the third-year B.Pharm student preparing for the Pharmaceutical Analysis (Theory) paper. It follows the prescribed syllabus unit by unit and topic by topic, and it is built so that a student who reads it carefully, works the examples, and answers the self-assessment questions is prepared for the examination. Every instrument is taught through one consistent frame: the radiation or signal source, the sample, the device that selects a wavelength or a phase, the detector, and the readout. Once that frame is in place, each new method becomes a variation on a pattern already understood rather than a fresh set of facts to memorise.

The treatment is concise but complete. Definitions are stated plainly, classifications are laid out in full, mechanisms are reasoned through rather than asserted, and each method closes with its pharmaceutical applications. Worked numerical examples are recomputed step by step with units carried throughout. Diagrams are drawn cleanly for print, and comparison tables are used wherever two techniques are best learned against each other. The chapter-end self-assessment mirrors the university question paper: short-answer questions with model answers, long-answer essays with structured answers, multiple-choice questions with keys, and numerical problems with full solutions.

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Course Objectives

The objectives of this course are to:

1. Understand the interaction of matter with electromagnetic radiation and its application in spectroscopic methods for pharmaceutical drug analysis.
2. Study the principles, instrumentation, and pharmaceutical applications of electroanalytical techniques such as potentiometry, conductometry, polarography, and amperometry.
3. Understand and apply various chromatographic and electrophoretic separation techniques used for qualitative and quantitative analysis of drugs.
4. Impart knowledge of instrumental methods used for accurate qualitative and quantitative analysis of pharmaceutical substances.
5. Develop the ability to select, optimize, and validate suitable analytical techniques, interpret analytical data.

Course Outcomes

Upon successful completion of this course, the students will be able to:

1. Explain the theoretical basis of electrochemical methods (potentiometry, conductometry, polarography, amperometry) and spectroscopic techniques (UV-Visible, IR, fluorimetry, atomic absorption).
2. Explain the instruments involved in electroanalytical and spectroscopic methods.
3. Describe the principles, instrumentation, and applications of various chromatographic and electrophoretic techniques.
4. Select suitable analytical techniques for specific pharmaceutical analysis requirements.
5. Analyze, interpret, and report analytical data accurately and draw meaningful conclusion

Syllabus

Unit	Topics	No. of lectures
I	Electrochemical Methods of analysis 1. Potentiometry: Electrode potential, electrochemical cell, construction and working of reference and indicator electrodes including membrane electrodes, measurement of potential and pH, potentiometric titrations, methods of detecting end point and Karl Fischer titration. 2. Conductometry: Introduction, conductivity cell, conductometric titrations and applications. 3. Polarography: Introduction, residual current, migration current, diffusion current and limiting current, DME, polarographic wave, Ilkovic's equation (Statement Only), and applications.	10 Hours
II	Spectroscopy 1. Fundamentals of Spectroscopy: Properties of electromagnetic radiation, electromagnetic spectrum. 2. UV Visible spectroscopy: Beer and Lambert's law, Derivation and deviations. Electronic transitions, chromophores, auxochromes, spectral shifts, solvent effect on absorption spectra, Instrumentation - Sources of radiation, wavelength selectors, sample cells, detectors (Photo tube, Photomultiplier tube, Photo voltaic cell, Silicon Photodiode). Applications - single and multi component analysis of pharmaceuticals. 3. IR spectroscopy: Introduction, fundamental modes of vibrations in poly atomic molecules, factors affecting vibrations, Instrumentation of dispersive Infrared spectrophotometer (including sample handling Techniques) and FTIR. Pharmaceutical applications.	10 Hours
III	Fluorimetric Analysis 1. Theory, luminescence, factors affecting fluorescence, quenching. Instrumentation and pharmaceutical applications. 2. Flame Photometry and Atomic Absorption Spectrometry: Theory, nebulisation, flame and flame temperature, interferences, instrumentation and pharmaceutical applications. 3. Nepheloturbidimetry: Principle, instrumentation and applications.	07 Hours

IV	Introduction to Chromatographic Techniques 1. Principle, various stationary and mobile phases, diverse development and detection techniques and applications of column, paper and thin layer chromatography. 2. Ion-exchange chromatography: Introduction, principles, types of ions exchange resins, factors affecting ion exchange, methodology and applications. 3. Gel filtration and affinity chromatography: Principles and applications. 4. Electrophoresis: Introduction, factors affecting electrophoretic mobility, Techniques of paper, gel, capillary electrophoresis, applications.	08 Hours
V	1. Gas chromatography: Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications. 2. High performance liquid chromatography: Introduction, theory, instrumentation, advantages and applications. 3. HPTLC: Principle, instrumentation and applications.	10 Hours

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