**G.V.P. COLLEGE FOR DEGREE AND PG COURSES (A)**
**M.Sc. ORGANIC OF CHEMISTRY SYLLABUS**
**III-SEMESTER**
**(Effective from 2020-21 admitted batch)**
**PAPER I – ORGANIC REACTION MECHANISMS-I AND PERICYCLIC REACTIONS**

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|---|---|---|
| **Credits : 4** | | **Theory : 4 Hours** |
| **Max Marks : 100** | **External : 80** | **Internal : 20** |

**Course Objectives:**

1. To know the importance of aliphatic, aromatic, free radical nucleophilic and electrophilic substitution reactions
2. To know the importance of pericyclic reactions using electrocyclic and cycloadditions.

**UNIT-I**

**Aliphatic nucleophilic and electrophilic substitution mechanisms:**

**Nucleophilic substitution:** Substitution reactions of ambident nucleophiles, neighboring group participation of O, S, N, halogens - aryl groups - alkyl and cycloalkyl groups in nucleophilic substitution reactions - sigma, pi bond participation in acylic and bicyclic systems (non-classical carbocations) - substitution at allylic, trigonal and vinylic carbons - hydrolysis of esters - Meyer's synthesis of aldehydes, ketones and carboxylic acids.

**Electrophilic substitution:** $S_E1$, $S_E2$, and $S_Ei$ mechanisms - hydrogen exchange - migration of double bonds - halogenation of aldehydes, ketones, acids, acyl halides, sulphoxides and sulphones - aliphatic diazonium coupling - nitrosation at carbon and nitrogen - diazo transfer reaction - carbene and nitrene insertion.

**UNIT-II**

**Aromatic nucleophilic substitution:** A general introduction to different mechanisms of aromatic substitution $S_NAr$**,** $S_N1$ and aryne - Von Richter rearrangement – Sommlet-Hauser rearrangement - Smiles rearrangement.

**Radical substitution Mechanism:** Reaction at $Sp^3$ carbon - reactivity in aliphatic substrates - reactivity at bridged position - reactivity at $sp^2$ carbon - reactivity in aromatic substrates - neighboring group assistance in free radical reactions - effect of reactivity in the attacking radical - effect of solvent on reactivity - halogenation at an alkyl carbon and allylic carbon - hydroxylation at aromatic carbon by means of Fenton's reagent - oxidation of aldehydes to carboxylic acids - formation of cyclic ethers with $Pb(OAC)_4$, - Reed reaction - Sandmayer reaction - Kolbe reaction and Hunsdiecker reaction.

**UNIT-III**

Molecular orbital symmetry - frontier orbitals of ethylene - 1,3-Butadiene, 1,3,5-Hexatriene, allyl system - classification of pericylic reactions - FMO approach - Woodward-Hoffman correlation diagram method and perturbation of molecular (PMO) approach for the explanation of pericyclic reactions under thermal and photochemical conditions. **Electrocyclic Reactions:** Conrotatory and disrotatory motions, (4n) and (4n+2) - allyl systems and secondary effects. **Cycloadditions:** Antarafacial and suprafacial additions, notation of cycloadditions, (4n) and (4n+2) systems with a greater emphasis on (2+2) and (4+2) - cycloadditions, (2+2) - additions of ketenes, secondary effects of substituents on the rates of cycloadditions and cheletropic reactions.

**UNIT-IV**

FMO approach and perturbation of molecular (PMO) approach for the explanation of sigmatropic rearrangements under thermal and photochemical conditions - suprafacial and antarafacial shifts of H - sigmatropic shifts involving carbon moieties - retention and inversion of configurations, (3,3) and (5,5) sigmatropic rearrangements - detailed studies of Claisen (Ireland-Claisen, Overman-Claisen, Jhonson-Claisen) and Cope rearrangements - aza-Cope rearrangement and fluxional tautomerism

**Course outcomes:**

1. To know synthetically the processes relevant organic-chemical reactions and be able to discuss the mechanism of these reactions
2. To familiarize the different types of nucleophilic and radical substitution reactions

3. To give theoretical basis of pericyclic reactions and helps them to carry out these reactions.
4. To learn analysis of pericyclic reactions by correlation diagrams

**Text books**


1. Advanced Organic Chemistry: Reactions Mechanisms and Structure, Jerry March, 5th Edition, McGraw Hill, New York, 2006
2. Pericyclic Reactions, S.N. Mukhrjee, Macmilan, New Delhi, 2010.
3. Photochemistry and Pericyclic Reactions, Jagadamba Singh and Jaya Singh, New Age International Publications, New Delhi, 2012.


**Reference Books:**


1. The Modern Structural Theory in Organic Chemistry, L.N. Ferguson, Prentice Hall, 1969.
2. Advanced Organic Chemistry, F.A.Carey and R-J Sunderg, Springer, 2007.
3. Principles of Organic Synthesis, R.O.C.Norman and J.M. Coxon, 3rd Edition, Blakie Academic & Professional, London, 1995.
4. Mechanisms and Theory in Organic Chemistry, T. H. Lowery and K.S. Richardson. Harper & Row Publishers, New York, Hagerstown, San Francisco, London, 1976.

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**M.Sc. ORGANIC OF CHEMISTRY SYLLABUS**
**III-SEMESTER**
**PAPER II – ORGANIC SPECTROSCOPY – I**
**(Effective from 2020-21 admitted batch)**

| Credits : 4 | | Theory : 4 Hours |
|---|---|---|
| Max Marks : 100 | External : 80 | Internal : 20 |

**Course Objectives:**

1. To know the importance of different spectroscopic techniques
2. To identify the spectral data and solve the structure of the organic compounds.

**UNIT-I**

**Infrared spectroscopy:** Units of frequency wavelength and wave number - molecular vibrations - factors influencing vibrational frequencies - IR spectrometer –instrumentation - sampling techniques - characteristic frequencies of organic molecules and interpretation of spectra.

**UNIT-II**

**Ultraviolet spectroscopy:** Introduction - absorption laws - measurement of the spectrum – chromophores - standard works of reference – definitions and applications of UV spectroscopy to conjugated dienes, trienes, unsaturated carbonyl compounds and aromatic compounds.

**UNIT-III**

**Nuclear Magnetic Resonance Spectroscopy** (Proton and $^{13}C$ NMR)
Measurement of spectra - chemical shift - intensity of NMR signals and integration - factors affecting the chemical shifts - spin-spin coupling to $^{13}C$,$^{I}H$-$^{I}H$ - first order coupling - some simple IH-IH splitting patterns - magnitude of IH-IH coupling constants.

**UNIT-IV**

**Mass spectroscopy:** Basic Principles – instrumentation - mass spectrometer - isotope abundances - molecular ion - metastable ions - ionization techniques - EI, CI, FAB, MALDI - fragmentation processes and fragmentation associated with functional groups.

**Course Outcome:**

1. To learn Infrared spectroscopy, principle, instrumentation, and molecular structure determination
2. To learn UV spectroscopy and its applications and molecular structure determination
3. To know the principle, instrumentation, and applications of NMR Spectroscopy
4. To know the principle, instrumentation, and applications of mass Spectroscopy

**Text books:**


1. Spectroscopic Methods in Organic Chemistry, D.M. Williams and I. Fleming, 4th Edition, Tata–McGraw Hill, New Delhi, 1990.
2. Organic Spectroscopy, W. Kemp, 2nd Edition, ELBS Macmillan, New Delhi, 1987.
3. Organic Spectroscopy, Jagmohan, Narosa Publications, New Delhi, 2004
4. Organic Spectroscopy, P.S. Kalsi, New Age International Publication, New Delhi, 2007
5. Elementary Organic Spectroscopy, Y.R. Sharma, S. Chand & Company Pvt. Ltd., New Delhi, 2014
6. Introduction to Organic Spectroscopy, Donald Pavia, G. Lampman, G. Kritz, J. Vyvyan, Cengage Learning, 2007

**Reference Books:**


1. Spectrometric Identification of Organic Compounds, 4th Edition, R.M. Silverstein, C.Vasslellr and T.C. Merill, John Willey, New York, 1974
2. Applications of Absorption Spectroscopy of Organic Compounds, J.R. Dyer, Prentice Hall of India, New Delhi, 1984.
3. Spectroscopy, H. Kaur, 9th Edition, Pragati Prakasan, Meerut, 2014.

**G.V.P. COLLEGE FOR DEGREE AND PG COURSES (A)**
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**III-SEMESTER**

**PAPER III – ORGANIC SYNTHESIS-I**
**(Effective from 2020-21 admitted batch)**

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|---|---|---|
| **Credits : 4** | | **Theory : 4 Hours** |
| **Max Marks : 100** | **External : 80** | **Internal : 20** |

**Course Objectives:**

1. To know the synthesis of organic compounds using C-C single bonds, C=C double bonds
2. To know the importance of organic reagents for oxidation and organo boranes in synthesis.

**UNIT-I**

**Formation of carbon-carbon single bonds:** Alkylations *via* enolate - the enamine and related reactions - umploung (dipole inversion) – the aldol reaction – applications of organopalladium (Heck-Suzuki coupling and Stille-Sonogishira cross coupling - Negishi-Kumada coupling reactions - organonickel and organocopper reagents (Gillman reagent) - applications of thiocarbanions - selenocarbanions and sulphur ylides - synthetic applications of carbenes and carbenoids.

**UNIT-II**

**Formation of carbon-carbon double bonds:** Elimination reactions – pyrolytic syn eliminations – sulphoxide - sulphonate rearrangement - Wittig reaction-alkenes from arylsulphonylhydrazones - Eschenmoser fragmentation - olefin metathesis (Grubb's reaction)

**UNIT-III**

**Synthetic applications of organoboranes:**

**Organoboranes**: Preparation of organoboranes *viz*., hydroboration with $BH_3$-THF - dicyclohexyl borane - disiamyl borane, thexyl borane, 9-BBN and diisopinocamphenyl borane - functional group transformations of organoboranes – oxidation, protonolysis and rearrangements - formation of carbon-carbon bonds *viz*., organo boranes carbonylation - cyanoborate process and reactions of alkenyl boranes and trialkylalknyl borates.

**UNIT-IV**

**Oxidation:** Oxidations of hydrocarbons, alkenes, alcohols, aldehydes and ketones - oxidative coupling reactions - use of $Pb(OAC)_4$, NBS, $CrO_3$, $SeO_2$, $MnO_2$, alkoxysulphonium ylides, $KMnO_4$, $OsO_4$, peracids and Tl(III) nitrate.

**Course outcomes:**

1. To learn the synthesis of compounds containing C-C bonds by coupling and cross coupling reactions
2. To learn the synthesis of compounds containing C=C bonds by elimination and Fragmentation reactions
3. To learn the synthesis and applications of the organic reagents like 9-borabicyclo(3.3.1)nonane (9-BBN) and other boranes
4. To learn the synthesis of compounds using various oxidizing agents

**Textbooks:**


1. Some Modern Methods of Organic Synthesis, W. Carruthers, 3rd Edition, Cambridge University Press, Cambridge, 1988.
2. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, 3rd Edition, Nelson Thornes, Cheltenham, UK, 1993

3. Advanced Organic Chemistry: Reactions Mechanisms and Structure, Jerry March, 5th Edition, McGraw Hill, New York, 2006

**Reference books:**

1. Organic Synthesis via Boranes, H. C. Brown, Wiley-Interscience, New York, 1975.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Springer, 2007.
3. Organic Chemistry, J. Clayden, N. Geeves and S. Warren, 2nd Edition, Oxford University Press, Oxford, 2012
4. Modern Synthetic Reactions, H.O. House, 2nd Edition, W.A. Benjamin Inc., Menlo Park, California, 1972.

**G.V.P. COLLEGE FOR DEGREE AND PG COURSES (A)**
**M.Sc. ORGANIC OF CHEMISTRY SYLLABUS**
**III-SEMESTER**
**PAPER IV - NATURAL PRODUCTS AND BIOPOLYMERS-I**
**(Effective from 2020-21 admitted batch)**

| Credits : 4 | | Theory : 4 Hours |
|---|---|---|
| Max Marks : 100 | External : 80 | Internal : 20 |

**Course Objectives:**

1. To know the importance of natural products
2. To know the synthesis of various natural products
3. To know the structure and biological properties of natural products.

Study of isolation, structure, stereochemistry, synthesis, and biological properties of the following classes of natural products from plant, animal, and microbial sources and biopolymers.

**UNIT-I**
**Acetogenins and antibiotics:**
Microbial metabolities - pencillin G - cephalosphorin-C - streptomycin.

**UNIT-II**
**Terpenes:** Forskolin - taxol - azadirachtin.

**UNIT-III**
**Alkaloids:** Morphine - reserpine - vincristine

**UNIT-IV**
**Biopolymers:**
**Peptides:** α-Aminoacids - their general properties and synthesis - synthesis of peptides by Merrifield solid phase synthesis - chemistry of oxytocin and dolastatin-10.

**Course outcomes:**

1. To study isolation, structure, stereochemistry, synthesis, and biological properties of actogenins and antibiotics
2. To study isolation, structure, stereochemistry, synthesis, and biological properties of terpenes - forskolin, taxol and azadirachtin
3. To study isolation, structure, stereochemistry, synthesis, and biological properties of alkaloids – morphine, reserpine and vincristine
4. To study isolation, structure, stereochemistry, synthesis, and biological properties of Peptides - α-Aminoacids, oxytocin and dolastatin-10

**Text books:**


1. Organic Chemistry, Volume 2, Stereochemistry and Chemistry of Natural Products, I.L. Finar, 5th Edition, Pearson, New Delhi, 2002.
2. Chemical Aspects of Biosynthesis, J. Mann, Oxford University Press, Oxford, UK, 1996.
3. Chemistry of Natural Products: A Unified Approach, N.R. Krishnaswamy, Universities Press, Hyderabad, 2010.
4. Chemistry of Natural Products, S.V. Bhat, B.A. Nagasampagi, M. Sivakumar, Narosa Publishing House, New Delhi, 2014.

**Reference Books:**


1. Classics in Total Synthesis, K.C. Nicolaou, E.J. Sorensen 1st Edition, Wiley-VCH, 1996.
2. Chemical Aspects of Biosynthesis, John Mann, Oxford University Press, Oxford, 1996
3. Introduction to Organic Chemistry, A. Streitweiser, C.H. Heathcock and E.M. Kosover, 4th Edition, Macmilan, New York, 1992.

**SEMESTER-III**

**PRACTICAL SYLLABUS**
**(Effective from 2020-21 admitted batch)**

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| **Credits : 8** | | **Lab : 15 Hours** |
| **Max Marks : 200** | **External : 160** | **Internal : 40** |

## Practical I

Multistage synthesis of six organic compounds involving three or more stages.

## Practical II

1. Thin Layer Chromatography
2. Column Chromatography

**Text Books:**


1. Vogel's Practical Organic Chemistry,
   A.R. Tatchell, B.S. Furnis, A.J. Hannaford and P.W.G. Smith, 5th Edition, Pearson,
   New Delhi, 2017.
2. Vogel's Text book of Quantitative Inorganic Analysis,
   J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th Edition,
   Pearson Education, New Delhi, 2008.
3. Chemistry of Natural Products: A Laboratory Handbook, N.R. Krishnaswamy, Universities
   Press, Hyderabad, 2013.
4. A Laboratory Manual of Organic Chemistry, R.K. Bansal,
   New Age International Publishers, New Delhi, 2008.
5. Practical Organic Chemistry, F.G. Mann & B.C. Saunders, Pearson, New Delhi, 2001