



**Faculty of Pharmacy**  
**Master of Pharmacy (M. Pharm.)**  
**(W. E. F.: 2023-24)**  
**Document ID: SUTEPHFM-01**

<b>Name of Faculty</b>	:	Faculty of Pharmacy
<b>Name of Program</b>	:	Master in Pharmacy
<b>Course Code</b>	:	1MQA01
<b>Course Title</b>	:	Modern Pharmaceutical Analytical Techniques
<b>Type of Course</b>	:	Basic Pharmaceutical Sciences
<b>Year of Introduction</b>	:	2023-24

<b>Prerequisite</b>	:	To have sufficient knowledge about basics of analytical methods for drug substances
<b>Course Objective</b>	:	This course is designed to impart knowledge on the area of advanced Pharmaceutical Analytical techniques.
<b>Course Outcomes</b>	:	At the end of this course, students will be able to understand.
	CO1	To <b>understand</b> the theoretical principle and instrumentation of Spectroscopic techniques like UV, IR, Fluorimetry, AAS and FES, Chromatography, X-ray crystallography, potentiometry, DSC and immunological assay.
	CO2	To <b>apply</b> the theoretical principle and instrumentation of Spectroscopic techniques like UV, IR, Fluorimetry, AAS and FES, Chromatography, X-ray crystallography, potentiometry, DSC
	CO3	To <b>interpret</b> the Spectroscopic techniques like UV, IR, Fluorimetry, AAS and FES, Chromatography, X-ray crystallography, potentiometry, DSC.

**Teaching and Examination Scheme**

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	SEE	CIA	SEE	CIA	
04	00	00	04	75	25	00	00	100

*Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P – Practical, C – Credit, SEE – Semester End Examination, CIA - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)*

**Course Content**

Unit No.	Topics	Teaching Hours	Weightage	Mapping with Cos
1	<p>UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy.</p> <p>IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation.</p> <p>Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.</p> <p>Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.</p>	11	18.33%	CO1 CO2 CO3
2	<p>NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and <sup>13</sup>C NMR. Applications of NMR spectroscopy.</p>	11	18.33%	CO1 CO2 CO3
3	<p>Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.</p>	11	18.33%	CO1 CO2 CO3
4	<p>Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:</p>	11	18.33%	CO1 CO2 CO3

	Thin Layer chromatography High Performance Thin Layer Chromatography Ion exchange chromatography Column chromatography Gas chromatography High Performance Liquid chromatography Ultra High Performance Liquid chromatography Affinity chromatography Gel Chromatography			
5	A) Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following:  a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing  B) X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.	11	18.33%	CO1 CO2 CO3
6	Immunological assays : RIA (Radio immuno assay), ELISA, Bioluminescence assays.	05	8.33%	CO1 CO2

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	0	33.33	33.33	33.33	0	0

*NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.*



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**Major Equipment/ Instruments and Software Required**

Sr. No.	Name of Major Equipment/ Instruments and Software
1	

**Suggested Learning Websites**

Sr. No.	Name of Website
1	<a href="https://pci.nic.in/pdf/Syllabus_B_Pharm.pdf">https://pci.nic.in/pdf/Syllabus_B_Pharm.pdf</a>
2	<a href="https://www.aicte-india.org/downloads/bpharma.pdf">https://www.aicte-india.org/downloads/bpharma.pdf</a>
3	<a href="https://www.ipc.gov.in/">https://www.ipc.gov.in/</a>
4	<a href="https://www.ayush.gov.in/">https://www.ayush.gov.in/</a>
5	<a href="https://ayudmla.gujarat.gov.in/home.php">https://ayudmla.gujarat.gov.in/home.php</a>
6	<a href="https://www.fda.gov/">https://www.fda.gov/</a>
7	<a href="https://www.pharmacopoeia.com/">https://www.pharmacopoeia.com/</a>
8	<a href="https://ipapharma.org/">https://ipapharma.org/</a>
9	<a href="https://gpat.nta.nic.in/">https://gpat.nta.nic.in/</a>
10	<a href="https://drnaitiktrivedi.com/">https://drnaitiktrivedi.com/</a>
11	<a href="https://gdc4gpat.com/course/gpat/">https://gdc4gpat.com/course/gpat/</a>
12	<a href="https://niscpr.res.in/">https://niscpr.res.in/</a>
13	<a href="https://delnet.in/">https://delnet.in/</a>
14	<a href="https://ihubgujarat.in/">https://ihubgujarat.in/</a>
15	<a href="https://www.ssipgujarat.in/">https://www.ssipgujarat.in/</a>

**Reference Books**

Sr. No.	Name of Reference Books
1	Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2	Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3	Instrumental methods of analysis - Willards, 7th edition, CBS publishers.
4	Practical Pharmaceutical Chemistry - Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5	Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6	Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7	Pharmaceutical Analysis - Modern Methods - Part B - J W Munson, Vol 11, Marcel. Dekker Series
8	Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.
9	Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.
10	Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.