VEER NARMAD SOUTH GUJARAT UNIVERSITY M.Sc.-I (CHEMISTRY)

PROPOSED SYLLABUS TO BE EFFECTIVE FROM JUNE 2018

PAPER-II (Organic Chemistry)

Max. Marks: 100 (External – 70 + Internal – 30) **Total Periods: 45**

SEMESTER-I

UNIT-I: REACTION MECHANISM & REACTIVE INTERMEDIATES 12 periods

Detailed study of organic reaction intermediates. Generation, structure, stability and reactions of –

Carbocations (Classical and non-classical): Phenonium ion, norbornyl system, common carbocation rearrangements- Demjanov, Pinacole-Pinacolone, Rupe.

Carbanions: Mechanism of condensation involving enolates - Aldol, Claisen, Mannich, Dieckmann, Michael and Shapiro reactions.

Carbenes: Mechanism of Arndt-Eistert reaction, Reimer-Tiemann reaction and Bamford Steven's rearrangement reaction.

Free Radicals: Allylic halogenation (NBS), coupling of alkenes and arylation of aromatic compounds by diazonium salts. Sandmeyer reactions. Free radical rearrangements, Hunsdiecker reaction.

Reference book:

1. Carbenes, Benzynes and Nitrenes by Gilchrist, T. L. and Rees.
2. Advanced Organic Chemistry-Reactions, Mechanism and Strucuture, Jerry March, John Wiley.
3. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh (McMillan India Ltd., 1976).
4. Organic Chemistry (3/e) by J. B. Hendrickson, Donald J. Crem and George S. Rammond (McGraw-Hill Book Co. &Kogekusha Co. Ltd., 1970).
5. Organic Chemistry (5/e) by Morrison & Boyd (Prentice Hall).
6. Advanced Organic Chemistry by Carey &Sundberg (3rd edition).
7. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
8. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum.
9. Organic chemistry 2nd ed. Jonathan clayden, Nick greeves, Stuart Warren.
10. Reaction Mechanism and Reagents in Organic Chemistry by C. R. Chatwal (Himalaya Publishing House, Bombay, 1987).

UNIT-II: PERICYCLIC REACTIONS **11 periods**

Introduction - Definition, Characteristics and Classification
Molecular orbitals and symmetry propertiesofethylene, 1,3- butadiene, 1,3,5- hexatriene and allylsystems.
Electrocyclic Reactions: Woodward-Hoffman Correlation diagram and derivation of selectionrules,Conrotatory and disrotatory motions, FMO and PMO approach for 4n and (4n+2) π electron system and allyl systems.
Cycloaddition Reactions: Antarafacial and suprafacial additions. FMOand PMO approach for 4n and (4n+2) π electron Systems(No correlation diagram),Diels-Alder reaction, stereoselectivity,Effect of substituents.
Sigmatropicrearrangements: Suprafacial and antarafacialshifts involving H & C moieties, retention and inversion of configurations.
The Cope and Claisen rearrangements, Ene reaction, 1, 3- dipolar cydoadditions.
Examples of electrocyclic, cycloaddition and sigmatropic rearrangements.

Reference book:

1. March's Advanced Organic Chemistry Reactions, Mechanisms, And Structure 7th ed. 2013 Michael B. Smith. Wiley.
2. Mechanism AndTheoryIn Organic Chemistry-2007 by Thomas H. Lowry, Kathleen S. Richardson, Forbes.Harper& Row, Publishers. New York, Hagerstown, San Francisco, London.
3. Advanced Organic Chemistry Part A: Structure and Mechanisms by Carey &Sundberg (5th edition),2000, Springer.
4. Pericyclic Reactions, S. M. Mukherji, Macmillan, India.
5. Photochemistry AndPericyclic Reactions 3rd ed. by Jagdamba Singh 2010. New Age International Publishers Ltd. New Delhi.
6. Pericyclic Reactions A mechanistic and problem solving approach Sunil Kumar, Vinod Kumar, S.P.Singh Academic Press 2015

UNIT-III; SUBSTITUTION AND ELIMINATION REACTIONS **11 periods**

A: Aliphatic Nucleophilic Substitution: The SN^1 , SN^2 , SN^i mechanisms. Reactions of Allylic halides, neighbouring group participation by -OH, -NH_2, -COO- , -RS, - halogen, aromatic ring.

B: Aromatic Nucleophilic Substitution: The SN^2 , SN^1 and benzyne mechanisms, Reactivity - effect of substrate structure, leaving group and attaching nucleophile, The Von Richter rearrangement.

C: Elimination reaction: Hoffmann and Zaitsev's rule of elimination, E1, E2 and E1CB Reaction mechanism and orientation.

Reference book:

1. Advanced Organic Chemistry-Reactions, Mechanism and Strucuture, Jerry March, John Wiley.
2. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh (McMillan India Ltd., 1976).
3. Organic Chemistry (3/e) by J. B. Hendrickson, Donald J. Crem and George S. Rammond (McGraw-Hill Book Co. &Kogekusha Co. Ltd., 1970).
4. Organic Chemistry (5/e) by Morrison & Boyd (Prentice Hall).
5. Advanced Organic Chemistry by Carey &Sundberg (3rd edition).
6. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
7. Physical organic chemistry by Jack Hyne
8. Reaction mechanism by Jagdambasingh.
9. organic chemistry - Reaction mechanism, by P.S. Kalsi, New age international publishers.

UNIT-IV: Stereochemistry **11 periods**

A. Stereo chemical principles; Enantiomeric relationships; Distereomeric relationship; R-S and E-Z nomenclature; Dynamic stereochemistry; Chiral-Prochiral relationships; Stereo selective and Stereo specific reactions; Racemates and racemic modification, Resolution of racemic modification, Optical activity in the absence of chiral carbons biphenyl, allenes, spiranes.

B. Confirmational Analysis: Interconversion of Fischer, Newman and Sawhorse projections. Newer method of asymmetric synthesis (including enzymatic and catalytic nexus), enantio and diastereo selective synthesis.Simple acyclic and cyclic (chair and boat cyclohexanes, Decalins, Perhydrophenanthrene)systems.Effects of conformation on reactivity in acyclic compounds and substituted cyclohexanes.

Reference book:

1. Advanced Organic Chemistry: Part A: Structure and Mechanisms; By Francis A. Carey, Richard J. Sundberg, fifth edition, Published by Springer.
2. Advanced Organic Chemistry: Part B: Reaction and Synthesis; By Francis A. Carey, Richard J. Sundberg, fifth edition, Published by Springer.
3. Stereochemistry of Carbon Compounds; By Ernest L. Eliel, Published by Tata McGraw-Hill Publishing Company Ltd.
4. Basic organic stereochemistry; By Ernest Ludwig Eliel, Samuel H. Wilen, Michael P. Doyle, Published by Wiley-Interscience.
5. Introduction to Stereochemistry; By Kurt Martin Mislow, Dover Publication INC.
6. Stereochemistry of Organic Compounds: Principles and Applications; By D. Nasipuri, New Age International (P) Ltd. Publisher.
7. Stereochemistry Conformation and Mechanism; By P.S. Kalsi, New Age International (P) Ltd. Publisher.
8. Basic Stereochemistry of Organic; By SubrataSen Gupta, First edition, Published by Oxford University Press.

M.Sc. Semester – I (PRACTICALS)

1. Mixture analysis: (Minimum eight mixtures) Ternary mixture to be given. (S+S+S), Semisolids or (L+L+L). Type determination.Separation by physical and chemical methods. (both permitted in case of liquids)
2. Paper Chromatography

Reference book:

1. A text book of practical organic chemistry – A. I. Vogel
2. Practical organic Chemistry – Mann and Saunders
3. A handbook of quantitative and qualitative analysis – H. T. Clarke
4. Comprehensive Practical Organic Chemistry: Qualitative Analysis V K Ahluwalia & S. Dhingra.
5. Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis V K Ahluwalia & R. Aggarwal Universities Press.
6. An Advance Course in practical Chemistry, A K. Nad, B. Mahapatra and A. Ghoshal.

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SEMESTER-II

UNIT-I: Organic Name Reactions 12 Periods

General nature, method, mechanism and synthetic applications of the following reactions:

(i) Heck reaction
(ii) Dakin reaction
(iii) Darzen'sglycidic ester synthesis
(iv) Suzuki reaction
(v) Willgerodt reaction
(vi) Buchwald-Hartwig reaction
(vii) H. V. Z. reaction
(viii) Mitsunobu reaction
(ix) Sonagashira reaction
(x) Dickmann reaction.

UNIT-II: AROMATICITY 11 Periods

A. Aromaticity and Aromatic character; structure and stability of benzene, Frost circle diagram, concept of aromaticity; Resonance and chemical stabilization; criteria to checkaromatic character-IR, NMR, heat of hydrogenation; Huckel's rule; HMO method
B. Antiaromaticity, homoaromaticity, nonaromaticity; aromaticity in benzanoid compounds: naphthalene, pyrene, acepleialdelene.
C. Aromaticity non-benzenoid compounds: azulene, tropolones, charged rings, annulenes, fullerenes, and mesoionic compounds.

UNIT-III: ORGANIC TRANSFORMATION AND REAGENTS 11 Periods

I. Sharplessepoxidation
II. Umpolung reagent (1,3-dithiane)
III. Dess martin periodinane
IV. DDQ
V. Tri-n-butyltinhydride $(C_4H_9)_3SnH$
VI. Diisobutyl aluminum hybride (DIDAL-H)
VII. Lithium disoprpyl amide (LDA)
VIII. OZONE
IX. Crown ethers
X. Wilkinson's Catalyst

UNIT-IV: **11 Periods**

PHOTO CHEMISTRY

A. Energy of molecules, photochemical energy, electronic excitation, Jablonski diagram, laws of photochemistry, quantum efficiency.
B. Photochemistry of carbonyl compounds- α- cleavage of acyclic, cyclicand α-β unsaturated cleavage of carbonyl compounds, β- cleavage of, inter and intramolecular hydrogen abstraction, addition to carbon- carbon doublr bond, photo reduction of carbonylcompounds.
C. Photo induce rearrangement of enones, dienones and alkenes. Photochemistry of alkenesand aromatic compounds- isomerization, dimerization and addition reactions.

Reference book:

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Reaction Mechanism in Organic Chemistry by S. M. Mukherji and S. P. Singh (McMillan India Ltd., 1976).
3. Organic Chemistry (3/e) by J. B. Hendrickson, Donald J. Crem and George S. Rammond (McGraw-Hill Book Co. & Kogekusha Co. Ltd., 1970).
4. Organic Chemistry (5/e) by Morrison & Boyd (Prentice Hall).
5. Advanced Organic Chemistry by Carey & Sundberg (3rd edition).
6. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
7. Name Reactions by A. R. Parikh &H.A.Parikh
8. Name reaction: A collection of detailed reaction mechanism by Jie Jack Li
9. Reaction Mechanism and Reagents in Organic Chemistry by C. R. Chatwal (Himalaya Publishing House, Bombay, 1987).
10. Organic Chemistry-Reactions and Mechanism by P S Kalsi
11. Advanced Organic Chemistry : Reactions and Mechanisms byM.S. Singh
12. Organic chemistrybyCram, Hammond, Pine and Handrickson
13. Photochemistry and Pericyclic Reactions by Jagdamba Singh
14. Pericyclic reactions: A text book by S. Sankararaman
15. Excited states in Organic Chemistry by J. D. Coyle and J. A. Barltrop
16. March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure by Michael B. Smith
17. Advanced Organic Chemistry: Part B: Reaction and Synthesis byCarey & Francis
18. Organic Chemistry by Jonathan Clayden

M.Sc. - Semester – II (PRACTICALS)

Preparation of organic compounds : (Minimum six)

(i) Nitration : m-dinitrobenzene from Nitrobenzene
(ii) Bromination: p-bromoacetanilide from acetanilide
(iii) Reduction: m-phenylenediamine from m-dinitrobenzene
(iv) Oxidation : p-nitrobenzoic acid from p-nitrotoluene
(v) Diazotization reaction: Orange-I
(vi) Friedl-Craft's reaction: Resacetophenone from Resocinol
(vii) Cannizzaro reaction: Benzoic acid from Benzaldehyde via KOH
(viii) Aldol condensation: Chalcone from Benzaldehyde + Acetophenone (Claisen Schmidt reaction)

Quantitative Estimations: (Minimum three)

a. Estimation of ester + acid
b. Estimation of formaldehyde
c. Estimation of glycine
d. Estimation of amide + acid

References:

1. A text book of practical organic chemistry – A. I. Vogel
2. Practical organic Chemistry – Mann and Saunders
3. A handbook of quantitative and qualitative analysis – H. T. Clarke
4. Comprehensive Practical Organic Chemistry : Qualitative Analysis V K Ahluwalia& S. Dhingra.
5. Comprehensive Practical Organic Chemistry : Preparations and Quantitative Analysis V K Ahluwalia & R. Aggarwal Universities Press.
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