

1.4 PHARMACEUTICAL ORGANIC CHEMISTRY - I (THEORY)

75 Hours ; 3 hours/week

- 1. Nomenclature of aliphatic and aromatic organic compounds belonging to the following classes:** alkanes, alkenes, dienes, alkynes, alcohols, aldehydes, ketones, amides, amines, phenols, alkyl halides, carboxylic acids, esters, acid chlorides and cycloalkanes. **8 hours; 7-8 marks**
- 2. Structure and physical properties:**
 - a) Polarity and Dipole moment, Hydrogen bonding and its applications, Inductive effect Mesomeric effect, Protic and aprotic solvents.
 - b) An introduction to Isomerism- Definition, Classification of structural and stereo isomerism **2 hours; 1-2 marks**
- a) Definition, formation, classification, and stability of free radicals.
 - b) Free radical chain reactions of alkanes-mechanism, relative reactivity and stability. **4 hours; 3-4 marks**
- a) **Alicyclic compounds:** Preparation of cycloalkanes, Bayer's strain theory, theory of Strainless ring, molecular orbital concept.
 - b) Concept of aromaticity (Huckel's rule). Definition, classification, Methods of synthesis (Haworth's and Diel's Alder), Properties and Reaction of Poly nuclear hydrocarbons Such as Naphthalene, Anthracene and Phenanthrene.
 - c) Attacking reagents- Electrophiles and Nucleophiles Definition with examples. **5 hours; 4-5 marks**
- a) Definition, formation, classification and stability of carbocations.
 - b) Nucleophilic aliphatic substitution mechanism: nucleophiles, and leaving groups, kinetics of second and first order reaction. Mechanism and Stereochemistry of SN_2 reaction, Mechanism and Stereochemistry of SN_1 reaction. Rearrangement of carbocation, SN_2 versus SN_1 reactions, Reactivity of alkyl halides in SN_2 and SN_1 , Factors affecting SN_2 and SN_1 reaction. **8 hours; 7-8 marks**
- 6. Elimination reactions:** Dehydrohalogenation of alkyl halides: 1, 2 elimination, kinetics, E_2 and E_1 mechanisms, E_2 versus E_1 , elimination versus substitution. Dehydration of alcohols and its mechanism, orientation and reactivity in E_1 and E_2 reactions, Saytzeff's and Hoffman's elimination. **7 hours; 6-7 marks**
- 7. Electrophilic addition:** a) Reactions at carbon-carbon double bond, hydrogenation and its mechanism Markovnikov's rule, addition of hydrogen halides, Addition of hydrogen bromides-peroxide effect. Electrophilic addition mechanism.
b) Definition, formation, classification and stability of carbenes, Mechanism of cycloaddition reactions with examples. Addition of carbenes to alkenes, Diel's Alder reaction. **5 hours; 4-5 marks**
- 8. Theory of resonance:** Allyl radical as a resonance hybrid, stability, and orbital picture. Resonance stabilization of Allyl cations: hyper conjugation, stability of conjugated dienes, mechanisms of 1,2 and 1,4-additions with examples **6 hours; 5-6 marks**

9. Electrophilic aromatic substitution; Definition and classification of electrophiles, effect of substituent groups, determination of orientation, and of relative reactivity, classification of substituent groups, mechanism of nitration, sulphonation, halogenation, Friedel Craft's alkylation and Friedel Craft's acylation, Reactivity and orientation, activating and deactivating (o, m, p, directing) groups, orientation and synthesis. Orientation in disubstituted benzenes, theory of reactivity and orientation, effects of halogens and Suzuki coupling reaction. **10 hours; 9-10 marks**

10. a) Definition, formation, classification and stability of carbonanions.
b) Nucleophilic additions in aldehydes and ketones, mechanisms with examples. Reactions of Grignard reagent. Aldol and crossed Aldol condensation, Claisen condensation, Cannizaro and crossed Cannizaro reaction, Benzoin's, Perkins, Knoevenagels and Reformatsky reactions. **7 hours; 6-7 marks**

11. Carboxylic acids - Ionization of carboxylic acids, acidity of constant, acidity of carboxylic acids, structure of carboxylate ion, effect of substituents on acidity of carboxylic acids, Conversion of carboxylic acids into acid chloride, ester, amide, anhydrides and Hatu coupling. **6 hours; 5-6 marks**

12. Amines – a) Basicity of Amines, effect of substituents on basicity of aliphatic and aromatic amines
b) Definition, formation, classification, stability and reactivity of nitrenes. Hofmann's, Beckmann's, Curtius, Smith, rearrangement with their mechanism
c) Diazotisation and its mechanism, Sandmeyer's and Gattermann reaction, coupling reaction of Diazonium salts with phenols and amines **5 hours; 4-5 marks**

13. Phenols – Acidity of phenols, effect of substituent on acidity of phenols. Kolbe's reaction, Reimer - Tiemann reaction, Fries rearrangement and Williamson's synthesis. **2 hours; 1-2 marks**

PHARMACEUTICAL ORGANIC CHEMISTRY I (PRACTICALS)
75 hours ; 3 hours/week

1. Introduction to the various laboratory techniques through demonstrations involving synthesis of the following compounds *

- a) Acetanilide / Aspirin (acetylation)
- b) Benzanilide / Phenyl benzoate (Benzoylation)
- c) p-Bromo acetanilide / 2,4, 6 Tribromo aniline. (Bromination)
- d) Dibenzylidene acetone (condensation)
- e) 1-Phenylazo-2-naphthol (Diazotisation)
- f) Benzoic acid / Salicylic acid (hydrolysis of ester)
- g) m-Dinitro benzene (nitration)
- h) Oxidation of Toluene to benzoic acid
- i) Benzophenone oxime (oxime formation)
- j) Benzyl benzoate and Sodium benzoate from Benzaldehyde (Cannizzaro's reaction)

2. Identification of organic compounds belonging to the following classes by systematic qualitative organic analysis including physical constant and preparation of their derivatives.**

1. Phenols, 2. Amides, 3. Carbohydrates, 4. Amines, 5. Carboxylic acids, 6. Aldehydes and ketones, 7. Alcohols, 8. Esters, 9. Hydrocarbons, 10. Anilides, 11. Nitro compounds.

3. Introduction to the use of stereo models

1. Methane, 2. Ethane, 3. Ethylene, 4. Acetylene, 5. cis-Alkene, 6. trans-Alkene, 7. Inversion of configuration

4. Determination of melting point and boiling point for some important pharmaceutical Organic compounds.

Note: ** Denotes major experiments * Denotes minor experiments

SCHEME OF EXAMINATION

1. Synopsis	-	10 Marks
2. Major Experiment (Experiments indicated by **) (Systematic Qualitative Analysis)	-	35 Marks
3. Minor Experiment –I (Experiments indicated by)* (Preparation of Simple Organic Compound)	-	15 Marks
4. Practical viva voce	-	10 Marks
Total	-	70 Marks

PHARMACEUTICAL ORGANIC CHEMISTRY I TEXT BOOKS (THEORY)

1. Morrison TR, Boyd R. Text of organic chemistry. 6th ed. New Delhi;Prentice Hall of India Pvt. Ltd.
2. Finar IL. Organic chemistry, the fundamentals of chemistry, vol 1. 6th ed. Longman Publishers.
3. Bhal A, Bhal BS. A textbook of organic chemistry. Revised ed. S.Chand & Company Pvt Ltd.
4. Atherden LM. Bentley and Driver's textbook of pharmaceutical chemistry. 8th ed.

PHARMACEUTICAL ORGANIC CHEMISTRY I REFERENCE BOOKS (THEORY)

1. Graham STW. Fundamentals of organic chemistry. 5th ed. USA:John Wiley & Sons Inc.
2. Catm JM, Carm DJ. Organic chemistry. 13th ed. Saunders College of Publishing.
3. Brown, Organic chemistry.
4. Indian Pharmacopoeia. All editions. Delhi: The Controller of Publications, Ministry of Health and Family welfare, Govt. of India.
5. Jerry, March. Advanced organic chemistry. 4th ed. New Delhi;Wiley Eastern Limited.
6. Cram, Hammer. Pine Hendrickson organic chemistry.
7. Alinger, Cava, Dejongh. Organic chemistry.
8. Neckers, Doyle. Organic chemistry.
9. Agrononov et. al., Problems and exercises in organic chemistry.
10. Man & Sounders. Practical organic chemistry.
11. Ahluwalia. Practical organic chemistry.
12. Pandey OP. Practical oraganic chemistry. S.Chand Publications.

PHARMACEUTICAL ORGANIC CHEMISTRY I REFERENCE BOOKS (Practicals)

1. Vogel AI. Elementary practical organic chemistry. London;ELBS and Longman Group Ltd.
2. Mann, Sounders. Practical organic chemistry. ELBS and Longman Group Ltd.
3. Pavia DL, Lampman G, Kriz GD. Introduction to organic laboratory techniques.
4. Indian Pharmacopoeia. All editions. Delhi: The Controller of Publications, Ministry of Health and Family welfare, Govt. of India.
5. Vogel. Textbook of practical organic chemistry. 4th ed. London;ELBS Longman.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Melting Point Apparatus	10 nos
2. Triple beam balances	10 nos
3. Physical balances	05 nos
4. Suction Pumps	01 no
5. Water Baths	10 nos
6. Hot Plates	01 no
7. Oven	01 no
8. Refrigerator	01 no
9. Distillation Unit	01 no