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

PAPER I – ORGANIC REACTION MECHANISMS-II AND ORGANIC PHOTOCHEMISTRY

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

Course objectives:

1. To learn addition to carbon-carbon multiple bonds, addition to carbon-hetero atom multiple bonds and elimination reactions
2. To learn Mechanisms of modern organic synthetic reactions and multicomponent reactions
3. To learn the basic concepts of organic photochemical reactions
4. To study the photochemistry of carbonyl compounds, alkenes, dienes and aromatic compounds

UNIT-I

Addition and Elimination Mechanisms: (a)Addition to carbon-carbon multiple bonds: Addition reactions involving electrophiles - nucleophiles and free radicals - cyclic mechanisms - orientation and stereochemistry - hydrogenation of double and triple bonds – hydroboration - Birch reduction - Michael reaction - addition of oxygen and N_2O_4;

(b) Addition to carbon-hetero atom multiple bonds: Mannich reaction - LAH reductions of carbonyl compounds, acids, esters, nitriles, addition of Grignard reagents - Reformatsky reaction - Tollen's reaction - Wittig reaction - Prins reaction.

(c) Elimination reactions: Stereochemistry of elimination reactions in acyclic and cyclic systems - orientation in elimination reactions – Saytzeff and Hofmann elimination - pyrolytic elimination.

UNIT-II

Modern Organic Synthetic Reactions: Tiffeneau–Demyanov rearrangement –Neber, Stevens, Wittig rearrangement - Baylis-Hillman reaction - Buchwald-Hartwig coupling - Mitsunobu reaction - McMurray reaction; **Multicomponent Reactions:** Ugi, Passerini, Biginelli, and Hantzsch. Ring formation reactions - Pausan-Khand reaction - Bergman cyclisation - Nazerov cyclisation.

UNIT-III

Organic Photochemistry: Photochemical energy, Frank-Condon Principle - Jablonski diagram singlet and triplet states - dissipation of photochemical energy – photosensitization – quenching - quantum efficiency and quantum yield - experimental methods of photochemistry - photochemistry of carbonyl compounds n-π, π-π* transitions - Norrish type I and Norrish type II cleavages - Paterno-Buchi reaction.

UNIT-IV

Photo reduction - photochemistry of enone - hydrogen abstraction - rearrangement of α,β-unsaturated ketones and cyclohexadienones - photochemistry of p-benzoquinones - photochemistry of unsaturated systems – olefins, *cis-trans*-isomerization and dimerisation - hydrogen abstractions and addition acetylenes dimerization, dienes - photochemistry of 1,3-butadiene (2+2) additions leading to cage structures - photochemistry of cyclohexadienes.

Photochemistry of aromatic compounds – excited state of benzene and its 1,2-, 1,3-, 1-4-additions - photofries rearrangement - photofries reactions of anilides, photosubstitution reactions of benzene derivatives.

Course Outcome:

1. Addition to carbon-carbon multiple bond, addition to carbon-hetero atom multiple bonds and elimination reactions
2. Mechanisms of modern organic synthetic reactions and multicomponent reactions
3. Basic concepts of organic photochemical reactions
4. Photochemistry of carbonyl compounds, alkenes, dienes and aromatic compounds

Text books:

1. Advanced Organic Chemistry: Reactions Mechanisms and Structure, Jerry March, 5th Edition, McGraw Hill, New York, 2006
2. Reaction Mechanism in Organic Chemistry, S M Mukherji and S P Singh, 3rd Edition, Macmillan, New Delhi, 1984.
3. Photochemistry and Pericyclic Reactions, Jagadamba Singh and Jaya Singh, New Age International Publications, New Delhi, 2012.
4. Molecular reactions and Photochemistry, C. Dupey and O. Chapman, Prentice Hall, New Delhi, 2014

Reference Books:

1. The Modern Structural Theory in Organic Chemistry, L.N. Ferguson, Prentice Hall, New Delhi, 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, 1976.

G.V.P. COLLEGE FOR DEGREE AND PG COURSES (A)
M.Sc. ORGANIC OF CHEMISTRY SYLLABUS
IV-SEMESTER
PAPER II- ORGANIC SPECTROSCOPY – II
(Effective from 2020-21 admitted batch)

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

Course Objectives:

1. To learn the principle and applications of ORD, CD and Octant rule
2. To learn FT NMR spectroscopy, 2D-NMR, COSY and ESR and their applications in molecular structure determination
3. To know the Fragmentation processes and its applications to structural elucidation of organic compounds by a combined application of the UV, IR mass and NMR.
4. To know the various chromatographic separation techniques. Principle and instrumentation of GC, HPLC and XRD

UNIT-I

Optical rotatory dispersion and circular dichroism: Phenomena of ORD and CD - classification of ORD and CD Curves - Cotton effect curves and their application to stereochemical problems - the octant rule and its application to alicyclic ketones.

UNIT-II

Improving the NMR spectrum: Mean pulse experiment - new techniques in FT NMR spectroscopy - separation of chemical shift and coupling on to different axes (2D-NMR, cosy) - spin decoupling - nuclear over Hauser effect associating the signals from directly bonded ^{13}C and ^{1}H.

ESR Derivative curves: Values and hyperfine splitting.

UNIT-III

Fragmentation processes: Fragmentation associated with functional groups; rearrangement and mass spectra of some chemical classes - structural elucidation of organic compounds by a combined application of the UV, IR mass and NMR.

UNIT-IV

Separation Techniques: Solvent extraction, chromatography – paper, thin layer - partition, column chromatography - electrophoresis.
Instrumentation – Gas Chromatography - High Performance Liquid Chromatography - X – Ray Diffraction (XRD).

Course outcomes:

1. learns the principle and applications of ORD, CD and Octant rule
2. FT NMR spectroscopy, 2D-NMR, COSY and ESR and their applications in molecular structure determination
3. To know the Fragmentation processes and its applications to structural elucidation of organic compounds by a combined application of the UV, IR mass and NMR.
4. To know the various chromatographic separation techniques. Principle and instrumentation of GC, HPLC and XRD

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, 4th Edition, Brooks Cole, Pacific Grove, USA, 2008.

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.
4. Elucidation of Organic Structures by Physical and Chemical Methods - Part I, (Eds). K.W. Bentley and G.W. Kirby, John Wiley, 1972.

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

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

Course Objectives:

1. To learn synthetic applications of organo silanes
2. To understand the synthetic utility of reducing agents
3. To have knowledge of asymmetric synthesis
4. To design the organic synthesis using retrosynthesis

UNIT-I

Organo silanes: Synthetic applications of trimethylsilylchloride, dimethyl-t-butylsilyl chloride, trimethylsilylcyanide, trimethylsilyl iodide and trimethylsilyl triflate - synthetic applications of α-silyl carbanion and β-silylcarbonium ions - phase transfer catalysis - principle and applications.

UNIT-II

Reduction: Catalytic hydrogenation (homogeneous and heterogeneous) - reduction by dissolving metals - reduction by hydride transfer reagents - reduction with hydrazine and diimide - selectivity in reduction of nitroso and nitro compounds - reductive cleavage.

UNIT-III

Asymetric synthesis: Introduction to asymetric synthesis - stereoselective in synthesis - prostereoisomerism - topicity in molecules - homotopic, stereoheterotopic (enantiotopic and diastereotopic) groups and faces- symmetry criteria Pro chiraility and Pro-R, Pro-S, Re and Si.(Nomenclature); % enantiomeric excess and diastereomeric excess - nucleophilic additions to chiral carbonyl compounds - 1,2-asymmetric induction - Cram's rule - Sharpless epoxidation - asymmetric aldol reaction - diastereoselective aldol reaction and asymmetric Diel's Alder reaction.

Reactions of unactivated carbon-hydrogen bonds: Hoffmann-Loeffler-Freytag reaction - Barton reaction - photolysis of organic hypohalites.

UNIT-IV

Design of Organic Synthesis: Retrosynthesis - disconnection approach – introduction – terminology - basic principles convergent and linear synthesis - one group C-X (X= hetero atom) - C-C disconnections and two groups C-X and C-C disconnections with reference to 1,1; 1,2; 1,3; 1,4 and 1,5 difunctionalised compounds - retrosynthesis and synthetic strategies with examples - salbutamol, benzocaine, paracetamol and dinocap.

Course outcomes:

1. To learn the synthetic applications of organo silanes
2. To learn the synthesis of compounds using various reducing agents
3. To learn the principles and applications of asymmetric synthesis
4. To learn the synthesis of organic compounds by retrosynthesis approach

Textbooks:

1. Some Modern Methods of Organic Synthesis, W. Carruthers, 3rd Edition, Cambridge University Press, Cambridge, 1988.
2. Organic Synthesis: The Disconnection Approach, S. Warran and P. Wyatt, 2nd Edition, John Wiley & Sons, New York, 2008.
3. Assymetric Synthesis - Principles and Methodology, Y Vatsala, 2nd Edition,

New Age International Publications, New Delhi, 2014.
4. Fundamentals of Assymetric Synthesis by G.L. David Krupadanam, Universities Press, New Delhi, 2013.

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Reference books:

1. Assymetric Synthesis edited by A. Aitken and S.N. Kilenvi, Blakie Academic and Professional, Chennai, 1992
2. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, 3rd Edition, Nelson Thornes, Cheltenham, UK, 1993
3. Catalytic asymmetric synthesis edited by Iwao Ojima John Wiley & Sons, 2012
4. Modern Synthetic Reactions, H.O. Horase, 2nd Edition, W.A. Benzamine Inc., Menio Park, California, 1972.
5. Organic Chemistry, J. Clayden, N. Geeves and S. Warren, 2nd Edition, Oxford University Press, Oxford, 2012

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M.Sc. ORGANIC OF CHEMISTRY SYLLABUS
IV-SEMESTER
PAPER IV – NATURAL PRODUCTS AND BIOPOLYMERS-II
(Effective from 2020-21 admitted batch)

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

Course Objectives:

1. To study the structure, isolations, and synthesis of acetogenins and shikimates
2. To study the structure, isolations, and synthesis of terpenes and Steroids
3. To study the structure, isolations, and synthesis of alkaloids
4. To study the structure, isolations, and synthesis of nucleic acid

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 shikimates:
Prostaglandin 15 R PGA_2 - podophyllotoxin - etoposide and rotenone.

UNIT-II
Terpenes and Steroids:
Cholesterol - progesterone - β-amyrin

UNIT-III
Alkaloids:
Strychnine - colchicine - camptothecin.

UNIT-IV
Nucleic acids: Basic concepts of the structures of RNA and DNA - hydrolysis products – nucleotides - nucleosides - heterocyclic bases.

Course outcomes:

1. To study isolation, structure, stereochemistry, synthesis, and biological properties of acetogenins and shikimates - prostaglandin 15 R PGA2, podophyllotoxin, etoposide and rotenone.
2. To study isolation, structure, stereochemistry, synthesis, and biological properties of Terpenes and Steroids – cholesterol, progesterone and amyrin
3. To study isolation, structure, stereochemistry, synthesis, and biological properties of alkaloids – strychnine, colchicine and camptothecin
4. To study isolation, structure, stereochemistry, synthesis, and biological properties of nucleic acids - RNA and DNA and their hydrolysis products.

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.
3. Introduction to Organic Chemistry, A. Streitweiser, C.H. Heathcock and E.M. Kosover, 4th Edition, Macmilan, New York, 1992.

SEMESTER-IV
(Effective from 2020-21 admitted batch)

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

PRACTICAL SYLLABUS

Practical I

Analysis of six organic mixtures containing two components.

Practical II

Estimations and Isolation

a) Estimations

1) Estimation of Phenol
2) Estimation of Aniline
3) Estimation of Glucose
4) Estimation of Sucrose
5) Estimation of Aspirin
6) Estimation of Ibuprofen

b) Isolation

1) Isolation of Caffeine from tea leaves
2) Isolation of Piperine from pepper
3) Isolation of Lycopene from tamato

Text Books:

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