

# Pharmaceutical Organic Chemistry

## Theory and Practical

has been compiled to completely cover the PCI syllabus, implemented in the subject of pharmaceutical chemistry for semesters II, III and IV (BP202T, BP208P, BP301T, BP305P and BP401T) of BPharm course. The book consists of two volumes covering the syllabus included in Semesters II, III and IV.

Volume 1 of this book consists of topics, covering the syllabus prescribed in BP202T. All the topics are covered in five units in an easy to understand language. At the end of each unit, questions are given for practice as MCQs, short and long questions, usually asked in end terminal examination. Volume 1 also includes the systematic analysis of organic compounds mentioned in BP208P for Semester II. This inclusion will be quite helpful to the students as well as the teachers associated with BPharm course.

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Volume  
1

Volume

1

Pharmaceutical Organic Chemistry

Siddiqui



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Volume  
1

# Pharmaceutical Organic Chemistry

## Theory and Practical

BP202T and BP208P

As per the latest syllabus prescribed by Pharmacy Council of India



Anees Ahmad Siddiqui | Seemi Siddiqui



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**Volume 1**

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**Theory and Practical**

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Courses: BP202T and BP208P

**As per the latest syllabus prescribed by Pharmacy Council of India**



**Volume 1**

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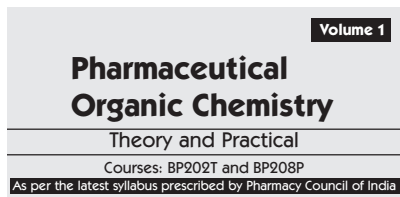
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## PREFACE

We had two main reasons for compiling the book on pharmaceutical organic chemistry as per the new PCI syllabus, implemented recently by Pharmacy Council of India for BPharm course. First, all the textbooks on pharmaceutical organic chemistry available for Semesters II to IV (BP202T, BP301T and BP401T) are not specific; these are general chemistry books consisting of bulk. The pharmacy students as well as the teachers have to make efforts to find out the topics which are relevant to the areas of their interest.

The second reason is Covid-19. The lockdown period during Covid-19 was a very difficult period for us. Hence, we thought to utilize this period to help the student community. We are already committed to help the pharmacy students in getting access to quality learning material through our various books published under CBS Publishers & Distributors Pvt Ltd.

This book *Pharmaceutical Organic Chemistry* is divided into two volumes: Volume 1 covers Semester II subjects (BP202T and BP208P) and Volume 2 covers Semesters III and IV subjects (BP301T, BP305P and BP401T), respectively. Each volume consists of five units (I to V) as per new PCI syllabus. Each chapter in various units is written in an easily understandable and simple language. The text is supported by relevant figures and reactions. At the end of each unit, questions are included: These are in the form of MCQs, short questions and long questions as per the guidance of PCI to the examiners. The practical exercises included in BP208P and BP305P are a part of relevant volume of this book to help the students as well as the teachers.

The first author is thankful to his wife, Rafatunisa Khanam, for encouraging as well as tolerating him during the lockdown period, as he was very much physically present in the house but not interactive most of the time.

Although, the textbook has undergone a rigorous review process, even then if the readers have any correction to suggest, please send me at my mail address (anees\_56@yahoo.co.in).

Last, we are thankful to the opportunity presented by the unique publishing strategy of Mr SK Jain and Mr Varun Jain, CBS Publishers & Distributors Pvt Ltd.

**Anees Ahmad Siddiqui**  
**Seemi Siddiqui**



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## SYLLABUS

### Course: BP202T: PHARMACEUTICAL ORGANIC CHEMISTRY-I (Theory)

45 Hours

**Scope:** This subject deals with classification and nomenclature of simple organic compounds, structural isomerism, intermediates forming in reactions, important physical properties, reactions and methods of preparation of these compounds. The syllabus also emphasizes on mechanisms and orientation of reactions.

**Objectives:** Upon completion of the course the student shall be able to:

1. write the structure, name and the type of isomerism of the organic compound
2. write the reaction, name the reaction and orientation of reactions
3. account for reactivity/stability of compounds
4. identify/confirm the identification of organic compound

### Course Content

General methods of preparation and reactions of compounds superscripted with **asterisk (\*)** to be explained.

To emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences.

#### UNIT-I

07 Hours

##### • Classification, nomenclature and isomerism

Classification of organic compounds

Common and IUPAC systems of nomenclature of organic compounds (up to 10 carbons open chain and carbocyclic compounds)

Structural isomerisms in organic compounds

#### UNIT-II

10 Hours

##### • Alkanes\*, alkenes\* and conjugated dienes\*

$sp^3$  hybridization in alkanes, halogenation of alkanes, uses of paraffins.

Stabilities of alkenes,  $sp^2$  hybridization in alkenes

$E_1$  and  $E_2$  reactions—kinetics, order of reactivity of alkyl halides, rearrangement of carbocations, Saytzeffs orientation and evidences.  $E_1$  versus  $E_2$  reactions, Factors affecting  $E_1$  and  $E_2$  reactions. Ozonolysis, electrophilic addition reactions of alkenes, Markownikoff's orientation, free radical addition reactions of alkenes, anti-Markownikoff's orientation.

Stability of conjugated dienes, Diel-Alder, electrophilic addition, free radical addition reactions of conjugated dienes, allylic rearrangement.

#### UNIT-III

10 Hours

##### • Alkyl halides\*

$S_N1$  and  $S_N2$  reactions—kinetics, order of reactivity of alkyl halides, stereochemistry and rearrangement of carbocations.

$S_N1$  versus  $S_N2$  reactions, factors affecting  $S_N1$  and  $S_N2$  reactions.

Structure and uses of ethylchloride, chloroform, trichloroethylene, tetrachloroethylene, dichloromethane, tetrachloromethane and iodoform.

• **Alcohols\***

Qualitative tests, structure and uses of ethyl alcohol, methyl alcohol, chlorobutanol, cetosteryl alcohol, benzyl alcohol, glycerol, propylene glycol.

**UNIT-IV**

**10 Hours**

• **Carbonyl compounds\* (aldehydes and ketones)**

Nucleophilic addition, electromeric effect, aldol condensation, crossed aldol condensation, Cannizzaro reaction, crossed Cannizzaro reaction, benzoin condensation, Perkin condensation, qualitative tests, structure and uses of formaldehyde, paraldehyde, acetone, chloral hydrate, hexamine, benzaldehyde, vanillin, cinnamaldehyde.

**UNIT-V**

**08 Hours**

• **Carboxylic acids\***

Acidity of carboxylic acids, effect of substituents on acidity, inductive effect and qualitative tests for carboxylic acids, amide and ester.

Structure and uses of acetic acid, lactic acid, tartaric acid, citric acid, succinic acid, oxalic acid, salicylic acid, benzoic acid, benzyl benzoate, dimethyl phthalate, methyl salicylate and acetyl salicylic acid.

• **Aliphatic amines\***

Basicity, effect of substituent on basicity, qualitative test, structure and uses of ethanolamine, ethylenediamine, amphetamine.

**Course: BP208P: PHARMACEUTICAL ORGANIC CHEMISTRY-I (Practical)**

**4 Hours/week**

1. Systematic qualitative analysis of unknown organic compounds like:

- (i) Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
- (ii) Detection of elements like nitrogen, sulphur and halogen by Lassaigne test
- (iii) Solubility test
- (iv) Functional group test like phenols, amides/urea, carbohydrates, amines, carboxylic acids, aldehydes and ketones, alcohols, esters, aromatic and halogenated hydrocarbons, nitro compounds and anilides
- (v) Melting point/boiling point of organic compounds
- (vi) Identification of the unknown compound from the literature using melting point/boiling point
- (vii) Preparation of the derivatives and confirmation of the unknown compound by melting point/boiling point
- (viii) Minimum 5 unknown organic compounds to be analyzed systematically.

2. Preparation of suitable solid derivatives from organic compounds.

3. Construction of molecular models.