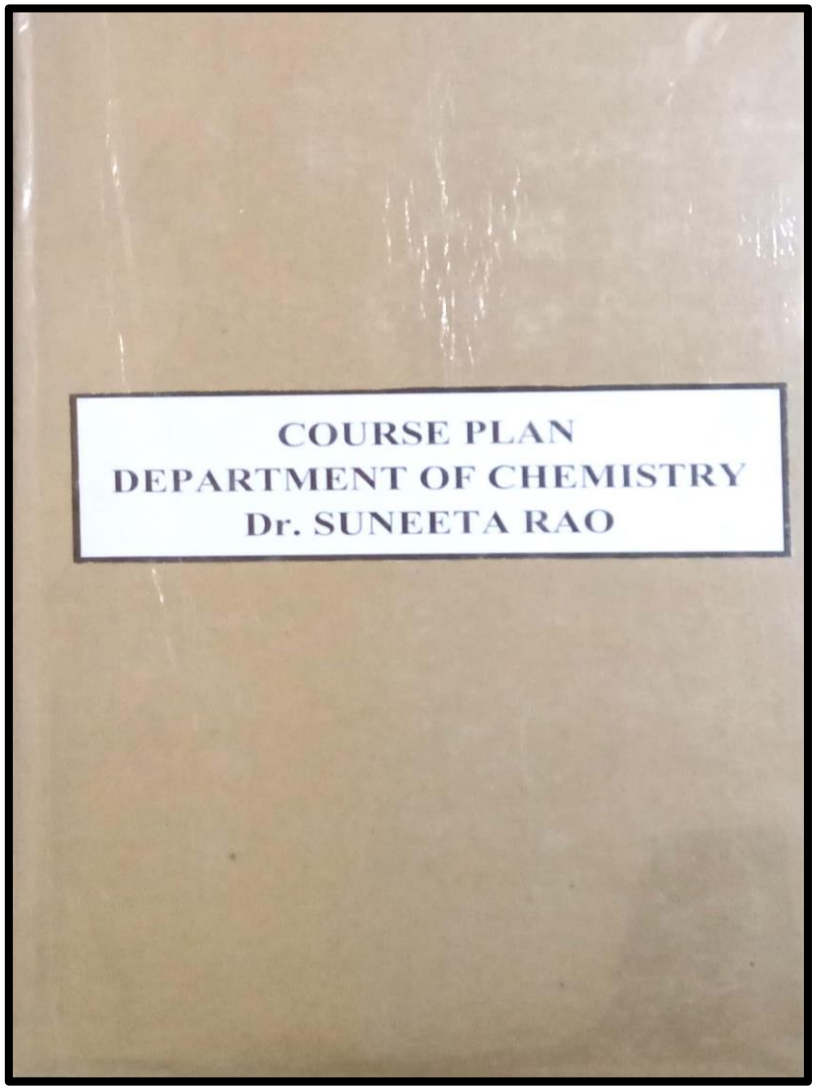
SOPHIA GIRLS' COLLEGE(AUTONOMOUS), AJMER



COURSE PLAN

U.G. & P.G. Programs

2020-21

ODD SEMESTER

SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER
B.Sc. II (SEMESTER III)

ORGANIC CHEMISTRY (PAPER II) (CHE-302)

Max. Marks: 75 (50Ext; 25 Int) Min. Marks: 30(20 Ext; 10 Int) Credit: 03

COURSE PLAN

SEM III Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM III July-Aug	**Unit – III** **Phenols** Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.	Structure and reactivity of Phenols and ethers	Audio- Visual Tutorials, Flipped Classroom, Peer group teaching	Illustrate the preparation and Chemical Reactions of Phenols, ethers and Epoxides	*Knowledge Based* -What is finger print region in IR spectroscopy? -Discuss the effect of conjugation in UV spectrum *Understanding Based* -Compare the chemical behaviour of monohydric alcohols and dihydric	Knowledge--50 Understanding-35 Higher Order-15

	Ethers and Epoxides Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions- cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides				alcohols. - Explain the acidic strength of phenol and cresol. *Higher Order Thinking Skills Based* -Justify the orientation of ring opening of ethers. -How we can differentiate between the pair of CH_3CH_2CHO and CH_3COCH_3 with the help of IR spectral data?
Sep-oct.	**Unit – I** **Spectroscopy** **Electromagnetic Spectrum: Absorption Spectra** Ultraviolet (UV) absorption spectroscopy- absorption laws (Beer-Lambert law), types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathchromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated dienes and enones, Application of electronic spectroscopy and Woodward rules for calculating λ max of conjugated dienes and	Interpretation of UV and IR spectra and their role in structural elucidation.	Problem Solving, PPT, Flipped Classroom	Assess the molecular structure using UV and IR Spectroscopy	

	α, β – unsaturated carbonyl compounds. **Infrared (IR) absorption spectroscopy**-molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.					
NOV. Jam.	**Unit – II** **Alcohols** Classification and nomenclature. Monohydric alcohols-nomenclature, methods of formation, Chemical reactions of alcohols. Dihydric alcohols and trihydric alcohols-nomenclature, formation, chemical reactions of vicinal glycols and pinacol-pinacolone rearrangement. Trihydric alcohols-nomenclature and methods of formation, chemical reactions, Role of alcohols in sanitization process against covid 19.	Structure and reactivity Of monohydric, dihydric and trihydric alcohols.	Assignments, Group discussion, Audio Visual Tutorials	Summarize the reactivity of primary, Secondary and tertiary alcohols		

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B.Sc. III (SEMESTER V)

ORGANIC CHEMISTRY (PAPER II) (CHE-502)

COURSE PLAN

SEM V Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM V July - August	**UNIT I** **Nuclear Magnetic resonance (NMR) spectroscopy.** Proton magnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2, - tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic	Structural elucidation of organic compounds with the help of spectroscopic techniques	Audio Visual Tutorials, Group discussions, Problem solving activities	Predict structure of various organic molecules using NMR Spectroscopy	*Knowledge Based* -How many signals do you expect for the following molecules in the NMR spectrum. (i) CH_3CH_2Cl (ii) CH_3CH_2OH - What are chemically equivalent protons. Explain with suitable examples. *Understanding Based* - Compare the	Knowledge--40 Understanding-40 Higher Order-20

	techniques.				advantage of Ziegler-Natta catalyst over addition polymerisation. - Explain why alkyllithium are called Super Grignard reagent *Higher Order Thinking Skills Based* - Determine the structural formula of the compounds on the basis of PMR data. C_7H_8 9.1 ppm (5H), Singlet, 2.3 ppm (3H), Singlet - An organic compound having molecular formula C_2H_4O gives following signals in its PMR spectrum	
Sep - Oct.	**UNIT II** **Organometallic Compounds** Definition, nomenclature and classification of organometallic compounds, Organo-magnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.	Properties of Organometallic Compounds	Flipped classrooms, Quiz, Group Discussions	Summarize the Chemical Properties of Organometallic Compounds, Synthetic Polymers and Oils, Fats and detergents.		
	Fats, Oil and Detergents Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value, Soaps, synthetic detergents, alkyl and aryl sulphonates. Action of soaps and detergents for protection against COVID-19.	Various properties of Fats, oils and detergents	Student Presentations, Peer Group Teaching, assignments			

	Synthetic Polymers Definition of monomers and polymers. Classification of polymers. Different types of processes for polymerization and their mechanisms (ionic, free radical and Ziegler-Natta catalyst). Preparation and uses of some polymers viz., nylons, polyesters, polyvinyl chloride, Teflon, Bakelite, urea and melamine formaldehyde resins. Natural rubber (isolation, structure and vulcanization). Synthetic elastomers – buna -S, butyl rubber and polyurethane.	Various properties and uses of synthetic polymers			2.2 ppm, db and 9.4 ppm, qr Estimate the structure of the compound.	

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PRACTICALS (CHE-303)

Max. Marks: 50(40Ext; 10 Int) Min Marks: 20(16 Ext;4 Int) Credit: 02

COURSE PLAN

SEM Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM III July- Aug	**Inorganic Chemistry** • Calibration of fractional weights, pipettes and burettes. -Preparation of standard solutions. • Dilution 0.1 M to 0.001 M solutions.	Preparation of solutions and dilution	Demonstration of Experiment with use of different apparatus and glassware	Understand the practical applications of various aspects of chemistry	*Knowledge Based* Practical File Work *Understanding Based* -To determine percentage composition of acetic acid in commercial vinegar using NaOH. -To determine alkali content in antacid tablet. *Higher Order Thinking Skills Based* Viva Voce	Knowledge—30 Understanding-50 Higher Order-20
Sep- oct.	**Volumetric Analysis** • Determination of acetic acid in commercial vinegar using NaOH. • Determination of alkali content-antacid tablet using HCl. • Estimation of calcium content in chalk as calcium	Volumetric Analysis	Demonstration of the exercise			

	oxalate by potassium permanganate. • Estimation of hardness of water by EDTA. • Estimation of ferrous and ferric dichromate method. • Estimation of copper using thiosulphate					
Nov. Jam.	**Gravimetric Analysis.** • Analysis of Cu as CuSCN • Ni as Ni-dimethylglyoxime.	Gravimetric Analysis.	Demonstration of Experiment with Use of different Apparatus like oven, desiccator, suction pump and crucible.			

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SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER
M.Sc. CHEMISTRY (PREVIOUS)
SEMESTER I

ORGANIC REACTION MECHANISM-I (CHEM-102)

Max. Marks: 100 (70Ext; 30 Int) Min. Marks: 40(28 Ext; 12 Int) Credit: 06

COURSE PLAN

SEM/ Month	Unit/Topic	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
Sem I Nov. – Dec.	**UNIT I** **Nature of Bonding in organic molecules** Aromaticity in benzenoid and non- benzenoid compounds, Huckel's rule, energy level of π molecular orbital, annulenes, antiaromaticity, homoaromaticity	Nature of Bonding in organic molecules	E-content, Flipped Classroom, Peer Group Teaching	Predict structure and bonding in common organic molecules and mechanism of organic reactions.	*Knowledge Based* - What is Antiaromaticity? -Define Homoaromaticity. *Understanding Based* -Compare the aromaticity of tropone and tropolone. - Summarize the aromatic behaviour	Knowledge-25 Understanding-45 Higher Order-30

	Reaction Mechanism: Structure and Reactivity Types of reactions, types of mechanisms, General methods for the determination of reaction mechanism – stereochemical evidences, kinetic evidences and isotope effects. Thermodynamic and kinetic requirements for a reaction, kinetic and thermodynamic control.	Structure and Reactivity of organic compounds	Audio Visual Tutorials, E-content, Group Discussions		of (14)-and (18)-Annulenes *Higher Order Thinking Skills Based* -Explain how reactivity is effected at bridgehead positions in free radical reaction mechanism. - Elaborate primary kinetic isotope effect and secondary kinetic isotope effects.	
Feb.	**UNIT III** **Free Radical Reactions** Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance, Reactivity for aliphatic and aromatic substrates at a bridgehead, Reactivity in the attacking radicals, the effect of solvent on reactivity. Allylic	Types of Free Radical Reactions	Flipped Classrooms, E-content, Assignments	Explain different types of free radical reactions		

	halogenations (NBS), oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction. Free radical rearrangement, Hunsdiecker reaction.					

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SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER
M.Sc. CHEMISTRY (FINAL)
SEMESTER III

PHOTOCHEMISTRY AND SOLID STATE CHEMISTRY (CHEM-302)

Max. Marks: 100 (70Ext; 30 Int) Min. Marks: 40(28 Ext; 12 Int) Credit: 06

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
Sem III Sep- oct.	**Unit-II** **Photochemical Reactions** Interaction of electromagnetic radiation with matter, type of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.	Different types of fates of excited molecules	Audio Visuals Tutorials, Quiz, Flipped classroom	Analyse various concepts of photochemical reactions and Photochemistry of Alkenes.	*Knowledge Based* - Define Quantum Yield. -What is actinometry? *Understanding Based* - Conclude fates of various types of excited molecules. - Discuss mechanism of 1,2-alkyl shift in photochemical isomerization of aromatic	Knowledge-25 Understanding-45 Higher Order-30
	Determination of Reaction Mechanism Classification, rate constants	Methods of determination of reaction mechanism	E-content, Flipped classroom, Group Discussion			

	and life time of reactive energy state- determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Type of photochemical reactions- photodissociation, gas-phase photolysis.				compounds. *Higher Order Thinking Skills Based* - Explain Norrish Type –I photochemical reactions of carbonyl compounds. - Discuss the following reactions with mechanism and suitable examples- (i) Photo-Fries rearrangement (ii) Barton reaction	
	Photochemistry of Alkenes Intermolecular reactions of the olefinic bond-geometrical isomerism cyclisation reaction, rearrangement of 1,4-and 1,5-dienes.	Types of photochemical reactions of alkenes	Audio Visuals Tutorials, Flipped classroom, Peer Group Teaching			
NOV. - JAN	**Unit-III** **Photochemistry of Carbonyl Compounds** Intramolecular reactions of the carbonyl compounds- saturated, cyclic and acyclic, α, β-unsaturated, cyclohexadienones, Intermolecular cycloaddition reaction- dimerisation and oxetane formation.	Photochemical reactions of Carbonyl Compounds	E-content, Group Discussion, Assignments	Elaborate the photochemistry of various organic compounds.		

	Photochemistry of Aromatic Compounds Isomerisations, additions and substitutions.	Photochemical reactions of Aromatic Compounds	Audio Visual Tutorials, Flipped Classroom		
	Miscellaneous Photochemical Reactions Photo-Fries reactions of anilides. Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photo Degradation of polymers.	Different types of Photochemical Reactions	Quiz, Group Discussion, Audio Visual Tutorials		

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M.Sc. CHEMISTRY (FINAL)
SEMESTER III

ENVIRONMENTAL AND GREEN CHEMISTRY (CHEM-303)

Max. Marks: 100 (70Ext; 30 Int) Min. Marks: 40(28 Ext; 12 Int) Credit: 06

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM III Aug - Oct.	**Unit-I** **Introduction, Principle and concept of green chemistry** Introduction, need of green chemistry, Basic principles, concept of atom economy, designing green synthesis using these principles.	Principles of green chemistry	E-content, Flipped Classroom, Assignments	Elaborate the principle and concept of green chemistry.	*Knowledge Based* -What is atom economy? *Understanding Based* -List four principles of green chemistry. *Higher Order Thinking Skills Based* - How a synthesis can be made green, elaborate with suitable example?	Knowledge-25 Understanding-45 Higher Order-30

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M.Sc. CHEMISTRY (FINAL)
SEMESTER III
Practicals (CHEM-305)

Max. Marks: 100 (70Ext; 30 Int) Min. Marks: 40(28 Ext; 12 Int) Credit: 06

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM III Sep-Oct.	**ORGANIC CHEMISTRY** **Qualitative Analysis** Separation and identification of the compound of mixture of three organic compounds (three solids and/or two solids and liquid) by Water, $NaHCO_3$, NaOH. Prepare derivatives, wherever possible.	Detection of organic compounds in ternary mixture	Flow chart, Demonstration of the methods of separation	Understand the practical applications of various aspects of chemistry	*Knowledge Based* Practical File Work *Understanding Based* -To separate and identify the components of the given organic ternary mixture. *Higher Order Thinking Skills Based* -Viva- Voce	Knowledge--20 Understanding-40 Higher Order-40

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COURSE PLAN

U.G. & P.G Programs

2020-21

EVEN SEMESTER

SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER

B. Sc. I (SEMESTER II)

ORGANIC CHEMISTRY (CHE-202)

Max. Marks: 75 (50 Ext; 25 Int) Min. Marks: 30(20 Ext; 10 Int) Credit: 03

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM II May - June	**Unit – II** **Arenes and aromaticity** Structure of benzene: molecular formula and Kekule structure. Stability of benzene, resonance structure, MO picture. Aromaticity: Huckle rule, aromatic ions. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl.	Structure, stability and reactivity of Benzene and its derivatives and Electrophilic substitution reaction of Aromatic Compounds	Group Discussion, PPT, flipped classroom	Assess the aromaticity of arenes and electrophilic substitution reactions.	*Knowledge Based* - Define Huckel's rule. - What is the resonance energy of benzene? *Understanding Based* - Explain the ortho-para directing effect of Chlorine on Benzene. -Compare the stability of cyclobutadienyl cation and cyclobutadienyl	Knowledge--60 Understanding-30 Higher Order-10

	Aromatic electrophilic substitution- General pattern of the mechanism, role of sigma and pi-Complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams, activating and deactivating substituents, orientation and ortho/para ratio.				anion. *Higher Order Thinking Skills Based* - Elaborate why halogens have ortho-para directing and deactivating effect on the benzene ring. - Explain the energy profile diagram of nitration reaction of benzene.	

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B.Sc. II (SEMESTER IV)

ORGANIC CHEMISTRY (CHE-402)

Max. Marks: 75 (50 Ext; 25 Int) Min. Marks: 30(20 Ext; 10 Int) Credit: 03

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM IV March.	**Unit – II** **Organic Compounds of Nitrogen** Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid. Halonitroarenes: reactivity, Structure and nomenclature of amines, physical properties, Stereochemistry of amines, Amines salts as phase-transfer catalysts.	Synthesis and reactivity of various N containing compounds	Audio Visual Tutorials, Flipped Classroom, Group discussion	Summarize the reactivity of nitroalkanes, Amines, and diazonium salts.	*Knowledge Based* -Write the structural formulas of 2-pentanamine. -Give the structural formula of Picric acid. *Understanding Based* -Describe the difference among primary, secondary and tertiary	Knowledge--50 Understanding-35 Higher Order-15

	Preparation of alkyl and aryl amines, Gabriel-phthalimide reaction, Hoffmann bromamide reaction. Reaction of amines, electrophilic aromatic substitution in aryl amines, Synthetic transformation of aryl diazonium salts, azo coupling.				amines. -Explain with examples what are Phase Transfer Catalyst? *Higher Order Thinking Skills Based* -Compare the effect of heat on various types of hydroxy acids. -How we can separate the mixture of three types of amines.	
July	**Unit – III** **Carboxylic Acids** Nomenclature, structure and bonding, Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids. Hydroxy acids: malic, tartaric and citric acids, dicarboxylic acid.	Structure and reactivity Of Carboxylic acids and Hydroxy acids and Synthesis and interconversion of acid derivatives	Peer Group Teaching, Quiz, Flipped Classroom, E-content	To Compare the reactivity of carboxylic acids and acid derivatives		

	Carboxylic Acid Derivatives – Synthesis of acid chlorides, esters, anhydrides and amides. Relative stability of acyl derivatives, Physical properties, interconversion of acid derivatives, Mechanisms of esterification and hydrolysis (acidic and basic).					

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B.Sc. II (SEMESTER IV)

PRACTICALS (CHE-403)

Max. Marks: 50(40Ext; 10 Int) Min Marks: 20(16 Ext;4 Int) Credit: 02

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM IV Mar.	**Organic Chemistry** **(A) Chromatography** (i) Separation , Rf values and identification of organic compounds. (ii) Preparation and separation of 2,4-dinitrophenylhydrozone of acetone,2- butanone, hexan-2- and 3-one using toluene and light petroleum (40:60:). (iii) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5)	Separation of organic compounds by chromatographic method	Demonstration of the experiment	Understand the practical applications of various aspects of chemistry	*Knowledge Based* Practical File Work *Understanding Based* -To identify the given organic compound. - To determine the transition temperature of the given substance by thermometric method ($MnCl_2,4H_2O$) *Higher Order Thinking Skills Based*	Knowledge--30 Understanding-50 Higher Order-20

April	**(B) Qualitative Analysis** Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.	Identification of an organic compound	Demonstration of the method of identification, Flow Chart		Viva Voce	
May- July	**Physical Chemistry (Any Four)** 1. Determination of the transition temperature of the given substance by thermometric method (e.g.$MnCl_2$,$4H_2O$/$SrBr_2$. $2H_2O$) 2. To study the effect of a solute(e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.	Determination of the transition temperature, enthalpy of neutralization	Exercises with Use of different Apparatus and Demonstration of the exercise			

	3. To construct the phase diagram of two component (e.g. diphenylaminebenzophenone) system by cooling curve method. 4. To determine the solubility of benzoic acid at different temperatures and to determine DH of the dissolution process. 5. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.					

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SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER
M.Sc. CHEMISTRY (PREVIOUS)
SEMESTER II

REACTION MECHANISM-II AND STEREOCHEMISTRY (CHEM-202)

Max. Marks: 100 (70Ext; 30 Int) Min. Marks: 40(28 Ext;12 Int) Credit:06

COURSE PLAN

SEM/ Month	Unit/Topic	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM II April	**UNIT I** **Addition to Carbon-Hetero Multiple Bonds** Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids and esters Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Wittig reaction. Mechanism of condensation reaction involving enolates-Aldol, Knoevenagel. Claisen, Mannich, Benzoin, Perkin and Stobbe reactions. Hydrolysis of esters and amides.	Addition reactions and Condensation reaction mechanisms	E-content, Flipped Classroom, Group Discussion	Explain the mechanism of various types of condensation and elimination reactions.	*Knowledge Based* - Define plane of symmetry with examples. - What is Perkin reaction. Explain with mechanism. *Understanding Based* - Discuss Benzoin Reaction with mechanism. - Illustrate E1	Knowledge-25 Understanding-45 Higher Order-30

	Elimination reactions The E2, E1 and E1CB mechanism and their spectrum, Orientation of the double bond, reactivity effect of substrate structure, attacking base, leaving group and the medium, Mechanism and orientation in Pyrolytic elimination.	Mechanism of different types of Elimination reactions	Assignments, Group Discussion, Flipped Classroom		Reaction Mechanism with example. *Higher Order Thinking Skills Based* - Discuss the mechanism of aldol and cross aldol condensation with mechanism. - Elaborate 1,3 dipolar cycloaddition and cheleotropic reactions.	
May - June	**UNIT II** **Stereochemistry** Elements of symmetry, Chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereroselective synthesis Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus. Conformational analysis of cycloalkanes and decalins, steric strain due to unavoidable crowding.	Different stereochemical aspects of organic compounds	Audio Visual Tutorials, Flipped Classroom, Group Discussion	Analyse the stereochemistry of organic compounds.		

July	**UNIT III** **Pericyclic Reactions** Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene,1,3,5-hexatriene and allyl system. Classification of pericyclic reaction. Woodward-Hoffmann correlation diagrams. FMO and PMO approach Electrocyclic reactions-conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions-antarafacial and suprafacial additions, 4n, 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloaddition and cheleotropic reactions. Sigmatropic rearrangements-suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3-and 5,5-sigmatropic rearrangements. Claisen, Cope and aza-Cope rearrangements, Ene reaction.	Concepts of Cycloaddition reactions and Sigmatropic rearrangements	Flipped Classrooms, E-content, Group Discussion	Review the various aspects of pericyclic reactions		

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M.Sc. CHEMISTRY (FINAL)
SEMESTER IV

GROUP-B ORGANIC CHEMISTRY
ORGANOMETALLICS AND DISCONNECTIONS -CHEM-401(B)

Max. Marks: 100 (70Ext; 30 Int) Min. Marks: 40(28 Ext;12 Int) Credit:06

COURSE PLAN

SEM/ Month	Unit/Topic	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM IV March.	**Unit- I** **Organometallic Reagents** Principles, preparations, properties and applications of the following in organic synthesis with mechanistic details. **Transition Metal organic compounds** Cu, Pd, Ni, Fe, Co, Rh, Cr and Ti Compounds.	Methods of preparations and properties of organometallic compounds of transition metal complexes	PPT, Audio Visual Tutorials, Flipped Classroom	Analyse organometallic reagents of transition metals.	*Knowledge Based* - Give structure and uses of Willkinson's catalyst. *Understanding Based* -Explain principle of protection of carbonyl compounds. *Higher Order Thinking Skills*	Knowledge--25 Understanding-45 Higher Order-30

	Protecting Groups Principle of Protection of alcohol, amine, carbonyl and carboxyl group.	Protection of specific organic compounds	Assignments, E-content, Flipped classroom		*Based* -Elaborate Hack reaction with mechanistic details.	

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M.Sc. CHEMISTRY (FINAL)

GROUP-B ORGANIC CHEMISTRY

SEMESTER IV

HETEROCYCLIC CHEMISTRY - CHEM-402(B)

Max. Marks: 100 (70Ext; 30 Int) Min. Marks: 40(28 Ext;12 Int) Credit:06

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM IV March.	**Unit-I** **Nomenclature of Heterocycles** Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic, fused and bridged heterocycles.	Structural Classification and nomenclature of heterocycles.	E-content, Problem Solving, Group Discussion	Interpret aromatic and non- aromatic heterocycles	*Knowledge Based* -What is Hockey stick effect?. - Give two synthesis of Oxirane. *Understanding Based* - Explain briefly the structure and	Knowledge-25 Understanding-45 Higher Order-30

	Aromatic Heterocycles General chemical behaviour of aromatic hetrocycles, classification (structural type), criteria of aromaticity (Bond lengths, ring current and chemical shifts in ^{1}H NMR-spectra, empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations.) Heteroaromatic reactivity and tautomerism in aromatic heterocycles.	Chemical Behaviour of aromatic heterocycles	E-content, Problem Solving, Group Discussion		reactions of Quinolizinium salts. - Discuss attractive interactions through space *Higher Order Thinking Skills Based* - Illustrate torsional strain and their consequences in small ring heterocycles - Describe Meso-Ionic heterocycles.	
	Non Aromatic Hetrocycles Strain-bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction. Stereo-electronic effects-	General chemical behaviours and non aromatic heterocycles	Audio Visual tutorials, Quiz, Peer group teaching			

	anomeric and related effects. Attractive interactions- hydrogen bonding and intramolecular nucleophilic-electrophilic interactions.					
April	**Unit-II** **Heterocyclic Synthesis** Principles of heterocyclic synthesis involving cyclization reaction and cycloaddition reactions.	Principles of heterocyclic synthesis	E-content, Quiz, PPT, Peer Group Teaching	Elaborate the synthesis of various types of heterocyclic compounds.		
	Small Ring Heterocycles Three - membered and four - membered heterocyles - synthesis and reactions of aziridines, oxiranes, azetidines, oxetanes.	Reactions and synthesis of small ring and six membered heterocycles.	Audio Visual Tutorials, Group Discussion			
May- July	**Unit-III** **Benzo Fused Five-membered Heterocyles** Synthesis and reactions including medicinal applications of benzopyrroles, benzofurans and benzothiophenes. Meso-Ionic heterocycles.	Applications and reactions of benzo fused heterocycles	E-content, Quiz, PPT, Peer Group Teaching	Illustrate benzo fused five-membered and six-membered heterocycles.		

	Six Membered Heterocycles with one Heteroatom Synthesis and reaction of quinolizinium and benzopyrilium salts, coumarins and chromones.	Characteristics of Six-Membered heterocycles with one Heteroatoms	Flipped classrooms, Audio Visual Tutorials			

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