

2.5 PHARMACEUTICAL ORGANIC CHEMISTRY-II (THEORY)

75 hours ; 3 hours/week

The subject is to be treated in the light of modern perspective giving stress wherever possible on the following aspects-structure, nomenclature, preparation, properties, energy of activation, transition state, resonance, stereochemistry, optical isomerism, Geometric isomerism and mechanism of reaction.

I. Stereochemistry: 14 hours;17-18 marks

- a) Stereo isomerism, classification of stereoisomers tetrahedral optical activity, enantiomerism, diastereoisomerism, meso structures, elements of symmetry, chirality, chiral centers, configuration, specification of D and L configuration, R and S configuration. Racemic modification and resolution of racemic mixture, conformational isomers, asymmetric synthesis, Reaction of chiral molecules
- b) Stereo selective and stereospecific reactions with examples. 2 hours;3-4 marks
- c) Geometrical isomerism, its nature of formation, rotation about bonds: nomenclature of isomers, determination of configuration, Nature of E and Z forms 5 hours; 6-7 marks
- d) Stereochemistry of alicyclic compounds, allenes and biphenyls, stereochemistry of oximes 3 hours; 4-5 marks

II. Heterocyclic Chemistry: 27 hours; 34-36 marks

General classification of heterocyclic compounds, nature and nomenclature. reactions, synthesis and properties of the following heterocyclic systems and their derivatives.

- a) Pyrrole, Furan and Thiophene
- b) Indole, Benzofuran and Benzothiophene
- c) Pyridine
- d) Quinoline, Isoquinoline, acridine
- e) Pyrazole, Imidazole, Oxazole, Isoxazole and Thiazole
- f) Pyrimidine, Pyrazine, Pyridazine, Purine, benzodiazepine and phenothiazine

III Chemistry of bio molecules of pharmaceutical importance:

1. Carbohydrates: 9 hours; 11-12 marks

Introduction, Definition, Classification, Nomenclature, Structural determination of Glucose and Fructose. Stereoisomers of monosaccharides, reactions, conversions, configuration, cyclic structures of glucose, determination of ring size in Glucose. Fischer projection formulae, and conformations. Disaccharides and polysaccharides. Chemical nature of maltose, lactose, sucrose, starch and cellulose, derivatives used in pharmacy.

2. Fats and Oils: 4 hours; 5-6 marks

Chemistry of fats oils and waxes. Occurrence and composition. Hydrolysis of fats, Fats as sources of pure acids and alcohols. Analytical constants of fats and oils such as Saponification value, Iodine value, Acid value and Unsaponifiable matter and methods of their determination and significance. Rancidity of oils, hardening of oils, hydrogenation of oils, drying, semidrying and nondrying oils with example.

3. Proteins and Amino acids: 4 hours; 5-6 marks

Introduction, definition, classification of proteins and amino acids their properties Zwitterions. Isoelectric point and its significance. reactions, synthesis of amino acids (Gabriel's Phthalimide synthesis, Strecker's synthesis, Koenig's and Erlenmeyer's azalactone

synthesis) and reactions. Peptide linkages, Peptide synthesis, solid phase synthesis structures of proteins, C-terminal and N-terminal analysis.

4. Protection and De-protection of groups:

3 hours; 4-5 marks

Introduction to protection and deprotection of functional groups examples of two protective agents each for amino, hydroxyl and carbonyl groups with their significance in organic synthesis.

5. A study and specific uses of the reagents in organic synthesis including their mechanism

4 hours; 5-6 marks

- a) Aluminium isopropoxide – Meerwein –Ponndorf- Verley reduction, Oppenauer oxidation.
- b) Aluminium tertiary butoxide – Allylic bromination
- c) Lithium aluminium hydride – Reduction of carboxylic acid
- d) Periodic acid – Oxidation of 1,2 – diol to carbonyl compound
- e) Sodamide – Chichibian reaction
- f) Sodium borohydride – Reduction of aldehyde carbonyl group
- g) Metachloro peroxybenzoic acid – Beyer – villegger oxidation (oxidation of ketone to esters)
- h) Diazo methane – Buchaner – Curtius – Schlotterbeck reaction (Aldehydes to methyl ketones)

PHARMACEUTICAL ORGANIC CHEMISTRY-II (PRACTICALS)

75 hours ; 3 hours/week

(Following experiments to be carried out in 25 classes)

I. Quantitative determination of organic compounds via functional groups **

1. Phenolic group by bromination method
2. Alcoholic group by acetylation method
3. Carbonyl group by hydroxylamine hydrochloride-pyridine method
4. Aldehyde group by sodium sulphite-sulphuric acid procedure
5. Carboxyl group by acid-base method
6. Determination of acetone by sodium hypoiodide method
7. Amino group by bromination method
8. Amino acid Formal titration method

II. Analysis of oils and fats: (I.P. Method)*

1. Acid value
2. Saponification value
3. Iodine value

III. Synthesis/ preparation involving more than one step*

1. p-bromoaniline from acetanilide
2. p-Nitroaniline from acetanilide
3. p-Nitrophenyldrazine from p-nitroaniline
4. 3-methyl-1-phenyl-5-pyrazole from ethyl acetoacetate
5. Benzilic acid from benzoin
6. Pthalimide from benzophenone
7. Pthalimide from phthalic acid
8. Synthesis of 2, 3-Diphenyl quinoxaline
9. Benzimidazole Orthophenylene Diamine

Note: ** Denotes major experiments

*** Denotes minor experiments**

SCHEME OF EXAMINATION

1 Synopsis	10 Marks
2 Major Experiment (**)	30 Marks
3 Minor Experiment (*or oil analysis)	20 Marks
4 Viva	10 Marks
Total	70 Marks

PHARMACEUTICAL ORGANIC CHEMISTRY-II TEXT BOOKS (THEORY)

1. E. L. Eliel, John Wiley and Son, Stereochemistry of Organic Compounds. New York, 1993.
2. I. L. Finar, Organic Chemistry Vol. I and II, Sixth Edition, 2003, ELBS.
3. A text book of Organic Chemistry Arun Bhal and B.S., Bhal, S. Chand Publishers revised edition.
4. Raj K. Bansal, Heterocyclic Chemistry, New age international Ltd., New Delhi, Third Edition, 2001.
5. B. S. Bhal and Arun Bhal, S. Chand, Advanced Organic Chemistry and Company, New Delhi, 2001.
6. T. W. G. Solomans, Organic Chemistry, Sixth Edition, , John Wiley and Son, New York, 1996.

PHARMACEUTICAL ORGANIC CHEMISTRY-II REFERENCE BOOKS (Theory)

1. R.O.C Norman and J. M. Conon, Principals of Organic Synthesis, Third Edition, 1995, ELBS,
2. R. J. Morrison and R. N. Boyd Organic Chemistry, Fifth Edition, Prentice Hall of India Pvt. Ltd., New Delhi.
3. J. A. Joule and L. K. Mills, Heterocyclic Chemistry Fourth edition, Blackwell Science Publisher, 2000.
4. S. M. Mukherji and S. P. Singh, Reaction Mechanisms in Organic Chemistry, Third Edition Macmillan publishers, 2001.
5. I. P. 1996, Govt. of India, Ministry of Health and Family Welfare, All edition including latest.
6. A. I. Vogel, Elementary Organic Chemistry, Part-3, Quantitative Organic Analysis, second edition, CBS Publishers and Distributors, New Delhi, 2000.
7. B. S. Furniss, A. J. Hannaford, P.W.G. Smith and A. R. Tatchell, Vogel's Text Book of Practical Organic Chemistry, Edited, Fifth Edition, Addison Wesley Longman, England, 1998.
8. Chemistry and Natural Products by Chatwal Vol. 1 & 2
9. Reaction and reagents O P Agrawal, Goel Publishing House, Subhash Bazar, Meerut (U.P) India

PHARMACEUTICAL ORGANIC CHEMISTRY-II REFERENCE BOOKS (Practical)

1. A.I. Vogel, Elementary Practical organic chemistry, ELBS and Longman group Ltd., London.
2. Mann and Sounders, Practical Organic Chemistry-ELBS and Longman group Ltd.,
3. D.L. Pavia, G. Lampman and G.D. Kriz. Introduction to Organic Laboratory Techniques.
4. I.P., Govt. of India, Ministry of Health and Family welfare, 3rd Edition (1985), 4th Edition (1996).
5. A. I. Vogel, Text Book of practical organic chemistry, ELBS Longman, London, 4th edition.

LIST OF MINIMUM EQUIPMENTS REQUIRED

1. Suction Pump	01
2. Analytical Balance	01
3. Physical Balance	05
4. Triple Beam Balance	Adequate
5. Water Baths, Reflux flask and condenser	10
6. Hot Plate	Adequate
7. Mechanical Stirrer	Adequate
8. Magnetic Stirrers with Thermostat	Adequate
9. Distillation Unit	01
10. Refrigerator	01
11. Oven	01