NIRMA UNIVERSITY
Institute of Pharmacy
(B. Pharm)
(Semester - VIII)

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Course Code	**BP811ET**
Course Title	**Advanced Instrumentation Techniques**

Scope:

This subject deals with the application of instrumental methods in qualitative and quantitative analysis of drugs. This subject is designed to impart advanced knowledge on the principles and instrumentation of spectroscopic and chromatographic hyphenated techniques. 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. Know the advanced instruments used and its applications in drug analysis.
2. Understand the chromatographic separation and analysis of drugs.
3. Understand the calibration of various analytical instruments.
4. Describe analytical techniques used for evaluation of macromolecule

Course Learning Outcomes (CLO):

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

1. Discuss the fundamental, principle and application of mass and NMR spectroscopy
2. Understand the techniques for solid state analysis like thermal and X-ray methods
3. Explain the calibration and validation of various instruments as per ICH and USFDA guidelines
4. Describe the importance of sample preparation for bioanalysis
5. Understand the instrumentation and application of hyphenated techniques

Syllabus: **Teaching hours**: **45 Hours**

UNIT I **10 Hours**

- **Nuclear Magnetic Resonance spectroscopy**
- Principles of H-NMR and C-NMR, chemical shift, factors affecting chemical shift, coupling constant, Spin - spin coupling, relaxation, instrumentation and applications
- **Mass Spectrometry-** Principles, Fragmentation, Ionization techniques – Electron impact, chemical ionization, MALDI, FAB, Analyzers-Time of flight and Quadrupole, instrumentation, applications

UNIT II **08 Hours**

- **Thermal Methods of Analysis**: Principles, instrumentation and applications of Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC)

- **X-Ray Diffraction Methods:** Origin of X-rays, basic aspects of crystals, X-ray Crystallography, rotating crystal technique, single crystal diffraction, powder diffraction, structural elucidation and applications.

UNIT III **06 Hours**

- **Calibration and validation-**as per ICH and USFDA guidelines.
  Calibration of following Instruments
  Electronic balance, UV-Visible spectrophotometer, IR spectrophotometer, Fluorimeter, Flame Photometer, HPLC and GC

UNIT IV **08 Hours**

- **Radio immune assay:** Importance, various components, Principle, different methods, Limitation and Applications of Radio immuno assay
- **Extraction techniques:** General principle and procedure involved in the solid phase extraction and liquid-liquid extraction

UNIT V **05 Hours**

- **Hyphenated techniques**: LC-MS/MS, GC-MS/MS, HPTLC-MS.

UNIT VI

- **Physico chemical characterization of Biopharmaceutical Protein:** **08 Hours**
  Covalent structure determination: Peptide mapping, N-Terminal sequencing, Disulfide bond characterization, Post translation modifications
  Higher order structure and folding, Stability related structural changes determination by AUC, SEC etc
  Cell based and non-cell based functional Bioassays

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.
11. Ronald E R, Peptide and Protein Drug Analysis, Marcel Dekker Inc,
12. Satinder Ahuja and Stephen Seypinski, Handbook of Modern Pharmaceutical Analysis, 2nd Edition, Academic Press

L= Lecture, T= Tutorial, P= Practical, C= Credit
^ this is not an exhaustive list