



SECOND-YEAR OF MASTER OF SCIENCE CHEMISTRY REVISED SYLLABUS ACCORDING TO CBCS NEP2020

COURSE TITLE: SYNTHETIC ORGANIC CHEMISTRY-II
SEMESTER-IV
W.E.F. 2024-2025

**RECOMMENDED BY THE BOARD OF STUDIES IN CHEMISTRY
AND**

APPROVED BY THE ACADEMIC COUNCIL

Devrukh Shikshan Prasarak Mandal's

Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and
Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh.
Tal. Sangameshwar, Dist. Ratnagiri-415804, Maharashtra,
India

Academic Council Item No:

Name of the Implementing Institute	:	Nya. Tatyasaheb Athalye Arts, Ved. S. R. Sapre Commerce, and Vid. Dadasaheb Pitre Science College (Autonomous), Devrukh. Tal. Sangameshwar, Dist. Ratnagiri-415804,
Name of the Parent University	:	University of Mumbai
Name of the Programme	:	Master of Science
Name of the Department	:	Chemistry
Name of the Class	:	Second Year
Semester	:	Four
No. of Credits	:	04
Title of the Course	:	Synthetic Organic Chemistry-II
Course Code	:	S611CHT
Name of the Vertical in adherence to NEP 2020	:	Compulsory Major
Eligibility for Admission	:	Chemistry Graduate learner seeking Admission to Post Graduate Programme in adherence to Rules and Regulations of the University of Mumbai and Government of Maharashtra
Passing Marks	:	40%
Mode of Assessment	:	Formative and Summative
Level	:	PG
Pattern of Marks Distribution for SEE and CIA	:	60:40
Status	:	NEP-CBCS
To be implemented from Academic Year	:	2024-2025
Ordinances /Regulations (if any)		

Syllabus for Second Year of Master of Science in Chemistry

(With effect from the academic year 2024-2025)

SEMESTER-IV

Course Title: Synthetic Organic Chemistry-II

Type of Vertical: Compulsory Major

Paper No.- II

No. of Credits: 04

COURSE CODE: S611CHT

Learning Outcomes Based on BLOOM's Taxonomy:

After completing the course, the learner will be able to...		
Course Learning Outcome No.	Blooms Taxonomy	Course Learning Outcome
CLO-01	Remember	to study protecting groups in organic synthesis, general strategy, cathodic and anodic reduction and basic concept related to transition and rare earth metals.
CLO-02	Understand	discuss disconnection approach, one and two group C-C disconnections and applications of Ni, Co, Fe, Rh, and Cr carbonyls in organic synthesis
CLO-03	Apply	construct the mechanism of michael addition, robinson annelation, heck reaction, suzuki-Miyaura coupling, sonogashira reaction.
CLO-04	Analyze	explain chemoselectivity, regioselectivity, stereoselectivity, enantioselectivity and applications of Crown ethers, cryptands, micelles, cyclodextrins in organic synthesis.

Syllabus for Second Year of Master of Science in Chemistry

(With effect from the academic year 2024-2025)

SEMESTER-IV

Paper No. - II

Course Title: Synthetic Organic Chemistry-II

No. of Credits: 04

Type of Vertical: Compulsory Major

COURSE CODE: S611CHT

COURSE CONTENT			
Module No.	Content	Credits	No. of Hours
1	<p>UNIT-I: Designing Organic Synthesis-I</p> <ul style="list-style-type: none">○ Protecting groups in Organic Synthesis: Protection and deprotection of the hydroxyl, carbonyl, amino and carboxyl functional groups and its applications.○ Concept of umpolung (Reversal of polarity): Generation of acyl anion equivalent using 1,3-dithianes, methyl thiomethyl sulfoxides, cyanide ions, cyanohydrin ethers, nitro compounds and vinylated ethers.○ Introduction to Retrosynthetic analysis and synthetic planning: Linear and convergent synthesis; Disconnection approach: An introduction to synthons, synthetic equivalents, disconnection approach, functional group interconversions (FGI), functional group addition (FGA), functional group removal (FGR) importance of order of events in organic synthesis, one and two group C-X disconnections (1,1; 1,2; 1,3 difunctionalized compounds), selective organic transformations: chemoselectivity, regioselectivity, stereoselectivity, enantioselectivity.	01	15

2	UNIT-II: Designing Organic Synthesis-II <ul style="list-style-type: none">○ General strategy: choosing a disconnection-simplification, symmetry, high yielding steps, and recognisable starting material.○ One group C-C Disconnections: Alcohols (including stereoselectivity), carbonyls (including regioselectivity), Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.○ Two group C-C Disconnections: 1,2- 1,3- 1,4- 1,5- and 1,6- difunctionalized compounds, Diels-Alder reactions, α, β-unsaturated compounds, control in carbonyl condensations, Michael addition and Robinson annelation.	01	15
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3	<p>UNIT-III : Electro-organic chemistry and Selected methods of Organic synthesis</p> <p>❖ Electro-organic chemistry:</p> <ul style="list-style-type: none"> ○ Introduction: Electrode potential, cell parameters, electrolyte, working electrode, choice of solvents, supporting electrolytes. ○ Cathodic reduction: Reduction of alkyl halides, aldehydes, ketones, nitro compounds, olefins, arenes, electro-dimerization. ○ Anodic oxidation: Oxidation of alkylbenzene, Kolbe reaction, Non-Kolbe oxidation, Shono oxidation. <p>❖ Selected Methods of Organic synthesis</p> <p>Applications of the following in organic synthesis:</p> <ul style="list-style-type: none"> ○ Crown ethers, cryptands, micelles, cyclodextrins, catenanes. ○ Organocatalysts: Proline, Imidazolidinone. ○ Pd catalysed cycloaddition reactions: Stille reaction, Saegusa-Ito oxidation to enones, Negishi coupling. ○ Use of Sc(OTf)₃ and Yb(OTf)₃ as water tolerant Lewis acid catalyst in aldol condensation, Michael reaction, Diels-Alder reaction, Friedel – Crafts reaction. 	01	15
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4	<p>Unit-IV: Transition and rare earth metals in organic synthesis</p> <ul style="list-style-type: none"> ○ Introduction to basic concepts: 18 electron rule, bonding in transition metal complexes, C-H activation, oxidative addition, reductive elimination, migratory insertion. ○ Palladium in organic synthesis: π-bonding of Pd with olefins, applications in C-C bond formation, carbonylation, alkene isomerisation, cross-coupling of organometallics and halides. Representative examples: Heck reaction, Suzuki-Miyaura coupling, Sonogashira reaction and Wacker oxidation. Heteroatom coupling for bond formation between aryl/vinyl groups and N, S, or P atoms. ○ Olefin metathesis using Grubb's catalyst. ○ Application of Ni, Co, Fe, Rh, and Cr carbonyls in organic synthesis. ○ Application of samarium iodide including reduction of organic halides, aldehydes and ketones, α-functionalised carbonyl and nitro compounds. ○ Application of Ce(IV) in synthesis of heterocyclic quinoxaline derivatives and its role as a de-protecting agent. 	01	15
	Total	04	60

Access to the Course

The course is available for all the students admitted for Second year of Master of Science.

Methods of Assessment

The assessment pattern would be 60:40, 60% for Semester End Examination (SEE) and 40% for Continuous Internal Assessment (CIA). The structure of the SEE and CIA would be as recommended by the Board of Studies and approved by the Board of Examination and the Academic Council of the college.

References:

- 1) Advanced Organic Chemistry, Part A and Part B: Reaction and Synthesis, Francis A. Carey, Richard J. Sundberg, 5th Edition, Springer Verlag
- 2) Modern Methods of Organic Synthesis, 4 th Edition, W. Carruthers and Iain Coldham, Cambridge University Press, 2004.
- 3) Chem.Rev. 2002, 102, 2227-2302, Rare Earth Metal Triflates in Organic Synthesis, S. Kobayashi, M. Sugiura, H. Kitagawa, and W.W.L. Lam.
- 4) Organic Chemistry, Clayden Greeves Warren and Wothers, Oxford Press (2001).
- 5) Modern Organic Synthesis: An Introduction, G.S. Zweifel and M.H. Nantz, W.H. Freeman and Company, (2007).
- 6) Advanced Organic Chemistry: Reaction Mechanism, R. Bruckner, Academic Press (2002).
- 7) Principles of Organic Synthesis, R.O.C. Norman & J. M. Coxon, 3 rd Edn., Nelson Thornes
- 8) Organic Chemistry, 7 th Edn, R. T .Morrison, R. N. Boyd, & S. K. Bhattacharjee, Pearson
- 9) Strategic Applications of Name Reactions in Organic Synthesis, L. Kurti & B. Czako (2005), Elsevier Academic Press
- 10) Advanced Organic Chemistry: Reactions & Mechanisms, 2 nd Edn., B. Miller & R. Prasad, Pearson
- 11) Organic reactions and their mechanisms, 3 rd revised edition, P.S. Kalsi, New Age International Publishers
- 12) Organic Synthesis: The Disconnection Approach, Stuart Warren, John Wiley & Sons, 2004
- 13) Name Reactions and Reagents in Organic Synthesis, 2 nd Edn., Bradford P. Mundy, Michael G. Ellard, and Frank Favoloro, Jr., Wiley-Interscience
- 14) Name Reactions, Jie Jack Lie, 3rd Edn., Springer
- 15) Organic Electrochemistry, H. Lund, and M. Baizer, 3rd Edn., Marcel Dekker.