INSTITUTE	**FACULTY OF PHARMACY**
PROGRAM	**BACHELOR OF PHARMACY**
SEMESTER	**7**
COURSE TITLE	**INSTRUMENTAL METHODS OF ANALYSIS**
COURSE CODE	**13PH0701**
COURSE CREDITS	**6**

Objective:

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

Course Outcomes: After completion of this course, student will be able to:

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

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

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	1	4	75	15	10	35	15

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Contents : Unit	Topics	Contact Hours
1	**Unit-1: UV Visible spectroscopy** 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, Photovoltaic 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.	10
2	**Unit-2: IR spectroscopy Introduction** IR spectroscopy Introduction: Fundamental modes of vibrations in polyatomic molecules, sample handling, factors affecting vibrations Instrumentation - Sources of radiation, wavelength selectors, detectors - Golay cell, Bolometer, Thermocouple, Thermistor, 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
3	**Unit-3: Introduction to chromatography** 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
4	**Unit-4: Gas chromatography** Gas chromatography: Introduction, theory, instrumentation, derivatization, temperature programming, advantages, disadvantages and applications. High-performance liquid chromatography (HPLC)-Introduction, theory, instrumentation, advantages and applications.	8
5	**Unit-5: Ion-exchange chromatography** Ion-exchange chromatography: Introduction, classification, ion exchange resins, properties, mechanism of the ion exchange process, factors affecting ion exchange, methodology and applications. Gel chromatography: Introduction, theory, instrumentation and applications. Affinity chromatography - Introduction, theory, instrumentation and applications.	7
Total Hours		**45**

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Tutorials will be based on the above syllabus** Tutorial-1, Tutorial-2, Tutorial-3, Tutorial-4, Tutorial-5, Tutorial-6, Tutorial-7, Tutorial-8, Tutorial-9, Tutorial-10, Tutorial-11, Tutorial-12, Tutorial-13, Tutorial-14, Tutorial-15	15
2	**Practical** Determination of absorption maxima and effect of solvents on absorption maxima of organic compounds., Estimation of dextrose by colourimetry., Estimation of sulphanilamide by colourimetry., Simultaneous estimation of ibuprofen and paracetamol by UV spectroscopy., Assay of paracetamol by UV- Spectrophotometry., Estimation of quinine sulphate by fluorimetry., Study of quenching of fluorescence., Determination of sodium by flame photometry., Determination of potassium by flame photometry., Determination of chlorides and sulphates by nephelo turbidometry., Separation of amino acids by paper chromatography., Separation of sugars by thin-layer chromatography., Separation of plant pigments by column chromatography., Demonstration experiment on HPLC., Demonstration experiment on Gas Chromatography.	60
Total Hours		**75**

Textbook :

1 Textbook Pharmaceutical Analysis, Kenneth A. Connors., Wiley, 2007

References:

1 Analytical Chemistry, Analytical Chemistry, Dr. B.K Sharma. , Krishna Prakashan Media, 2014

2 Elementary Organic Spectroscopy, Elementary Organic Spectroscopy, Y.R Sharma. , S. Chand, 2013

3 Qualitative Chemical Analysis, Qualitative Chemical Analysis, A.I. Vogel. , Pearson Education, 2009

4 Pharmaceutical Chemistry, Pharmaceutical Chemistry, A.H. Beckett and J. B. Stenlake. , CBS, 2005

5 Organic Chemistry, Organic Chemistry, I. L. Finar. , Pearson Education India, 2002

6 Organic Spectroscopy Paperback , Organic Spectroscopy Paperback , William Kemp. , MACMILLAN, 2019

7 Quantitative Analysis , Quantitative Analysis , D. C. Garrett., CBS PUBLISHERS AND DISTRIBUTORS , 2005

8 Quantitative Analysis, Quantitative Analysis, P. D. Sethi. , CBS Publishers & Distributors, 2015

9 Analytical Chemistry, Analytical Chemistry, https://www.wiley.com/en-in/search?pq=%7Crelevance%7Cauthor%3ARobert M. Silverstein, Wiley, 2014

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and the need of students. The teacher in addition to the conventional teaching method by the black board may also use any tools such as demonstration, role play, quiz, brainstorming, MOOCs etc.

2 The internal evaluation will be done based on continuous evaluation of students in the laboratory and classroom.

3 Students will use supplementary resources such as online videos, NPTEL videos, MOOCs/ e-courses, virtual laboratories.

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