



Dr. Rafiq Zakaria Campus

Maulana Azad Educational Trust's

Y. B. CHAVAN COLLEGE OF PHARMACY

(B. Pharm, M. Pharm & Research Centre)

ISO 21001:2018 & ISO 14001:2015 CERTIFIED | NIRF-2022 ALL INDIA RANK 65TH

NAAC ACCREDITATION "A" GRADE WITH 3.23 CGPA SCORE

COURSE MODULE

Program Title	M. Pharmacy
Department	Pharmaceutical Chemistry
Course Title	Modern Pharmaceutical Analytical Techniques (MPC 101T, MPH 101T, MPL 101T, MQA 101T)

1. **NAME OF INSTITUTION** : Y. B. CHAVAN COLLEGE OF PHARMACY,
AURANGABAD
2. **AFFILIATED UNIVERSITY** : DR. BABASAHEB AMBEDKAR
MARATHWADA UNIVERSITY, AURANGABAD
3. **DEPARTMENT** : PHARMACEUTICAL CHEMISTRY
4. **PROGRAM TITLE** : M. PHARM.

4.1. Program Specific Outcome: After completing the program, student will be able to:

PSO-1: Highlight advancements in knowledge associated with medicinal chemistry, Natural products chemistry, drug discovery, drug design and analytical techniques.

PSO-2: Independently carry out the design of bioactive molecules and synthetic research work.

PSO-3: Interpret the spectra of synthetic compounds, natural products and determine their structures.

PSO-4: Build professional, computational, analytical and critical thinking skills

PSO-5: Explain the unit operation and unit reactions in process chemistry

5. COURSE SPECIFICATION :

5.1.Course Identification and General Information

a. Course Title:	Modern Pharmaceutical Analytical Techniques	
b. Course Number/Code	(MPC 101T, MPH 101T, MPL 101T, MQA 101T)	
c. Credit Hours	Theory	Practical
	60(4hr/wk)	12hrs /wk
d. Study level/semester at which this course is offered	First Semester M. Pharm.	
e. Pre-requisite	Pharmaceutical Quality Assurance and Quality Control	
f. Co-requisite	Pharmaceutical Analysis	
g. Program in which the course is offered	M. Pharm	
h. Language of teaching the course	English	
i. Prepared by	Dr. Mirza Shahed Baig (M. Pharm Ist SEM)	
j. Approved by HOD	Dr. K. G. Baheti	

5.2. Course Description:

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

5.3. Course Objectives:

After completion of course student is able to know about chemicals and excipients

- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

6.0. Course Outcomes (COs) : (Min. 4 and Max. 6)

(Use Bloom's Taxonomy words)

CO Code	Course outcome
CO-1	Aware of the availability of wide choice of analytical techniques for routine drug analysis
CO-2	Able to select appropriate analytical technique for a given analytical problem
CO-3	Possess sound knowledge on theory, principle, instrumentation and use of commonly used instrumental methods.
CO-4	Acquired expertise in mathematical treatment of analytical data in quantitative analysis
CO-5	Acquired expertise in interpretation of analytical data to characterize drugs in qualitative analysis..

6.1. Knowledge and Understanding

(Alignment of PSOs to COs)

Course Code	Program Specific Outcome				
	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1 (MPC 101T, MPH 101T, MPL 101T, MQA 101T)	H	-	M	M	-
CO-2 (MPC 101T, MPH 101T, MPL 101T, MQA 101T)	H	L	H	L	-
CO-3 (MPC 101T, MPH 101T, MPL 101T, MQA 101T)	H	H	M	L	-
CO-4 (MPC 101T, MPH 101T, MPL 101T, MQA 101T)	M	H	H	-	-
CO-5 (MPC 101T, MPH 101T, MPL 101T)	M	M	L	H	-

101T, MQA 101T)					
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Correlation levels 1, 2 or 3 as defined below:

1: Slight (Low); 2: Moderate (Medium); 3: Substantial High); If there is no correlation, put ‘-‘

6.2. Teaching and Assessment Methods for achieving learning outcome:

Teaching Strategies(methods)/Tools used	Methods of Assessment
Lectures (Constructivist learning) Collaborative learning (Discussion) Project based Learning Blended learning Inquiry based learning Flash cards Video Equipment models	Formative Assessment Case study Class test Multiple choice questions Assignments Seminar Viva Voce Synopsis Tutorials Summative Assessment

6.3. Tools for the Teaching and learning

Theory subjects	Practical Subjects
<ul style="list-style-type: none"> • PowerPoints presentation • Videos • Flash Card • Models • Software • Charts • Smart Boards • White boards • Online Platform 	<ul style="list-style-type: none"> • White boards • Glassware • Chemicals • Instruments • Equipment • Software • Models • Plants/Crude Drugs • Animal

6.4. COURSE CONTENT

6.1. Theoretical Aspect:

Order	Topic list/units	Subtopics list	Number of Weeks	Contact Hours
1	Unit-I:	<p>a. 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>b. 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>c. 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>d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.</p>	03	10 Hrs
2	UNIT-II	<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 ¹³C NMR. Applications of NMR spectroscopy.</p>	03	10 Hrs
3	UNIT-III	<p>Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy,</p>	03	10 Hrs

		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.		
4	UNIT-IV	<p>Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:</p> <p>a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography</p>	03	10 Hrs
5	UNIT-V	<p>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</p> <p>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.</p>	03	10 Hrs
6	UNIT-VI	<p>a. Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry.</p> <p>b. Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling</p>	03	10 Hrs

		rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.		
	TOTAL			60 Hrs

6.2. Pharmaceutical Chemistry Practical – I

Order	Name of Experiment	Number of Weeks
1	1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer, RNA & DNA estimation 2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry 3. Experiments based on Column chromatography 4. Experiments based on HPLC 5. Experiments based on Gas Chromatography 6. Estimation of riboflavin/quinine sulphate by fluorimetry 7. Estimation of sodium/potassium by flame photometry	12
2	To perform the following reactions of synthetic importance 1. Purification of organic solvents, column chromatography 2. Claisen-schimidt reaction. 3. Benzilic acid rearrangement 4. Beckmann rearrangement. 5. Hoffmann rearrangement 6. Mannich reaction 7. Synthesis of medicinally important compounds involving more than one step along with purification and Characterization using TLC, melting point and IR spectroscopy (4 experiments) 8. Estimation of elements and functional groups in organic natural compounds 9. Isolation, characterization like melting point, mixed melting point, molecular weight determination, functional group analysis,	12

co-chromatographic technique for identification of isolated compounds and interpretation of UV and IR data. 10. Some typical degradation reactions to be carried on selected plant constituents	
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7.0. ASSESSMENT MECHANISM:

Sr. No.	Assessment Mechanism	Week due	Marks	Proportion of Final Assessment
1	Continuous Assessment (Theory)	2 nd week of every month	10	4%
2	Sessional (Internal Theory exam)	As per schedule of examination	15	6%
3	Continuous Practical Assessment (Sessional Practical exam)	Weekly during practical	20	8%
4	Sessional (Internal Practical exam)	As per schedule of examination	30	12%
5	Final exam (theory)	As per University at end of course	75	30%
6	Final exam(practical)		100	40%
Total			150	100%

8.0.STUDENT SUPPORT:

Office hours/week	Other procedures
Two hours minimum	MENTORING AND GUIDING

9.0.TEACHER'S AVAILABILITY FOR STUDENT SUPPORT:

Days	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Time	4:00-5:00	4:00-5:00	4:00-5:00	4:00-5:00	4:00-5:00	4:00-5:00

10.0. LEARNING RESOURCES:

Sr. No.	Title of Learning Material	Details
1	Text books	1. Spectrometric Identification of Organic

		<p>compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.</p> <p>2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman, 5 th edition, Eastern press, Bangalore, 1998.</p> <p>3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.</p> <p>4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.</p> <p>5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.</p> <p>6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.</p> <p>7. Pharmaceutical Analysis - Modern Methods – Part B - J W Munson, Vol 11, Marcel. Dekker Series</p> <p>8. Spectroscopy of Organic Compounds, 2 nd edn., P.S/Kalsi, Wiley estern Ltd., Delhi.</p> <p>9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.</p>
2	Reference material	<p>1) Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman, 5 th edition, Eastern press, Bangalore, 1998.</p> <p>2. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.</p> <p>3. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.</p>
3	E-materials and websites	PPT's, Text Notes, Soft copies (word/Pdf files),

4	Other learning material	College WhatsApp Group

11.0. FACILITIES REQUIRED:

Sr. No.	Particular of Facility Required
1	Lecture Rooms (capacity for 60 students)
2	Laboratory (capacity for 20 students)
3	Computing resources: PC with latest version and hardware/software and utilization of open source and licensed application software
4	Other resources: Appropriate laboratory tools, Chemicals, Glass ware, Apparatus, Instrumentation

12.0. COURSE IMPROVEMENT PROCESSES:

12.1. Strategies for obtaining student feedback on effectiveness of teaching:

Course delivery evaluation by students using: Questionnaire forms and online questionnaires

12.2. Other strategies for evaluation of teaching by the instructor or by the department:

Periodic review by Academic Planning & Monitoring Committee and departmental review committee, Observations and assistance of colleagues, External assessments by advisors/ examiners and auditors.

12.3. Process for improvement of teaching:

Use of ICT tools, teaching aids, Simultaneous practical orientation and theory classes (SPOT), Adoption of reflective teaching.

12.4. Describe the planning procedures for periodically reviewing of course effectiveness and planning for improvement:

Periodic review by departmental meeting, Review of course delivery and outcome through assessment and feedback from all stake holders.

12.5. Course development plans:

Provide inputs for course improvement and update to University Course development Committees (Board of Studies)

13.0. INFORMATION ABOUT FACULTY MEMBER RESPONSIBLE FOR THE COURSE:

Name	1) Dr. K. G. Baheti 2) Dr. Mirza Shahed Baig (MSB)
Location	Department of Pharmaceutical Chemistry
Contact Detail (e-mail & cell no.)	mirzashahedbaig@ybccpa.ac.in & 9890336238
Office Hours	10:00 AM to 5:00 PM