SEMESTER -I

M.Sc. ORGANIC CHEMISTRY

PAPER-2ORGANIC CHEMISTRY-I

THEORY

Programme: M.Sc. **Max.Hours : 60**
Course Code: P20/CHE/DSC/102 **Hours per week: 4**
Type of course: DSC – 2 **Max.Marks: 100**
No. of credits : 4

Course Objectives:

- To learn various concepts of stereochemistry by applying symmetry operations.
- To understand the mechanisms involved in Additions and Elimination reactions.
- Deals with different types of strains, energy and stability of different conformers.
- To rationalize on the nomenclature, synthesis and reactivity of some heterocyclic compounds.

Course Outcome:

CO1: Identify the symmetry elements and symmetry operations in molecules

CO2: Explain the criteria for chirality and discuss axial, planar and helical chirality

CO3: Discuss the methods of determination of relative and absolute configuration

CO4: Discuss Racemization and Resolution techniques

CO5: Determine the configuration in E and Z isomers

CO6: Explain the mechanism of electrophilic addition to carbon carbon double bond and Elimination reactions

CO7: Discuss the various methods of determination of reaction mechanism

CO8: Discuss the conformations in saturated and unsaturated acyclic compounds and the factors affecting the stability and reactivity of conformations

CO9: Explain the general methods in structure determination of terpenoids and alkaloids

CO10: Explain the nomenclature, synthesis and reactivity of heterocyclic compounds.

MODULE I - STEREOCHEMISTRY: **(15 hrs)**

Molecular representations: Wedge, Fischer, Newman and Saw-horse formulae, their description and interconversions.

Molecular Symmetry & Chirality: Symmetry operations and symmetry elements (Cn & Sn). Criteria for Chirality.Desymmetrization.

Axial, planar and helical chirality: Axially chiral allenes,spiranes,alkylidene cycloalkanes, chiral biaryls, atropisomerism, planar chiral ansa compounds and trans- cyclooctene, helically chiral compounds and their configurational nomenclature

Relative and absolute configuration: Determination of configuration by chemical correlation methods.

Racemisation and resolution techniques: Racemisation, resolutions by direct crystallization, diastereoisomer salt formation chiral chromatography and asymmetric transformation.

Determination of configuration in E, Z-isomers: Spectral and Chemical methods of configuration determination of E,Z isomers. Determination of configuration in aldoximes and ketoximes.

MODULE II - REACTION MECHANISM-I: (15 hrs)

Electrophilic addition to carbon carbon double bond: Stereoselective addition to carbon carbon double bond; anti addition- Bromination and epoxidation followed by ring opening. Syn addition of OsO4 and KMnO4.

Elimination reactions Elimination reactions E2, E1, E1CB mechanisms.Orientation and stereoselectivity in E2 eliminations.Pyrolyticsynelimination and α-elimination, elimination Vs substitution.

Determination of reaction mechanism: Determination of reaction mechanism: Energy profiles of addition and elimination reactions, transition states, product isolation and structure of intermediates, use of isotopes, chemical trapping and crossover experiments. Use of IR and NMR in the investigation of reaction mechanism.

MODULE III - CONFORMATIONAL ANALYSIS (ACYCLIC SYSTEMS): (15 Hrs)

Conformational isomerism: Introduction to the concept of dynamic stereochemistry. Conformational diastereoisomers and conformational enantiomers .Study of conformations in ethane and 1,2-disubstituted ethane derivatives like butane, dihalobutanes, halohydrin, ethylene glycol, butane-2, 3-diol amino alcohols and 1,1,2,2-tetrahalobutanes. Klyne-Prelog terminology for conformers and torsion angles

Conformations of unsaturated acyclic compounds: Propylene, 1-Butene, Acetaldehyde

Propionaldehyde and Butanone.

Factors affecting the conformational stability and conformational equilibrium:
Attractive and repulsive interactions.Use of Physical and Spectral methods in conformational analysis.

Conformational affects on the stability and reactivity of acyclic diastereoisomers: Steric andstereoelectronic factors-examples.Conformation and reactivity. The Winstein-Holness equation and the Curtin – Hammett principle

MODULE IV - HETEROCYCLIC COMPOUNDS & NATURAL PRODUCTS (15 Hrs)

Heterocyclic compounds: Introduction, Nomenclature Synthesis and reactivity of indole, quinoline, isoquinoline, carbazole and acridine

Natural products : Importance of natural products as drugs.

Terpenoids : General methods in the structure determination of terpenes. Isoprene rule. Structure determination and synthesis of β-carotene, α-terpeniol and camphor.

Alkaloids: General methods of structure determination of alkaloids. Structure determination and synthesis of papaverine

References Books:

1. Eliel, E.L., and Wilen, S. H. *Stereochemistry of carbon compounds.*
2. Nasipuri, D. *Stereochemistry of Organic compounds-Principles and Applications.*
3. Gilchrist, T.L. (1985). *Heterocyclic Chemistry.* London: Longman UK Ltd.
4. Mustafa, A. (1974). *Benzofurans*. NewYork: Wiley-Interscience.
5. Joule, J.A., Mills, K., and Smith, G.F. (1998). *HeterocyclicChemistry* (3rd ed.) UK: Stanley Thornes Ltd.
6. Sunderberg, R.J. (1970). *The Chemistry of Indole*. NewYork: AcademicPress.
7. Acheson, R.M. (1967).*An introduction to the chemistry of heterocyclic compounds* (2nd ed.). NewYork: Interscience Publishers.
8. Jerry March. *Advanced Organic Chemistry*.
9. Mukerjee, S. *Mechanism and Structure in Organic Chemistry.*

SEMESTER -I

PAPER-2ORGANIC CHEMISTRY-I

MODEL THEORY QUESTION PAPER

Course Code: P20/CHE/DSC/102 **Max Time: 2½ Hrs**

Credits: 4 **Max. Marks :60**

SECTION A

I Answer the following Questions:- **4 x10 =40 M**

1. a) Explain about the four symmetry elements with one example each. **(CO1)**
   b) Describe axial chirality in allenes. **(CO2)**

OR

2. a) How do you determine the configuration of aldoximes and ketoximes? **(CO3)**
   b) Explain resolution of racemic mixture by Diastereomeric salt method in detail. **(CO4)**

3. a) Write a short note on Chemical trapping. **(CO7)**
   b) Explain orientation in elimination reactions **(CO6)**

OR

4. a) How Crossover experiments are used in determining the reaction mechanisms **(CO7)**
   b) Explain the stereochemistry involved in E2 Eliminations **(CO6)**

5. Write a note on how physical and spectral methods are useful in conformational Analysis**(CO8)**

OR

6. a) Write about Klyne Prelog terminology ?Illustrate with examples **(CO8)**
   b).Draw the preferred conformations of ethylene chlorohydrin, and 1- Butene **(CO8)**

7. a) Describe Skraup synthesis of Quinoline **(CO 10)**
   b) Write the synthesis and reactivity of Carbazole. **(CO 10)**

OR

8. Explain synthesis and reactivity of Indole **(CO 10)**

SECTION B

II Answer any <u>FIVE</u> of the following . 5x4 =20 M

9. Write a short note on ANSA compounds. **(CO2)**
10. Discuss any three spectral method used to distinguish cis and Trans isomers. **(CO5)**
11. Write about syn and anti addition with one example each. **(CO6)**
12. Write about E1CB elimination reactions **(CO6)**
13. Explain Curtin Hammet principle. Explain with a suitable example. **(CO8)**
14. Explain the conformational analysis of n- Butane. **(CO8)**
15. What is the isoprene rule? Draw the structure of β- carotene ? **(CO9)**
16. Describe the importance of natural products as drugs **(CO9)**

SEMESTER I
PAPER 2, ORGANIC CHEMISTRY
PRACTICAL SYLLABUS

Programme :M.Sc
Course Code : P20/CHE/DSC/102/P **Max marks : 50**
CourseType :DSC-2 **No. of Hrs./Week: 4 Hrs**
No. of Credits :2

COURSE OUTCOME:

- Identify various functional groups present in the given organiccompound by using a systematic procedure.
- Get familiarize with solubility nature of organic substances ofdifferent functional groups
- To get acquainted with the tests involved in identification of various functional groups

Identification of organic compounds systematic qualitative analysis:
Physical data BP / MP, Ignition test, solubility classification, Extra elements-N,S& Halogens, (Lassagnine sodium fusion test, Beilstein test)
Functional groups tests, Preparation of crystalline derivative and determination of their m.p.s and reference to literature to identify the compounds
A minimum of **8** following compounds to be studied as unknown covering atleast one from each of the solubility classes
Glucose, benzoic acid, 2-chloro benzoic Acid, Anisic acid, p-Nitrobenzoic acid; p-Cresol, p-Chlorophenol, α-Naphthol; Aniline, o/m/p-Chloroanilines; N-Methyl aniline/N-Ethylaniline, N,N-Dimethylaniline,Benzamide, Benzaldehyde, Anisaldehyde, Acetophenone,benzophenone,Ethylbenzoate,methylbenzoate,Nitrobenzene, chlorobenzene, bromobenzene , naphthalene, biphenyl anthracene

References Books:

1. Vogel. *Text book of Practical Organic Chemistry*.
2. Mann, F.G., and Saunders, F.C. *Text book of practical organic chemistry*.
3. Silverstein Bassler, M. *Spectrometric identification of organic compounds* (5th ed.).

SEMESTER 1

PAPER -2ORGANIC CHEMISTRY-I

MODEL PRACTICAL QUESTION PAPER

Course Code: P20/CHE/DSC/102/P **Time: 3Hrs**

Credits : 2 **Max. Marks:50**

1. Write the tests involved in the identification of weak acids. **(CO1)** 1**0M**
2. Identify the functional group present in the given organic compound by a study of its Solubility behaviour, ignition and confirmatory tests. Determine its b.p/m.p and submit the derivative. **(CO2)** **25M**
3. Record + Attendance **5 M**
4. Viva voce **10 M**