COURSE MODULE

Program Title	B. Pharmacy
Department	Pharmaceutical Chemistry
Course Title	Pharmaceutical Organic Chemistry -II

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** : B. PHARM.

4.1. Program Outcomes (PO):

PO 01: Pharmacy Knowledge: Possess knowledge and comprehension of the core and basic knowledge associated with the profession of pharmacy, including biomedical sciences; pharmaceutical sciences; behavioral, social, and administrative pharmacy sciences; and manufacturing practices.

PO 02: Planning Abilities: Demonstrate effective planning abilities including time management, resource management, delegation skills and organizational skills. Develop and implement plans and organize work to meet deadlines.

PO 03: Problem analysis: Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decisions during daily practice. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.

PO 04: Modern tool usage: Learn, select, and apply appropriate methods and procedures, resources, and modern pharmacy-related computing tools with an understanding of the limitations.

PO 05: Leadership skills: Understand and consider the human reaction to change, motivation issues, leadership and team-building when planning changes required for fulfillment of practice, professional and societal responsibilities. Assume participatory roles as responsible citizens or leadership roles when appropriate to facilitate improvement in health and wellbeing.

PO 06: Professional Identity: Understand, analyze and communicate the value of their professional roles in society (e.g. health care professionals, promoters of health, educators, managers, employers, employees).

PO 07: Pharmaceutical Ethics: Honour personal values and apply ethical principles in professional and social contexts. Demonstrate behavior that recognizes cultural and personal variability in values, communication and lifestyles. Use ethical frameworks; apply ethical principles while making decisions and take responsibility for the outcomes associated with the decisions.

PO 08: Communication: Communicate effectively with the pharmacy community and with society at large, such as, being able to comprehend and write effective reports, make effective presentations and documentation, and give and receive clear instructions.

PO 09: The Pharmacist and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety and legal issues and the consequent responsibilities relevant to the professional pharmacy practice.

PO 10: Environment and sustainability: Understand the impact of the professional pharmacy solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 11: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. Self-assess and use feedback effectively from others to identify learning needs and to satisfy these needs on an ongoing basis.

5. COURSE SPECIFICATION :

5.1.Course Identification and General Information

a. Course Title:	Pharmaceutical Organic Chemistry-II	
b. Course Number/Code	BP301T (Theory)	
c. Credit Hours	Theory	Practical
	45(3 Hrs/Week	60 (4Hrs. / Week)
d. Study level/semester at which this course is offered	B. Pharm III semester	
e. Pre-requisite	11th & 12th Chemistry-II and POC-I (BP202T)	
f. Co-requisite	NA	
g. Program in which the course is offered	B Pharm	
h. Language of teaching the course	English	
i. Prepared by	Mr. Sayad Imran	
j. Approved by HOD	Dr. K. G. Baheti	

5.2.Course Description:

The course is the continuation of Pharmaceutical Organic Chemistry-I studied in B. Pharm first year (semester-II). It emphases on study chemistry of aromatic, phenols, aromatic amines, polynuclear aromatic compound and cycloalkanes. The special emphasis has been given to study

the acidity and basicity of phenols and amines. The various useful compounds will be studies with reference to their physical properties, structures and uses.

5.3. Course Objectives:

Specific learning objectives for Pharmaceutical Organic Chemistry-II (BP202T) are mentioned below. By completing this course, students should be able to:

1. To explain the classification, classification, principles/mechanisms, applications, examples of organic compound as per the syllabus.
2. Explain the effects of substituent on acidity of phenols and basicity of amines
3. Describe physical, properties and uses of some of the organic compound mentioned in the syllabus.
4. Perform synthesis of compounds, characterize tem and estimate the percentage purity of organic compounds by calculations.
5. To carry out analysis fats and oils using suitable analytical techniques and interpret their results.
6. Synthesis, reactions and stability of cyclohexane.

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

(Use Bloom's Taxonomy words)

After completion course, student should be able to

CO Code	Course outcome
CO 301.01	Identify the structure and recite the reactions and mechanism of the compounds
CO 301.02	Compare the effects of substituent on acidity and basicity of compounds
CO 301.03	Recite the physical properties and uses of the organic compound as per course
CO 301.04	To synthesize, characterize and % yield of organic compounds
CO 301.05	Perform analysis of fats, oils and interpret the results

6.1. Knowledge and Understanding

(Alignment of POs to COs)

Course code (CO)	Program Outcome (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 301.01	3	---	2	---	---	---	--	1	---	1	2
CO 301.02	2	---	3	---	---	---	---	1	---	---	2
CO 301.03	3	---	2	---	1	---	---	2	---	---	1
CO 301.04	3	3	2	3	2	---	---	1	2	1	2
CO 301.05	2	3	2	3	2	---	--	1	2	1	2

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
• PowerPoints presentation • Videos • Flash Card • Models • Software • Charts • Smart Boards • White boards • Online Platform	• 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
01	**Benzene & aromaticity**	Introduction and aromaticity	**2.5**	**10**
02		Nomenclature of benzene derivatives		
03		Analytical, synthetic and other evidences in the structure of benzene, Orbital picture		
04		resonance in benzene, aromatic characters, Huckel's rule		
05		Methods of preparation		
06		Reactions of benzene - nitration, sulphonation, halogenation-reactivity, Substituents		
07		Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation		
08		Effect of substituent's on reactivity and orientation of mono substituted benzene (electron donating group)		

09		Effect of substituent's on reactivity and orientation of mono substituted benzene (electron withdrawing gr)		
10		Structure and uses of DDT, Saccharin, BHC and Chloramine.		
11	**Phenols**	Definition, Nomenclature Methods of preparation Reactions of phenols	**1**	**3**
12		Acidity of phenols, effect of substituents on acidity		
13		qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols		
14	**Aromatic amines**	Definition, Nomenclature Methods of preparation	**1**	**4**
15		Reactions of aromatic amines		
16		Basicity of aromatic amines , effect of substituents on acidity		
17		Aryl diazonimu salts and its applications		
18	**Aromatic Acids**	Definition, Nomenclature Methods of preparation	**1**	**3**
19		Acidity, effect of Substituents on acidity		
20		Important Reaction of Benzoic acida		
21	**Polynulcear hydrocarbons**	Definition, examples, nomenclatures	**2**	**8**
22		Naphthalene : preparation		
23		Naphthalene : Reactions		
24		Naphthalene : Reactions		
25		Anthracene: Preparations and reactions		
26		Anthracene: Preparations and reactions		
27		Phenanthrene: Preparation and reactions		
28		Structure and uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives		
29	**Fats and oils**	Definition, classification and importance of fats and oils	**2.5**	**10**
30		Fatty acids: introduction and its nomenclature		
31		Reactions of fatty acids		
32		Hydrolysis, hydrogenation of oils		
33		Safonification, rancidity,drying of oils		
34		Significance, principle, procedure of acid value determination		
35		Significance, principle and procedure of safonification values		
36		Significance, principle and procedure iodine values		
37		Significance, principle and procedure ester , acetyl values		
38		Significance, principle and procedure Reisrt Meissl values.		
39	**Cycloalkanes**	Introduction and Nomenclature	**2**	**7**
40		Methods of preparations		
41		Reactions of cylcobutanes		
42		Reactions of cyclopropanes		
43		Baeyer's strain theory		
44		Coulson and Moffitt's modification		
45		Sachse Mohr's theory (Theory of strainless rings)		

6.2.Practical Aspects

Order	Tasks/Experiments	Number of Weeks	
1.	Safety & general hazards in chemical laboratory & use of aid in accidental cases	1	
2.	To study different reagents used in chemistry laboratory	1	
3.	Study of unit operation crystallization	1	
4.	Study of unit operation distillation	1	
5.	Synthesize & report melting point and % yield of Benzanilide.	1	
6.	Synthesize & report MP and % yield of 2.4,6-tribromo aniline.	1	

7.	Synthesize & report MP & % yield of p-Bromo Acetantltde	1	
8.	Synthesize & report MP & % yield of salicylic acid.	1	
9.	Synthesize & report MP & % yield of benzil	1	
10.	Synthesize & report MP & % yield of 1-Phenyl azo-2-napthol	1	
11.	Synthesize & report MP & % yield of O-Iodobenzoic acid	1	
12.	Synthesize & report MP & % yield of Dibenzal acetone	1	
13.	Synthesize & report MP& % yield of Benzoic acid	1	
14.	Determination of acid value	1	
15.	Determination of saponification value	1	
16.	Determination of Iodine value	1	
17.	Characterization of Synthesize product	1	

6.0. ASSESSMENT MECHANISM :

Sr. No.	Assessment Mechanism	Week due	Marks	Proportion of Final Assessment
1	Assignments, Exercises & Home works	2nd week of every month	10	6%
2	Sessional (Internal Theory exam)	As per scheduled examination	15	10%
3	Continuous Practical Assessment (Sessional Practical exam)	Weekly during practicals	15	10%
4	Final exam (theory)	As per University at end of course	75	50%
5	Final exam(practical)		35	24%
Total			150	**100%**

7.0.STUDENT SUPPORT:

Office hours/week	Other procedures
Two hours minimum	**Whatsapp, etc.**

8.0.TEACHER'S AVAILABILITY FOR STUDENT SUPPORT:

Days	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Time	**03:00-04:00**	**03:00-04:00**	**03:00-04:00**	**10:00-11:00**	**12:00-1:00**	**10:00-11:00**

9.0.LEARNING RESOURCES:

Sr. No.	Title of Learning Material	Details
1	Text books	Morrison R.T. and Boyd R.M., Organic Chemistry, Prentice Hall Of India Ltd., New Delhi-110 001.
2	Essential references (as per syllabus)	Finar I.L., Organic Chemistry (Vol.I and II) Longman Group Ltd., London. Elbs Series.
3	Reference material	1. House H.O., Modern Synthetic Reactions, W.A. Benjamin, London 2. Carey F.A., Organic Chemistry, The Mc Graw Hill Companies. 3. Pine S.H., Organic Chemistry, Tata Mc Graw Hill Publishing Company 4. Reaction and reagent Sanyal and Sanyal Organic Chemistry by Bahl and Bahl
4	E-materials and websites	• http://nptel.ac.in/ • http://sayadimranpoc.blogspot.com/ • https://youtu.be/d0PRbuPklQs
5	Other learning material	….

10.0. 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

11.0. COURSE IMPROVEMENT PROCESSES:

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

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

11.2. 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.

11.3. Process for improvement of teaching:

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

11.3.1. 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.

11.4. Course development plans:

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

12.0. INFORMATION ABOUT FACULTY MEMBER RESPONSIBLE FOR THE COURSE:

Name	Mr. Sayad Imran and Dr. Yasar Qazi
Location	Pharm. Organic Chem Lab., Ground Floor.
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