Gyanmanjari Innovative University

Course Syllabus

Gyanmanjari Pharmacy College

Semester-7 (B. Pharm)

Subject: Instrumental Methods of Analysis (BPHBP17333)

Type of course: Major

Prerequisite: B. Pharmacy

Rationale: 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.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
3	1	4	6	75	25	10	25	15	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Chapter No.	Course content	Hrs	% Weightage
1.	**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	10	25

	Fluorimetry Theory, Concepts of singlet, doublet and triplet electronic states, internal and external conversions, factors affecting fluorescence, quenching, instrumentation and applications		
2.	**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	10	25
3.	**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	10	25
4.	**Gas chromatography** - Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications **High performance liquid chromatography (HPLC)**-Introduction, theory, instrumentation, advantages and applications	08	15
5.	**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	07	10

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1.	**Calibration Curve Preparation** Faculty will Provide one ACTIVE PHARMAEUTICAL INGREDIENT and Students will prepare a standard calibration curve of given ACTIVE PHARMACEUTICAL INGREDIENT (Using UV method) and interpret linearity using MS EXCEL and submit on GMIU Web Portal.	05
2.	**Instrument Comparison Chart** Faculty will Provide analytical Instruments list to the students and Students will prepare a chart of analytical instruments (UV, IR AND HPLC) including principle, advantages, Flow Diagram and applications and submit on GMIU Web portal.	10
	Total	15

Suggested Specification table with Marks

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	**Remembrance (R)**	**Understanding (U)**	**Application (A)**	**Analyze (N)**	**Evaluate (E)**	**Create (C)**
Weightage	30%	30%	20%	10%	05%	05%

Course Outcome:

After learning the course, the students should be able to:	
CO1	Demonstrate knowledge of the principles, instrumentation and applications of UV-Visible spectroscopy and fluorimetry in pharmaceutical analysis.
CO2	Explain the fundamentals of IR spectroscopy, flame photometry, atomic absorption spectroscopy and nepheloturbidometry and apply them in qualitative and quantitative analysis.
CO3	Illustrate the principles, techniques and applications of chromatographic methods including column chromatography, thin layer chromatography and paper chromatography.
CO4	Analyze chromatographic data and interpret results obtained from gas chromatography and high-performance liquid chromatography (HPLC) in drug analysis.
CO5	Apply the principles of ion exchange, gel and affinity chromatography for separation, purification and characterization of pharmaceutical compounds.

List of Practical:

Sr. No.	Description	Hrs.
1.	Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds.	4
2.	Estimation of dextrose by colorimetry.	4
3.	Estimation of sulfanilamide by colorimetry.	4
4.	Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy.	4
5.	Assay of paracetamol by UV- Spectrophotometry.	4
6.	Estimation of quinine sulfate by fluorimetry.	4
7.	Study of quenching of fluorescence.	4
8.	Determination of sodium by flame photometry.	4
9.	Determination of potassium by flame photometry.	4
10.	Determination of chlorides and sulphates by nephelo turbidometry.	4
11.	Separation of amino acids by paper chromatography	4
12.	Separation of sugars by thin layer chromatography	4
13.	Separation of plant pigments by column chromatography	4
14.	Demonstration experiment on HPLC	4
15.	Demonstration experiment on Gas Chromatography	4
	Total	60

Instructional Method:

The course delivery method will depend upon the requirement of content and the need of students theory.

The internal evaluation will be done on the basis of Active Learning Assignment. Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Instrumental Methods of Chemical Analysis by B.K Sharma
[2] Organic spectroscopy by Y.R Sharma
[3] Text book of Pharmaceutical Analysis by Kenneth A. Connors
[4] Vogel's Text book of Quantitative Chemicai 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.