ANDHRA UNIVERSITY
DEPARTMENT OF ORGANIC CHEMISTRY & FDW
Revised Syllabus for M.Sc Chemistry (Organic chemistry specialization)
(With effect from the Admitted batch of 2021-2022 Academic Year)

Programme objectives:

1. To provide students in the scientific skills and chemical knowledge essential to develop and apply the knowledge in chemical sciences for preparing chemists of exceptional skills and abilities.
2. To provide knowledge, application, skills in required areas of chemical education
3. To equip students with effective scientific communication skills
4. To encourage the pursuit of lifelong education
5. To develop each student into a committed individual with ethical and social responsibility

Programme Specific objectives:

The students who complete the M.Sc. Organic Chemistry course shall:

1. Have strong foundation in the fundamentals and applications of chemical knowledge and understanding
2. Have the abilities to think critically, logically and analytically and solve problem in the area of chemical sciences, materials, environmental aspects, medicines and energy
3. Have the abilities to carry out chemical experiments, record and analyze the results and design advanced models
4. Have the abilities to use modern library and information retrieving tools to obtain information and assimilate to generate concepts and apply them in challenging situations
5. Have the abilities to effectively communicate their knowledge and skills to other chemists and non-chemists in oral or written formats
6. Secure suitable employment in the areas of chemical industries like pharmaceutical, steel and metals, polymers, fuels and nuclear, environmental and pollution control, nanotechnology and composite materials, teaching and research, etc.
7. Have the personal attributes and ethical sensibilities to enable them to function as effective scientists and citizens

M.Sc. Chemistry (Final Year)

Specialization: ORGANIC CHEMISTRY

Syllabus (w.e.f.2021-22 admitted batch)

Scheme of Instruction and Examination for **III Semester**

S.No	Course Title	Course Type	Instruction Periods per week	External Marks	Internal Marks	Total Marks	Duration of External Examination	Credits
1	Organic Reaction Mechanisms, Pericyclic Reactions and Photochemistry	Theory	4	80	20	100	3 hours	4
2	Organic Spectroscopy	Theory	4	80	20	100	3 hours	4
3	Organic Synthesis	Theory	4	80	20	100	3 hours	4
4	Chemistry of Natural Products	Theory	4	80	20	100	3 hours	4
5	Practical-I: Multi stage organic synthesis	Lab	3	80	20	100	6 hours	4
6	Practical-II: Chromatography & Viva-voce	Lab	3	80	20	100	6 hours	4
7	MOOC course		-	-	-	-	-	4
8	Value added course - Intellectual Property Rights (IPR)		-	-	-	-	-	2
	Total					600		30

Scheme of Instruction and Examination for **IV Semester**

S.No	Paper Title	Course Type	Instruction Periods per week	External Marks	Internal Marks	Total Marks	Duration of External Examination	Credits
1	Modern Synthetic Methodology in Organic Chemistry	Theory	4	80	20	100	3 hours	4
2	Organic Spectroscopy and Structure determination of natural products	Theory	4	80	20	100	3 hours	4
3	Designing organic synthesis and synthetic applications of organo- boranes and – silanes	Theory	4	80	20	100	3 hours	4
4	Drug design and drug chemistry	Theory	4	80	20	100	3 hours	4
5	Project work	Lab	-	100	-	100	-	4
6	Practical-I: Organic Mixture analysis	Lab	3	80	20	100	6 hours	4
7	Practical-II: Estimations and Isolation		3	80	20	100	6 hours	4
8	MOOC course		-	-	-	-	-	4
9	Value added course (Research Methodology)		-	-	-	-	-	2
	Total					700		34

M.Sc. Chemistry (First Year)
SEMESTER I
Paper III- Organic Chemistry
(w.e.f. 2021-22 admitted batch)

Scheme of Instruction and Examination for **I Semester**

S.No	Paper Title		Instruction Periods per week	External Marks	Internal Marks	Total Marks	Duration of External Examination	Credi
1	Organic Chemistry	Theory	4	80	20	100	3 hours	4
2	Practical : Organic Chemistry	lab	3	60	15	75	3 hours	3
					Total	175		7

M.Sc. Chemistry (First Year)
SEMESTER II
Paper III- Organic Chemistry
(w.e.f. 2021-22 admitted batch)

Scheme of Instruction and Examination for **II Semester**

S.No	Paper Title		Instruction Periods per week	External Marks	Internal Marks	Total Marks	Duration of External Examination	Credits
1	Organic Chemistry	Theory	4	80	20	100	3 hours	4
2	Practical : Organic Chemistry	Lab	3	60	15	75	3 hours	3
					Total	175		7

M.Sc., CHEMISTRY (Organic Chemistry Specialization)
SEMESTER – I SYLLABUS
(From the batch admitted during the academic year 2021-2022)

PAPER III - ORGANIC CHEMISTRY

Course Objectives: To make the students

CO 1: Acquire the knowledge of aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

CO 2: Understand aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

CO 3: Apply the knowledge and understanding of aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products to new situations

CO 4: Develop interest in the areas of aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 2: Interpret aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 3: Compare aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 4: Analyse aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 5: Solve aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 6: Identify aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 7: Apply aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

UNIT - I

Aliphatic Nucleophilic Substitutions: The SN2, SN1, SNi and SET mechanisms. Substitution reactions of ambident nucleophiles, anchimeric assistance, the neighbouring group mechanism: neighbouring group participation by O, N, S, halogens, aryl groups, alkyl and cycloalkyl groups in nucleophilic substitution reactions. Sigma, Pi bond participation in acylic and bicyclic systems (Non- classic carbocations). Nucleophilic Substitution at allylic, trigonal and Vinylic carbons. Effect of substrate, attacking nucleophile, leaving group and reaction medium.

UNIT-II

Aliphatic Electrophilic Substitutions: SE1 SE2 and SEi mechanisms. Reactivity-effects of substrate, leaving group and solvent. Reactions- hydrogen exchange, migration of doublebonds, halogenation of aldehydes, ketones, carboxylic acids, acyl halides, sulphoxides and sulphones.

UNIT-III

Stereochemistry and Conformational Analysis : Optical Isomerism: optical activity, molecular dissymmetry and chirality - elements of symmetry. Fisher's projection D,L. and R,S. configurations - relative and absolute configurations optical isomerism due to asymmetric carbon atoms - optical isomerism in biphenyls, allenes and spirans- optical isomerism of nitrogenous compounds, racemisation and resolution.
Geometrical isomerism: E, Z -configurations, properties of geometrical isomers. Conformational analysis: Conformations of acyclic molecules –alkanes and substituted alkanes- compounds having intramolecular hydrogen bonding. Conformations of cyclohexane, mono and disubstituted cyclohexanes and decalins, effect of conformations on reactivity.

UNIT-IV

Chemistry of Heterocyclic Compounds : Structure, reactivity and synthesis of three membered Heterocycles: (a) Oxirane: Sharpless method, Shi epoxidation, Jacobsen epoxidation, etc, (b) Aziridine; four membered Heterocycles: (a) Oxetane (b) Azetine; five membered Heterocycles: (a) Pyrrole: Paal Knorr, Hantzsch Methods, etc, (b) Thiophene: Paal Knorr, Hinsberg method, etc. (c) Furan: Paal Knorr, Fiest-Benary, Industrial Method, etc.; (d) Pyrazole, (e) Imidazole, (f) Oxazole, (g) Thiazole; Six membered Heterocycles: (a) Pyridine, (b)Pyridazine,(c) pyrimidine and (d) Pyrazine; Aromatic heterocyclics: a) Indole: Fischer indole synthesis, Bischler synthesis, and Madelung synthesis (b) Quinoline and Isoquinoline, (c) Coumarins and Chromones**.**

UNIT-V

Chemistry of Natural Products:
A) Terpenoids: - Occurrence, Isolation, isoprene rule, structure elucidation and synthesis of α- Terpineol and α- pinene
B) Steroids:- Nomenclature of steroids, structure elucidation, synthesis and stereochemistry of cholesterol and progesterone

C) Lipids:- Classification,properties and function-free fatty acids, triglycerides, phospholipids, glycolipids & waxes conjugated lipids-lipoproteins

Reference Books

1. Advanced Organic Chemistry: Reactions Mechani;sms and Structure by Jerry March,
Mc.Graw Hill and Kogakush.

2. Organic Chemistry Vol. I (Sixth Ed.) and Vol. II (Fifth Ed.) by I L Finar ELBS.

3. Organic Chemistry (fifth Ed.,) by Morrison and Boyd, PHI, India.

4. Organic Chemistry (fifth edition) by Francis A. Carey Tata Mc Graw Hill publishing
Company Limited, New Delhi.

5. Stereochemistry of Organic compounds by Ernest L. Eliel, Samuel H. Wilen

6. Chemistry of natural products by S. V. Bhat, B. A. Nagasampangi and M. Sivakumar
Narosa Publishing House, 6th reprint 2010

M.Sc., CHEMISTRY (Organic Chemistry Specialization)
SEMESTER – II SYLLABUS
(From the batch admitted during the academic year 2021-2022)

PAPER III - ORGANIC CHEMISTRY

Course Objectives: To make the students

CO 1: Acquire the knowledge of aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

CO 2: Understand aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

CO 3: Apply the knowledge and understanding of aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids to new situations

CO 4: Develop interest in the areas of aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 2: Interpret aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 3: Compare aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 4: Analyse aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 5: Solve aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 6: Identify aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 7: Apply aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

UNIT-I: Aromaticity **[12 Hours]**

A) Aromaticity: Concept of Aromaticity, Aromaticity of five membered, six membered and fused systems - non-benzenoid aromatic compounds:-cyclopropenylcation, cyclobutadienyldication, cyclopentadienyl anion – tropyliumcation and cyclooctatetraenyl di anion – matallocenes, ferrocenes, azulenes, fulvenes, annulenes, fullerenes. Homo aromaticity, Anti aromaticity and Pseudo aromaticity.

B) Aromatic NucleophilicSubstitutions: The SNAr, SN1, benzyne and SRN1 mechanisms. Reactivity: Effect of substrate, leaving group and attacking nucleophile. The Von-Richter,Sommlet- Hauser and Smiles rearrangements.

UNIT-II: Reactive Intermediates and Name Reactions **[12 Hours]**

A) Reactive Intermediates: Generation, structure, stability and reactivity of Reactive intermediates :carbanion, carbocation, free radicals, carbenes and nitrenes.

B) Name Reactions: - Wittig reaction, Grignard reaction, Stork enamine reaction, Michael addition, Mannich Reaction, Diel's-Alder reaction andEne- reaction,

UNIT-III: Molecular Rearrangements **[12 Hours]**

Molecular Rearrangements:

Types of molecular rearrangements, migratory aptitude;

Rearrangements to electron deficient carbon: Pinacol-pinacolone, Wagner-MeerweinandBenzil-Benzilic acid,

Rearrangements to electron deficient nitrogen: Beckmann, Hofmann, Curtius, Schmidt and Lossen rearrangements;

Rearrangements to electron deficient oxygen: Baeyer-villiger, Dakin rearrangements;

Other rearrangements: Neber rearrangement and Favorskii rearrangements

UNIT - IV: Spectroscopy **[12 Hours]**

A)**UV Spectroscopy**: Various electronic transitions, selection rules, effect of solvent on electronic transitions, the absorption laws, chromophores, auxochromes, bathochromic and hypso chromic shifts, hyperchromic and hypochromic effects, Woodward-Fieser rules for conjugated dienes and carbonyl compounds.

B) **Infrared Spectroscopy**: Basic principles: types of molecular vibrations, fingerprint region and identification of functional groups.

C)**Nuclear Magnetic Resonance Spectroscopy (^{1}H-NMR)**: nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shifts, factors affecting the chemical shift, and assignment of chemical shifts.

D) **Mass Spectroscopy**: Basic principles, nitrogen rule and fragmentation pattern of carbonyl compounds and alcohols

UNIT – V Alkaloids, Peptides, Proteins and Nucleic acids **[12 Hours]**

A) **ALKALOIDS**: Occurrence, Isolation, classification based on nitrogen heterocyclic ring and synthesis of quinine and nicotine

B) Peptides and Proteins: α-Aminoacids, their general properties and synthesis, Synthesis of peptides byMerrifield solid phase synthesis.Primary, secondary and tertiary structures of proteins

C) Nucleic acids: Heterocyclic bases; Purines: Adenine and Guanine; Pyramidines: Cytosine, Uracil and Thymine; nucleosides, nucleotides Basic concepts of the structures of RNA and DNA

Text books:

1. Organic Chemistry Vol. I (Sixth Edn.) and Vol. II (Fifth Ed.,) by IL finar ELBS.
2. Organic Chemistry (fifth Edn.,) by Morrison and Boyd, PHI, India.
3. Organic Chemistry (fifth edition) by Francis A. Carey Tata McGraw Hill publishing Company Limited, New Delhi.
4. Reaction Mechanism in Organic Chemistry by Mukherjee Sirigh, N Terniitarr, Indiar
5. A guide book to mechanism in Organic Chemistry by Peter Sykes, ELBS.
6. Advanced organic chemistry by Jerry March (4th Edition)Wiley Eastern. .
7. Stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.
8. Stereochemistry of Organic compounds by D. Nasipuri.

Chemistry of Natural products by R.S. KalsiKalyani Publ

M.Sc., CHEMISTRY (Organic Chemistry Specialization)
SEMESTER – III SYLLABUS
(From the batch admitted during the academic year 2020-2021)

PAPER I - ORGANIC REACTION MECHANISMS, PERICYCLIC REACTIONS AND PHOTOCHEMISTRY

Course Objectives: To make the students

CO 1: Acquire the knowledge of reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry
CO 2: Understand reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry
CO 3: Apply the knowledge and understanding of new situations reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry
CO 4: Develop interest in the areas of reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry
LO 2: Interpret reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry
LO 3: Compare reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry
LO 4: Analyse reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry
LO 5: Solve reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry
LO 6: Identify reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry
LO 7: apply reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

UNIT-I: Radical Substitution Reactions **[12 Hours]**

Reactivity for aliphatic substrates,reactivity at Bridgehead, Reactivity in aromatic substrates, neighbouring group assistance in free radical reactions, 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, formation of cyclic ethers with Pb (OAC)4, Hunsdiecker reaction, Kolbe reaction, Reed reaction and Sandmayer reaction.

UNIT-II: Elimination Reactions: **[12 Hours]**

Mechanisms of E2, El, and E1CB, factors-effects of substrate,attacking base, leaving group and medium. Stereochemistry of eliminations in acyclic and cyclic systems. Saytzeff elimination, Hoffman elimination and pyrolytic elimination.

UNIT-III: Addition Reactions: **[12 Hours]**

(a) **Addition to carbon-carbon multiple bonds**- Addition reactions involving electrophiles, nucleophiles and free radicals, cyclic mechanisms. Stereochemistry and reactivity. Hydrogenation of double and triple bonds, Birch reduction, Hydroboration, Michael reaction, Prins reaction. Addition of oxygen and N_2O_4.

(b) **Addition to carbon-hetero atom multiple bonds**: Mechanism and reactivity.Reductions of carbonyl compounds, carboxylic acids, esters, nitriles. Addtion of Grignard reagents, Mannich reaction, Reformatsky reaction, Tollen's reaction, Wittig reaction,

UNIT-IV: Pericyclic reactions: [12 Hours]

Molecular Orbital Symmetry, MO diagrams of ethylene, 1,3 Butadiene, 1,3,5- Hexatriene and allyl system. Woodward- Hoffman correlation diagram method, Frontier molecular orbital approach (FMO) and Perturbation molecular orbital approach (PMO) for the explanation of pericyclic reactions under thermal and photochemical conditions.
Classification of pericyclic reactions: **Electrocyclic Reactions**: Conrotatory and Dis rotatory motions. 4n π and 4n+2 π electrons systems. **Cycloadditions**: Antarafacial and Suprafacial additions. 2+2, 4+2 cycloadditions and chelotropic reactions. **Sigmatropic rearrangements** - Suprafacial and Antarafacial shifts of H, Sigmatropic shift involving carbon moieties (1,3), (1,5), (3,3) and (5,5) sigmatropic rearrangements. Claisen, Cope, Oxy-cope and aza- Cope rearrangements. Ene reaction.

UNIT-V: Organic Photochemistry: [12 Hours]

Photochemistry of carbonyl compounds- n-$\pi^*$and π-π^* transitions. Norrish type I and Norrish type II cleavages. Patterno-Buchi reactions, Photoreduction, Photo chemistry of α,ß-unsaturated ketones, photochemistry of enones and cyclohexadienones. Photochemistry of unsaturated systems (Olefins): cis-trans isomerisation, dimerization, and addition.Acetylenes-dimerisation. Photochemistry of 1,3 butadienes, di-π-methane rearrangement.Photochemistry of aromatic compounds – 1,2, 1,3, and 1,4- additions. Photo-Fries rearrangement, Photo-Fries reactions of anilides.

Text Books:

1. Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
2. Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
3. Pericyclic reactions by S.N. Mukharji, Mcmilan.
4. Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Richgardson.
5. The modern structural theory in Organic Chemistry by L.N.Ferguson, Pretice Hall

PAPER II- ORGANIC SPECTROSCOPY

Course Objectives: To make the students

CO 1: Acquire the knowledge of UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

CO 2: Understand UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

CO 3: Apply the knowledge and understanding of new situations UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

CO 4: Develop interest in the areas of UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 2: Interpret UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 3: Compare UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 4: Analyse UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 5: Solve UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 6: Identify UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 7: Apply UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

UNIT-I: UV SPECTROSCOPY: **[12 Hours]**

UV spectra of aromatic and heterocyclic compounds, α-diketones , β-diketones, enediones and quinines. Applications of UV Specroscopy-study of isomerism, determination of strength of hydrogen bonding and conformations of α-substituted cyclohexanones. Steric effect in biphenyls.

UNIT-II: Infrared Spectroscopy: **[12 Hours]**

Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols, amines, carbonyl compounds, esters, amides, carboxylic acids, anhydrides, lactones, lactums, nitriles and conjugated carbonyl compounds. Effect of hydrogen bonding and solvent on vibrational frequencies.

UNIT-III: Nuclear Magnetic Resonance Spectroscopy (1H NMR): [12 Hours]

Nuclear spin, resonance, satuaration, shielding of magnetic nuclei, chemical shifts and its measurements, factors affecting chemical shift, chemical and magnetic equivalence of spins, spin-spin coupling, integration, the coupling constant, types of spin-spin couplings, factors influencing coupling constants, first-order and non-first order spectra, spin system notations (ABX, AMX, ABC, A_2B_2 etc.). Simplification of non-first order spectra- use of higher magnetic fields, nuclear magnetic double resonance and contact shift reagents. Deuterium exchange, Nuclear Overhauser Effect difference spectra, Study of dynamic processes by Variable temperature (VT) NMR, restricted rotation DMF, cyclohexane ring inversion.

UNIT-IV: Mass spectroscopy: **[12 Hours]**

Basic Principles, instrumentation, isotope abundance, the molecular ion, metastable ions, base peak, fragment ions, even-electron rule and nitrogen rule. McLafferty rearrangement, ortho effect. *retro*-Diels- Alder reaction, Fragmentation processes- fragmentation associated with various functional groups (alkanes, cycloalkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, ethers, aldehydes , ketones, esters , carboxylic acids, amides, amines, alkyl chlorides and alkyl bromides.

UNIT-V: Application of UV, IR, NMR and MASS **[12 Hours]**

Structural elucidation of Organic compounds by a combined application of the UV, IR, NMR and MASS spectral data.

Text Books:

1. Spectroscopic identification of organic compounds by RM Silverstein, G C Bassler and T B Morrill
2. Organic Spectroscopy by William Kemp
3. Spectroscopic methods in Organic chemistry by DH Williams and I Fleming
4. Modern NMR techniques for chemistry research by Andrew B Derome
5. NMR in chemistry - A multinuclear introduction by William Kemp
6. Spectroscopic identification of organic compounds by P S Kalsi
7. Introduction to organic spectroscopy by Pavia
8. Carbon-13 NMR for organic chemists by GC Levy and O L Nelson
9. Nuclear Magnetic Resonance Basic principles by Atta-ur-Rahman

PAPER III – ORGANIC SYNTHESIS

Course Objectives: To make the students

CO 1: Acquire the knowledge of formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

CO 2: Understand formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

CO 3: Apply the knowledge and understanding of formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis to new situations

CO 4: Develop interest in the areas of formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 2: Interpret formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 3: Compare formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 4: Analyse formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 5: Solve formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 6: Identify formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 7: apply formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

UNIT-I: Formation of Carbon-Carbon (C-C) single bonds: [12 Hours]

Alkylations via enolate anions-1,3-diarbonyl and related compounds, direct alkylation of simple enolates, imine and hydrozone anions, enamines. The aldol reaction, umpolung (dipole inversion). Via Organometallic reagents - organ palladium, organo nickel and organo copper reagents

UNIT-II: Formation of carbon-carbon double bonds: **[12 Hours]**

β- Elimination reactions, Pyrolytic *syn* eliminations, alkenes form hydrazones, 1,2-diols, sulfones, sulphoxide-sulphonate rearrangement, the Wittig and related reactions

UNIT-III: Organic Polymers [12 Hours]

Introduction to organic polymers, general properties and classification of polymers. Methods of polymerization: (a) Addition polymerization-Definition, synthesis and applications, vulcanization. (b) Condensation polymerization- Definition, synthesis and applications. Radical polymerization. (With at least two examples in each category)

UNIT-IV: Reactions of unactivated carbon-hydrogen bonds [12 Hours]

Unactivated carbon-hydrogen bonds: Definition, mechanism and synthetic applications- The Hoffmann-Loeffler-Freytag reaction(HLF reaction)-cyclisation reactions of Nitrenes-the Barton reaction-Photolysis of organic hypohalites, hypochlorites, hypobromites and hypoiodites,

UNIT-V: Asymmetric Synthesis **[12 Hours]**

Topocity – Prochirality – Substrate selectivity – Diastereoselectivity and enantioselectivity – Substrate controlled methods – use of chiral substrates – examples Auxiliary controlled methods – Use of chiral auxiliaries – Chiral enolates – alkylation of chiralimines-Reagent controlled methods – Use of chiral reagents – Asymmetric oxidation – Sharpless epoxidation – Asymmetric reduction – borate reagents.

Text Books:

1. Some Modem Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
2. Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
3. Principle of Organic Synthesis- R.O.C. Norman and J. M. Coxon.(ELBS)
4. Advanced organic chemistry part A & B; Fourth edition; Francis A Cary and Richard J. Sundberg; Kluwer Academic/Plenum Publisher New York, 2000.
5. Organic chemistry Jonathan Clayden, Nick Geeves, Stuart Warren, 2nd Edition, 2012, Oxford University Press.
6. Stereochemistry of organic compounds — Principles & Applications by D Nasipuri.
7. Stereochemistry of Carbon compounds by Ernest L Eliel & Samuel H. wilen.
8. Stereochemistry: Conformation & Mechanism by P S Kalsi.
9. The third dimension in organic chemistry, by Alan Bassendale.
10. Stereo selectivity in organic synthesis by R S Ward.
11. Asymmetric synthesis by Nogradi.
12. Asymmetric organic reactions by J D Morrison and H S Moschcr.
13. Principles in Asymmetric synthesis by Robert E. Gawley & JEFFREY AUBE.

PAPER IV – CHEMISTRY OF NATURAL PRODUCTS

Course Objectives: To make the students

CO 1: Acquire the knowledge of isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

CO 2: Understand isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

CO 3: Apply the knowledge and understanding of new situations isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

CO 4: Develop interest in the areas of isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 2: Interpret isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 3: Compare isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 4: Analyse isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 5: Solve isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 6: Identify isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 7: Apply isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

UNIT-I: Antibiotics **[12 Hours]**

Isolation, structure elucidation, stereochemistry, synthesis and biological properties of Penicillin G, Cephalosporin-C, Streptomycin, Chloramphenicol and Tetracycline

UNIT-II: Terpenes **[12 Hours]**

Isolation, structure elucidation, stereochemistry, synthesis and biological properties of Terpenes: Forskolin, Taxol and β-amyrin

UNIT-III: Alkaloids **[12 Hours]**

Isolation, structure elucidation, stereochemistry, synthesis, and biological properties of Alkaloids: Morphine, Reserpine and Vincristine

UNIT-IV: Flavonoids **[12 Hours]**

Natural Flavonoids: Apigenin, Flavanones - Hesperetin, Isoflavones - Genistein, Flavonol quercetin, xanthone - Euxanthone.

UNIT-V: Natural Pigments: **[12 Hours]**

Natural Pigments: Introduction structure elucidation and synthesis of quinones-Polyporic acid. Chlorophyll and haemin.

Text Books:

1. Organic Chemistry, Volume 2, Stereochemistry and chemistry of natural products, I.L. Finar, 5th Edition. ELBS.
2. Chemical A spects of Biosynthesis, John Mann, Oxford University Press, Oxford,1996
3. Chemistry of Natural Products. A Unified Approach, N.R. Krishnaswamy, University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999.
4. Chemistry of Natural Products, S. V. Bhat, Narosa Publishing House, 6th reprint 2010.

M.Sc., CHEMISTRY (Organic Chemistry Specialization)
SEMESTER – IV SYLLABUS
(From the batch admitted during the academic year 2020-2021)
PAPER – 1: MODERN SYNTHETIC METHODOLOGY IN ORGANIC CHEMISTRY

Course Objectives: To make the students

CO 1: Acquire the knowledge of various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
CO 2: Understand various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
CO 3: Apply the knowledge and understanding of new situations various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
CO 4: Develop interest in the areas of various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
LO 2: Interpret various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
LO 3: Compare various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
LO 4: Analyse various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
LO 5: Solve various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
LO 6: Identify various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions
LO 7: Apply various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

UNIT – I: Modern Synthetic Methods [12 Hours]

Baylis-Hillman reaction, Henry reaction, Nef reaction, Kulinkovich reaction, Ritter reaction, Sakurai reaction, Tishchenko reaction and Ugi reaction. Brook rearrangement; Tebbe olefination. Metal mediated C-C and C-X coupling reactions: Heck, Stille, Suzuki, Negishi and Sonogashira, Nozaki-Hiyama, Buchwald-Hartwig, Ullmann coupling reaction.

UNIT-II: Multi component Reactions: [12 Hours]

Passerini reaction, Biginelli reaction, Hantzsch reaction and Mannich reaction. Metathesis: Grubb's 1st generation and 2nd generation catalyst, Olefin Cross coupling Metathesis (OCM), Ring Closing Metathesis (RCM), Ring Opening Metathesis (ROM) and applications.

UNIT-III: Oxidation [12 Hours]

Oxidation: Metal based and non-metal based oxidations of (a) alcohols to carbonyls (Chromium, Manganese, aluminium, silver, ruthenium, DMSO, hypervalent iodine and TEMPO based reagents). (b) phenols (Fremy's salt, silver carbonate) (c) alkenes to epoxides (peroxides/per acids based), Sharpless asymmetric epoxidation, Jacobsen epoxidation, Shi epoxidation.(d) alkenes to diols (Manganese, Osmium based), Sharpless asymmetric dihydroxylation, Prevost reaction and Woodward modification, (e) alkenes to carbonyls with bond cleavage (Manganese, Osmium, Ruthenium and lead based, ozonolysis) (f) alkenes to alcohols/carbonyls without bond cleavage (hydroboration-oxidation, Wacker oxidation, selenium, chromium based allylic oxidation) (g) ketones to ester/lactones (Baeyer-Villiger)

UNIT-IV: Reduction **[12 Hours]**

Reduction: (a) Catalytic hydrogenation (Heterogeneous: Palladium/ Platinum/ Rhodium/ Nickel etc; Homogeneous: Wilkinson). Noyori asymmetric hydrogenation. (b) Metal based reductions using Li/Na/Ca in liquid ammonia, Sodium, Magnesium, Zinc, Titanium and Samarium (Birch, Pinacol formation, McMurry, Acyloin formation, dehalgenation and deoxygenations) (c) Hydride transfer reagents-$NaBH_4$ triacetoxyborohydride, L-selectride, K-selectride, Luche reduction; $LiAlH_4$, DIBAL-H, and Red-Al.

UNIT-V: NEWER METHODS IN ORGANIC SYNTHESIS: **[12 Hours]**

Green Chemistry: Introduction, principles, atom economy and scope (illustrate with two examples) **Microwave induced reactions:** Principle conditions, advantages over conventional heating methods-applications **Ionic liquids:** Introduction and applications in organic synthesis (illustrate with two examples). **Nanomaterials:** Introduction, methods of preparation, applications in organic synthesis **Phase-transfer catalysis:** solid-solid, solid-liquid systems-mechanism of catalytic action, type of catalysts, application in few important reactions

Text Books:

1. Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
2. F. A. Cary and R. I. Sundberg, Advanced Organic Chemistry, Part A and B, 5th Edition, Springer, 2009.
3. M. B. Smith, Organic Synthesis, 2nd Edition, 2005
4. J. Tsuji, Palladium Reagents and Catalysts, New Perspectives for the 21st Century, John Wiley & Sons, 2003.
5. I. Ojima, Catalytic Asymmetric Synthesis, 2nd edition, Wiley−VCH, New York, 2000.
6. J. Clayden, N. Greeves, S. Warren and P. Wothers, Organic Chemistry, Oxford University Press, 2001.
7. R. Noyori, Asymmetric Catalysis in Organic Synthesis, John Wiley & Sons, 1994.
8. L. Kuerti and B. Czako, Strategic Applications of named Reactions in Organic Synthesis Elsevier Academic Press, 2005.
9. Green chemistry, Theory and Practical, Paul T.Anastas and John C.Warner.
10. New trends in green chemistry By V.K.Ahulwalia and M.Kidwai.
11. Organic Synthesis: Special techniques. V.K.Ahulwalia and Renu Agarwal

PAPER II - ORGANIC SPECTROSCOPY AND STRUCTURE DETERMINATION OF NATURAL PRODUCTS

Course Objectives: To make the students

CO 1: Acquire the knowledge of ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

CO 2: Understand ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

CO 3: Apply the knowledge and understanding of new situations ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

CO 4: Develop interest in the areas of ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 2: Interpret ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 3: Compare ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 4: Analyse ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 5: Solve ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 6: Identify ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 7: Apply ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

UNIT-I: ^{13}C NMR spectroscopy [12 Hours]

Introduction, ^{13}C-chemical shifts, factors affecting the chemical shifts, chemical shifts of organic compounds. Calculation of chemical shifts of alkanes, alkenes and aromatic compounds. Types of 13C NMR spectra: Proton-coupled, proton- decoupled and OFF-resonance decoupled (ORD) spectra, DEPT. ^{13}C-NMR solvents:

UNIT-II: Heteronuclear NMR spectroscopy & Electron Spin Resonance Spectroscopy (ESR): Heteronuclear couplings: ^{13}C-^{1}H, ^{13}C-D, ^{13}C-^{19}F, ^{13}C-^{31}P.^{1}H-D, ^{1}H-^{19}F, ^{1}H-^{31}P, ^{1}H-^{15}N
ESR Spectroscopy: Principles, hyperfine splitting

UNIT-III: NMR Instrumentation, 2D-NMR techniques [12 Hours]

NMR Instrumentation: Types of NMR Spectrometers-Continuous Wave (CW)-NMR, Fourier Transform (FT)-NMR, NMR solvents, sample preparation

2D-NMR techniques: Principles of 2D NMR, Correlation spectroscopy (COSY) HOMO COSY (1H-1H COSY), Hetero COSY (^{1}H, ^{13}C COSY, HMQC), long range ^{1}H,^{13}C COSY (HMBC), NOESY and 2D-INADEQUATE experiments and their applications.

UNIT-IV: Optical Rotatory Dispersion (ORD) and CD Spectroscopy: [12 Hours]
Optical rotation, circular birefringence, and circular dichroism and Cotton effect. Plain curves and anomalous curves. Empirical and semiempirical rules-The axial haloketone rule, the octant rule, Application of the rules to the study of absolute configuration and conformations of organic molecules.

UNIT-V: Structure Determination of Natural Products by Spectral Methods [12 Hours]
Sructure elucidation - Spectroscopic techniques IR, UV, ^{1}H-NMR, ^{13}C-NMR, COSY, HETEROCOSY, and MS- natural products - Examples, flavones - Apigenin, flavanones-Hesperetin, isoflavones - Genistein, coumarins-7-hydroxycoumarin, alkaloids - morphine, quinine, terpenoids - (-)-Menthol, Steroids - stigmasterol, Glycosides - salicin (Alcoholic β-glucoside)

Text books:

1. Spectroscopy, fourth edition, D. L Pavia, G. M Lampman CENGAGE Learning, 2012
2. Spectroscopic Methods in Organic Chemistry. Forth Edition D. M. Williams and I. Fleming Tata - McGraw Hill, New Delhi, 1990. For all spectral methods except ORD and CD and ESR.
3. Organic Spectroscopy, Second Edition, W. Kemp, ELBS Macmillan, 1987 for ORD and CD and ESR.
4. Chemistry of natural products, S. V. Bhat, Narosa Publishing House, 6th reprint 2010 (For IV th unit)
5. Applications of absorption spectroscopy of Organic Compounds J.R. Dyer, Prentice Hall of India, New Delhi, 1984.
6. Spectrometric identification of Organic Compounds, Fourth Edition, R.M. Silverstein: G.C.Vassiellr and T.C. Merill, Johne Willey, Singapore, 1981.
7. For ORD and CD "Applications of Optical rotation and Circular Dichroism", G.C. Barret, in "Elucidation of Organic structures by Physical and Chemical Methods" Part I (Eds)
8. K.W. Bentley and G.W.Kirty John Wiley, 1972, Chapter VIII (only those aspects mentioned in the syllabus).

PAPER – III: DESIGNING ORGANIC SYNTHESIS AND SYNTHETIC APPLICATIONS OF ORGANO- BORANES AND SILANES

Course Objectives: To make the students

CO 1: Acquire the knowledge of the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

CO 2: Understand the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

CO 3: Apply the knowledge and understanding of new situations the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

CO 4: Develop interest in the areas of the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 2: Interpret the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 3: Compare the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 4: Analyse the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 5: Solve the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 6: Identify the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 7: Apply the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

UNIT-I: Disconnection Approach – Principles [12 Hours]

Introduction, Terminology: Retrosynthesis, Target Molecule (TM), synthon, synthetic equivalent,functional group interconversion (FGI). Linear and convergent synthesis. Criteria for selection oftarget . Order of events in retrosynthesis with reference to Salbutamol, Proparcaine and Dopamine. Chemoselectivity, Regioselectivity, reversal of polarity and cyclizations. Protecting groups- Principles of protection of alcohols, amine, carbonyl and carboxyl groups

UNIT-II: Synthetic Strategies - One group Disconnections [12 Hours]

Introduction to one group disconnections: C-C disconnection-alcohols and carbonyl compounds; C-X disconnections- alcohols and carbonyl compounds and sulphides two group C-C and C-X Disconnections.

UNIT-III: Synthetic Strategies - Two group Disconnections [12 Hours]

Introduction to Two group C-C disconnections; Diels-Alder reaction, 1,5- difunctionalised compounds, Michael addition and Robinson annulation. Two group C-X disconnections; 1, 1-difunctionalised, 1, 2-difunctionalised and 1, 3-difunctionalised compounds. Control in carbonyl condensations, explanation with examples oxanamide and mevalonic acid.

UNIT –IV: Organoboranes **[12 Hours]**

Hydroboration- Preparation of Organoboranes. Reagents – dicylohexyl borane, disiamyl borane, thexyl borane, 9-BBN and mono-, di-isopinocamphenyl borane. Functional group transformations of Organo boranes-Oxidation, protonolysis and rearrangements. Formation of carbon-carbon-bonds viz organo boranes- carbonylation, cyanoboration.

UNIT –V: Organosilanes **[12 Hours]**

Preparation and synthetic applications of trimethylsilyl chloride, dimethyl-t-butylsilyl chloride, trimethylsilylcyanide, trimethylsilyliodide and trimethylsilyltriflate. Protection of functional groups - Trimethylsilylethers, Silylenolethers. Synthetic applications of α-silyl carbanions, β-silyl carbonium ions. Peterson's olefination.

Text Books:

1. Organic syntheses via boranes / Herbert C. Brown; with techniques by Gary W. Kramer,
2. Alan B. Levy, M. Mark Midland. New York : Wiley, 1975
3. Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
4. Organic Synthesis: The disconnection approach, S. Warrant John Wiley & sons, New York, 1984.
5. Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
6. Principle of Organic Synthesis- R.O.C. Norman and J. M. Coxon.(ELBS)
7. Organic Synthesis: Special techniques. V.K.Ahulwalia and Renu Aggarwal.
8. Organic Synthesis by C Willis and M Willis
9. Problems on organic synthesis by Stuart Warren

PAPER IV-DRUG DESIGN AND DRUG CHEMISTRY

Course Objectives: To make the students

CO 1: Acquire the knowledge of drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs

CO 2: Understand drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs

CO 3: Apply the knowledge and understanding of new situations drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs

CO 4: Develop interest in the areas of drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 2: Interpret drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 3: Compare drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 4: Analyse drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 5: Solve drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 6: Identify drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 7: Apply drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

UNIT I: Introduction to Drugs [12 Hours]

General Classification, nomenclature, drug metabolism. Development of drugs: Procedure followed in drug design, concepts of lead compound lead modification, concept of prodrugs, Structure Activity Relationship (SAR)-factors affecting bio-activity-resonance, inductive effect, isosterism, bio-isosterism, spatial considerations, Quantitative Structure Activity Relationships (QSAR)-Concepts of drug receptors. Elementary treatment of drug receptor interactions. Physico-chemical parameters: lipophilicity, partition coefficient, electronic ionization constants, steric, Shelton and surface activity parameters and redox potentials.

UNIT II: Antineoplastic Agents: [12 Hours]

Introduction, classification-alkylating agents- mechanism and mode of action, nitrogen mustards-synthesis, properties, uses and dosage - Chlorambucil, cyclophosphamide and melphalan. Antimetobolites- synthesis, properties, uses and dosage-pyrimidine analogues-5-flurouracil, purine analogues-6-mercaptopurine, folic acid analogues-Methotrexate. Antibiotics-structure, properties and dosage-Doxorubicin, Mitomycin.

UNIT III: Cardiovascular Drugs: [12 Hours]

Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output. Direct acting arteriolar dilators. Synthesis of amyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa, atenolol, oxyprenolol.

UNIT IV: Oral Hypoglycaemic Drugs: [12 Hours]

Introduction, Classification, Sulphonylureas- synthesis, mode of action, properties, uses and dosage- tolbutamide, glipizide. Biguanides- synthesis, mode of action, properties, uses and dosage-Metformin. α-glucosidage inhibitors- synthesis, mode of action, properties, uses and dosage- Miglitol. Dipeptidyl Peptidase-4 (DPP-4) inhibitors- synthesis, mode of action, properties, uses and dosage-saxagliptin and sitaglipti

UNIT V: Local Anti-infective & Antiviral drugs [12 Hours]

Local Anti-infective Drugs: Introduction and general mode of action. Synthesis of sulphonamides, ciprofloxacin, norfloxacin, dapsone, amino salicylic acid, isoniazid, fluconazole, econozole and chloroquin.

Antiviral Drugs: Introduction, classification based on mechanism of action, Nucleoside or Nucleotide Reverse Transcriptase Inhibitors (NRTIs)-Synthesis, metabolism, properties and uses and dosage-Acyclovir, Zidovudine (Anti-HIV agent). Non-Nucleoside or Nucleotide Reverse Transcriptase Inhibitors (NNRTIs)-Synthesis, metabolism, properties and uses and dosage-Nevirapine, Efavirenz. Protease Inhibitors (PIs)- Synthesis, metabolism, properties and uses and dosage-Indinavir. CCR5-Inhibitors- Synthesis, metabolism, properties and uses and dosage-Maraviroc

Text Books:

1. Text book of medicinal chemistry, Volume 1 & II, Third edition by V Alagarsamy, CBS-publishers
2. Introduction to Medicinal Chemistry, A Gringuage, Wiley-VCH.
3. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F. Dorge.
4. An Introduction to Drug Design, S. S. Pandeya and J. R. Dimmock, New Age International.
5. Burger's Medicinal Chemistry and Drug Discovery, Vol-1 (Chapter.-9 and Ch-14), Ed. M. E. Wolff, John Wiley.
6. Goodman and Gilman's Pharmacological Basis of Therapeutics, McGraw-Hill.
7. The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, Academic Press.
8. Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley.