

NIRMA UNIVERSITY
Institute of Pharmacy

(B. Pharm)
(Semester - VII)

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Course Code	BP701T
Course Title	Instrumental Methods of Analysis – Theory

Scope:

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

Objectives:

Upon completion of the course, the student shall be able to-

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

Course Learning Outcomes (CLO):

At the end of the course, students will be able to –

1. Describe the fundamentals of UV Visible spectroscopy and Fluorimetry, its instrumentation and applications
2. Understand principle, instrumentation and applications of IR spectroscopy, Atomic Spectroscopy and Nepheloturbidometry
3. Explain basic theories and applications of conventional chromatographic methods
4. Apply knowledge of GC and HPLC for evaluation of pharmaceutical compounds
5. Discuss theory, instrumentation and application of ion exchange, gel and affinity chromatography

Syllabus:

Teaching hours: 45 Hours

UNIT I

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, Photo voltaic 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 II

10 Hours

- **IR spectroscopy**
Introduction, fundamental modes of vibrations in poly atomic molecules, sample handling, factors affecting vibrations
Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermister, 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 III

10 Hours

- **Introduction to chromatography**
Adsorption and partition column chromatography-Methodology, advantages, disadvantages and applications.
Thin layer chromatography- Introduction, Principle, Methodology, R_f 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 IV

08 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 V

07 Hours

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

Suggested Readings[^]: (Latest edition)

1. Sharma, B. K. Instrumental methods of chemical analysis. Krishna Prakashan Media.
2. Sharma, Y. R. Elementary organic spectroscopy. S. Chand Publishing.
3. Connors, K. A. A textbook of pharmaceutical analysis. John Wiley & Sons.
4. Vogel, A. I., & Jeffery, G. H. Vogel's textbook of quantitative chemical analysis. Wiley.
5. Beckett, A. H., & Stenlake, J. B. (Eds.). Practical Pharmaceutical Chemistry: Part I & II. A&C Black.
6. Finar, I. L. Organic Chemistry. Wiley.
7. Kemp, W. Qualitative organic analysis: spectrochemical techniques. McGraw-Hill Book Co Ltd.

8. Garratt, D. C. The quantitative analysis of drugs. Springer Science & Business Media.
9. Sethi, P. D. Quantitative analysis of drugs in pharmaceutical formulations. Unique Publishers.
10. Silverstein, R. M., Bassler, G. C., & Morrill, T. C. Spectrometric Identification of Organic Compounds, John Wiley & Sons. Inc., New York.

L= Lecture, T= Tutorial, P= Practical, C= Credit

^ this is not an exhaustive list
