

University of Pune
Revised Syllabus 2014
M.Sc. II: Organic Chemistry

Semester III

CHO-350	Organic Reaction Mechanism	48 Lectures, 4 Credits
CHO-351	Spectroscopic Methods in Structure Determination	48 Lectures, 4 Credits
CHO-352	Organic Stereochemistry	48 Lectures, 4 Credits
CHO-353	Pericyclic Reactions, Photochemistry and Heterocyclic Chemistry	48 Lectures, 4 Credits

Semester IV

CHO-450	Natural Products	48 Lectures, 4 Credits
CHO-451	Advanced Synthetic Organic Chemistry	48 Lectures, 4 Credits
CHO-452	Carbohydrate and Chiron approach/ Chiral Drugs and Medicinal Chemistry	48 Lectures, 4 Credits
CHO-453	Designing Organic Synthesis and Asymmetric Synthesis	48 Lectures, 4 Credits

M.Sc. II: Organic Chemistry Practical

CHO-347	Single Stage Preparations	6 Credits
CHO-447	Two Stage Preparations	6 Credits
CHO-448	Project/Industrial training/ Green Chemistry and Chemical Biology Experiments	6 Credits

Equivalence of previous Syllabus

	New Syllabus 2014 Pattern		Old Syllabus 2008 Pattern
CHO-350	Organic Reaction Mechanism	CH-350	Organic Reaction Mechanism
CHO-351	Spectroscopic Methods in Structure Determination	CH-351	Spectroscopic Methods in Structure Determination
CHO-352	Organic Stereochemistry	CH-352	Organic Stereochemistry
CHO-353	Pericyclic Reactions, Photochemistry and Heterocyclic Chemistry	CH-353	Free Radicals, Photochemistry, Pericyclic Reactions and their Applications
CHO-450	Chemistry of Natural Products	CH-450	Chemistry of Natural Products
CHO-451	Advanced Synthetic Organic Chemistry	CH-451	Synthetic Methods in Organic Chemistry
CHO-452	Carbohydrate and Chiron Approach/ Chiral Drugs and Medicinal Chemistry	CH-452	Heterocyclic Chemistry, Chiron Approach and Medicinal Chemistry
CHO-453	Designing Organic Synthesis and Asymmetric Synthesis		
CHO-347	Single Stage Preparations	CH-347	Ternary Mixture Separation
CHO-447	Double Stage Preparation	CH-447	Single Stage and Two Stage Preparation
CHO-448	Project/Industrial Training/ Green Chemistry and Chemical Biology Experiments	CH-448	Project and Practicals

M.Sc. Organic Chemistry PART-II
REVISED SYLLABUS-2014

CHO-350: Organic Reaction Mechanism [4 credits, 48 Lectures]

1. Carbanions-Formation, stability and related name reactions [14L]
Ref. 1, 2, 3 Vol.A and 7
2. Enamines –formation and applications, Ref. 3 [4L]
3. NGP :Neighbouring group participation , Ref. 1 [6L]
4. Reactions of carbenes and nitrenes Ref.3 Vol B [4L]
5. Free radicals: [14L]
Generation of radiacals, Stable free radicals, Nucleophilic and electrophilic radicals,
Characteristics reactions, -Free radical substitution, addition to multiple bonds,
Radicals in synthesis: Inter and intra molecular C-C bond formation via mercuric
hydride, tin hydride, thiol dionors, cleavage of C-X, C-Sn, C-Co, C-S, O-O bonds.
Oxidative coupling. C-C bond formation in aromatics, SNAr reactions
Ref. 1, 3 Vol A, 6
6. Mechanisms in Biological Chemistry (Ref. 5) [6L]

References:

1. Mechanism and structure in Organic Chemistry – E. S. Gould (Holt, Rinehart and Winston)
2. Advanced organic chemistry by J. March, 6th Ed.
3. Advanced organic chemistry. F. A. Carey and R. J. Sundberg, 5th Ed. Springer (2007)
4. A guidebook to mechanism in organic chemistry – Peter Sykes 6th Ed. Orient Longman
5. Organic Chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers. Oxford University Press (2001)
6. Radicals in Organic Synthesis B. Giese, Pergamon press (1986)

CHO-351: Spectroscopic Methods in Structure Determination

[4 credits, 48 Lectures]

¹H NMR Spectroscopy

(14 L)

Chemical shift, factors influencing chemical shift, deshielding, chemical shift values and correlation for protons bonded to carbons (aliphatic, lefinic, aldehydic, aromatic) and other nuclei (alcohols, phenols, enols, acids, amides mercaptans), chemical exchange, effect of deuteration, spin-spin coupling, (n+1) rule, complex spin-spin interaction between two, three, four and five nuclei (first order spectra), factors effecting coupling constant “J”, classification of spin system like AB, AX, AX₂, ABX, AMX, ABC, A₂B₂. Spin decoupling, Factors affecting coupling constant, simplification of complex spectra, nuclear magnetic

double resonance, spin decoupling, contact shift reagents, solvent effects, nuclear overhauser effect (NOE), resonance of other nuclei like ^{31}P , ^{19}F

^{13}C NMR spectroscopy (8 L)

FT NMR, Types of ^{13}C NMR Spectra: un-decoupled, Proton decoupled, Off resonance, APT, INEPT, DEPT, chemical shift, calculations of chemical shifts of aliphatic, olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbons, factors affecting chemical shifts, Homo nuclear (^{13}C - ^{13}C) and Hetero nuclear (^{13}C - ^1H) coupling constants.

2D NMR Techniques (6 L)

General idea about two dimensional NMR spectroscopy, Correlation spectroscopy (COSY)- Homo COSY (^1H - ^1H), TOCSY, Hetero COSY (HMQC, HMBC), Homo and Hetero nuclear 2D resolved spectroscopy, NOESY and 2D-INADEQUATE experiments and their applications.

Mass Spectrometry (10 L)

Instrumentation, various methods of ionization (field ion, field desorption, SIMS, FAB, MALDI, Californium plasma), different detectors (magnetic analyzer, ion cyclotron analyzer, Quadrupole mass filter, time of flight (TOF)). Rules of fragmentation of different functional groups, factors controlling fragmentation

Problems based on joint application of UV, IR, PMR, CMR, and Mass. (10 L)

(Including reaction sequences)

References:

1. Introduction to Spectroscopy – D. L. Pavia, G.M. Lampman, G. S. Kriz, 3rd Ed. (Harcourt college publishers).
2. Spectrometric identification of organic compounds R. M. Silverstein, F. X. Webster, 6th Ed. John Wiley and Sons.
3. Spectroscopic methods in organic chemistry - D. H. Williams and I. Fleming Mc Graw Hill
4. Absorption spectroscopy of organic molecules – V. M. Parikh
5. Nuclear Magnetic Resonance – Basic Principles- Atta-Ur-Rehman, Springer-Verlag (1986).
6. One and Two dimensional NMR Spectroscopy – Atta-Ur-Rehman, Elsevier (1989).
7. Organic structure Analysis- Phillip Crews, Rodriguez, Jaspars, Oxford University Press (1998)
8. Organic structural Spectroscopy- Joseph B.Lambert, Shurvell, Lightner, Cooks, Prentice-Hall (1998).
9. Organic structures from spectra –Field L.D., Kalman J.R. and Sternhell S. 4th Ed. John Wiley and sons Ltd.

10. Spectroscopic identification of organic compound- R M Silverstein, G C Bassler and T C Morrill, John Wiley
11. Introduction to NMR spectroscopy-R J Abraham, J Fisher and P Loftus Wiley
12. Organic spectroscopy-William Kemp, E L B with McMillan
13. Spectroscopy of organic molecule-PS Kalsi, Wiley, Esterna, New Delhi
14. Organic spectroscopy-RT Morrison and RN Boyd
15. Practical NMR spectroscopy-ML Martin, J J Delpench, and D J Martyn
16. Spectroscopic methods in organic chemistry-D H Willson, I Fleming
17. Spectroscopy in organic chemistry- C N R Rao and J R Ferraro
18. NMR –Basic principle and application-H Guntur
19. Interpretation of NMR spectra-Roy H Bible
20. Mass spectrometry organic chemical applications, J H Banyon

CHO-352: Organic Stereochemistry

[4 credits, 48 Lectures]

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| 1. Stereochemistry of six membered rings. | Ref. 1, 4, 5, 6 | (12L) |
| 2. Stereochemistry of rings other than six membered | Ref. 1, 4, 5, 6 | (8L) |
| 3. Fused Bridged and caged rings | Ref. 1, 2, 4, 5 | (6L) |
| 4. Resolution of racemic modification | Ref. 1, 4 | (6L) |
| 5. Geometrical Isomerism and Stereochemistry of olefins | Ref. 1, 2 | (10L) |
| 6. CD and ORD | Ref. 1, 2, 4 | (2L) |
| 7. Determination of stereochemistry organic compounds using NMR. | | (4L) |
| Ref. 3 Chapters 32 (1 st Edition) | | |

References:

1. Stereochemistry of carbon compounds - E. L. Eliel
2. Stereochemistry of carbon compounds - E. L. Eliel and S. H. Wilen
3. Organic Chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers 1st. Ed.
4. Stereochemistry of organic compounds –Nasipuri
5. Stereochemistry of organic compounds-Kalsi
6. Organic stereochemistry – Jagdamba Singh