

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF PHARMACY
Semester: VII

Subject Name: **Pharmaceutical Analysis III**

Subject Code: **270004**

[THEORY]

Sr. No	Course Content	Total Hrs.
1.	Fundamentals of Spectroscopy: Classification of spectra i.e. line, band, continuous spectra / absorption, emission spectra; Wave properties of electromagnetic radiation; Particle/photon properties of electromagnetic radiation; Electromagnetic spectrum.	03
2.	UV-VIS spectroscopy: Theory; Beer and Lambert's law - limitations and deviations from the law; Terminologies associated with absorption measurements; Types of transitions; Factors affecting spectral characteristics (structural and nonstructural); Effect of conjugation; Woodward Fieser rule; Photometric titrations; Instrumentation, applications (in analysis of organic compounds and inorganic complexes), advantages and limitations of UV Visible spectroscopy; Quantitative analysis of binary mixtures of absorbing substances by simultaneous equation method; Calibration of UV Visible Spectrophotometer as per Pharmacopoeia.	10
3.	Fluorescence spectroscopy: Introduction: luminescence, photoluminescence; Theory of Fluorescence and Phosphorescence; Jablonski diagram; Factors affecting fluorescence intensity (structural and nonstructural); Instrumentation, applications, advantages and limitations of fluorescence spectroscopy.	04
4.	IR spectroscopy: Theory of absorption of Infrared radiation by molecules; Molecular vibrations; Factors influencing vibrational frequencies; Calculation of vibrational frequencies (Hooke's law); Sample handling techniques; Instrumentation (Dispersion and FTIR spectrometer) and applications of IR Spectroscopy; Calibration of IR Spectrophotometer as per Pharmacopoeia.	07
5.	Atomic spectroscopy: Basics of atomic spectroscopy; Principle of atomic absorption and atomic emission spectroscopy; Interferences in atomic spectroscopy; Factors affecting atomic spectroscopy like solvents, buffers, other ions, etc; Flame Photometry; Atomic emission spectroscopy with plasma and electrical discharge sources; Instrumentation (including radiation sources like hollow cathode lamp), applications, advantages and limitations of atomic absorption and atomic emission spectroscopy.	05

6.	Mass spectrometry: Theory; Ionization techniques, Ion separating techniques; Different types of ions and their significance in mass spectra, Fragmentation rules and rearrangements; Instrumentation and applications of mass spectrometry.	06
7.	Nuclear Magnetic Resonance spectroscopy: Fundamental Principles - nuclear spin, magnetic moment; Proton NMR spectroscopy - theory, chemical shift and factors affecting chemical shift, spin-spin coupling, coupling constant, relaxation process, Instrumentation and applications of PMR; Brief overview of C13 NMR.	07
8.	Structure elucidation by joint application of UV, IR, NMR and Mass spectrometry	03

Note:

Examples based on assays & structure elucidation shall be covered at concerned subtopics in each of the above chapters.

[PRACTICAL]

Note:

Following Experiments shall include different dosage forms & pharmacopoeial testing from different pharmacopoeias, wherever applicable.

1	Calibration of UV, IR spectrophotometer.
2	Determination of λ_{\max} , $A(1\text{cm}^{1\%})$, Detection-Quantitation Limit and preparation of calibration curve (Verification of Beer's law) for any drug by UV-visible spectrophotometer.
3	Determination of the dissociation constant of indicator/ stability constant of complex (e.g. Ferric salicylate) using UV/visible - spectrophotometric method.
4	Determination of isosbestic point/pKa of indicator (e.g. Phenol red)
5	Two experiments on Spectrophotometric estimation of drugs in marketed formulations (e.g. Paracetamol/Ibuprofen/sulphadiazine).
6	Simultaneous estimation of Paracetamol & Ibuprofen/any other combination.
7	Two experiments- Fluorimetric estimation of drug (quinine sulphate/ riboflavin/Thiamine).
8	Flame photometric estimation of sodium/potassium ions in urine/ORS.
9	Two experiments: Colorimetric assay of colored drug (e.g. Vitamin B ₂) & non-colored drug (e.g. Sulpha-BMR, Nitration of Paracetamol)
10	Identification of API by IR spectrum.
11	Content Uniformity of any drug as per Pharmacopoeia.
12	Identification using λ_{\max} , $A(1\text{cm}^{1\%})$, λ_{\min} , ϵ & absorption ratio as per pharmacopoeia.
13	Workshop on structure elucidation of simple organic compounds using UV, IR, NMR, and Mass spectra.

Text Books:

1. Principles of Instrumental Analysis by skoog, holler, Nieman, 5th edition.
2. Instrumental methods of Analysis, H.H. Willard, L.L. Meritt, J.A. Dean and F.A. Settle Wadsworth, New York

Reference Books:

1. Pharmaceutical Analysis: Modern methods Part A, Part B, James W. Munson.
2. G. H. Jeffery, J. Basset, J. Mendham, R. C. Denny (Rev. by) Vogel's Text Book of Quantitative Chemical Analysis, Longman, London
3. A Textbook of Pharmaceutical Analysis. Connors K.A.
4. A.H. Beckett and J.B. Stenlake, Practical Pharmaceutical chemistry, part 1&2, the athlone press, London.
5. Pharmacopoeia of India, Govt. of India, Ministry of Health.
6. British Pharmacopoeia, ministry of health and social welfare, UK.
7. The United States Pharmacopeia–National Formulary (USP–NF)