



**COURSE PLAN**  
**U.G. & P.G. Programs**  
**2021-22**  
**ODD SEMESTER**



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

ORGANIC CHEMISTRY (PAPER II) (CHE-502)

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 V  SEP- Oct.	<b>UNIT I</b> <b>Nuclear Magnetic resonance (NMR) spectroscopy.</b>  Proton magnetic resonance (1H NMR) spectroscopy- Introduction, chemical shift and nuclear shielding and deshielding, areas of signals, spin-spin splitting and coupling constants, NMR Shift Reagents, 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,	Structural elucidation of organic compounds.	Group Discussion, Problem solving, PPT	Predict structure of various organic molecules using NMR Spectroscopy.	<u>Knowledge Based</u> -How many signals do you expect for the following molecules in the NMR spectrum?  (i) $\text{CH}_3\text{CH}_2\text{Br}$  (ii) $\text{CH}_3\text{CH}_2\text{OH}$  -What are chemically equivalent protons. Explain with suitable examples.  <u>Understanding Based</u>	Knowledge-40 Understanding-40 Higher Order-20



	IR and PMR spectroscopic techniques.					
NOV	<b>UNIT II</b>  <b>Organometallic Compounds</b> Definition, nomenclature and classification of organometallic compounds, Organomagnesium 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 and Synthetic Polymers, Properties of fats and oils.	Flipped classrooms, Quiz	Summarize the Chemical Properties of Organometallic Compounds and Synthetic Polymers.	- Compare the advantage of Ziegler-Natta catalyst over addition polymerisation. - Why alkyl lithium are called Super Grignard reagent?  <u>Higher Order Thinking Skills</u> <u>Based</u> - Give 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  - Explain Keto-Enol Tautomerism	
	<b>Synthetic Polymers</b> 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).		PPT, Audio – Visual, E-content			





	<p>Synthetic elastomers – buna -S, butyl rubber and polyurethane.</p> <p><b>Fats, Oil and Detergents</b> 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.</p>					
DEC.	<p><b>UNIT III</b></p> <p><b>Organic Synthesis via Enolates</b> Acidity of <math>\alpha</math>-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1, 3-dithianes. Alkylation and acylation of enamines.</p>	Application of enolates in Organic Synthesis	PPT, Flipped classrooms, Group discussions	Assess the chemical properties of enolates and chemical nature of fats and oils.		

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

**GREEN AND ENVIRONMENTAL CHEMISTRY (CHEM-303)**

Max. Marks: 100 (70 Ext; 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.	<b>Unit- I</b>  <b>Introduction, Principle and concept of green chemistry:</b> Introduction and need of green chemistry, green chemistry in day-to-day life, basic principles of green chemistry, concept of atom economy, atom economy in substitution, elimination, addition and rearrangement reactions, designing green synthesis using these principles, Green Synthesis of Acetanilide from primary amines, base catalyzed Aldol Condensation, photoreduction of Benzophenone	Importance of Green Chemistry.	Animated Videos, PPT, E-content	Elaborate the principle and concept of green chemistry.	<u>Knowledge Based</u> -Define Atom Economy? <u>Understanding Based</u> Explain Atom Economy. Determine Saponification of ester. <u>Higher Order Thinking Skills Based</u> - Elaborate Polymer supported Regents.	Knowledge--25 Understanding-45 Higher Order-30



OCT- NOV.	<b>Unit-II</b>					
	<b>Application of greener alternative approaches Different approaches to green synthesis:</b> Use of green reagents-dimethyl carbonate, polymer supported reagents- (per acids and chromic acids), green solvents, Synthetic organic transformations under microwave- Fries rearrangement, Diels-Alder reaction, decarboxylation, Saponification of esters, alkylation of reactive methylene compounds, heterocyclic synthesis: 3-aryl coumarins, flavones, 3-aryl-2H-1,4- benzoxazines.	Importance of Green Reagents	PPT, E-content, Animated Video	Illustrate application of greener alternative approaches		

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

**OXIDATION, REDUCTION AND REARRANGEMENT REACTIONS IN ORGANIC COMPOUNDS (CHEM-304)**

Max. Marks: 100 (70 Ext; 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	<b>Unit-I Oxidation</b> Introduction, Oxidation of Hydrocarbons- alkenes, aromatic rings, saturated C-H groups (activated and inactivated), Alcohols, diols, aldehydes, ketones, carboxylic acids, amines, hydrazines and sulphides.	General mechanism of oxidation.	PPT, Animated video, flipped classroom.	Review the oxidation reaction of various compounds.	<u>Knowledge Based</u> - Define Pinacol-Pinacolone rearrangement. - What do you mean by Shapiro Reaction? <u>Understanding Based</u> - Discuss the Oxidation of Hydrazine.	Knowledge--25 Understanding-45 Higher Order-30
SEP	<b>Unit-II Reduction</b> Introduction, Reduction of Hydrocarbons- alkenes, alkynes and aromatic rings, aldehydes, ketones, carboxylic acids and derivatives, epoxides, nitriles, nitro compounds and nitroso compounds. Reduction	General Mechanism of Reduction.	Ppt, E-content, animated video	Discuss the reduction of different functionalities in organic molecules	-Discuss the reduction of Aromatic rings, aldehyde, carboxylic acid.	
OCT- NOV						





	by Hydride transfer reagents- LiAlH <sub>4</sub> , NaBH <sub>4</sub> , mixed lithium aluminium hydride- aluminium chloride reagents, DIBAL-H, Sodium cyanoborohydride, Sodium triacetoxyborohydride, borane and derivatives.				<u>Higher Order Thinking Skills Based</u> - Elaborate Dienone-Phenol rearrangement.  - Explain Dakin rearrangement.	
DEC .	<b>Unit-III</b>  Rearrangements Introduction, general mechanistic considerations-nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements: Pinacol- Pinacolone, Wagner- Meerwein, Demjanov, Dienone- Phenol rearrangement, Arndt- Eistert synthesis, Beckmann, Hofmann, Curtius, Lossen, Schmidt reaction, Baeyer-Villiger rearrangement, Dakin rearrangement, Benzilic acid, Favorskii, Neber, Stevens, Wittig, Jacobsen, Hofmann- Martius, Fischer- Hepp, Benzidine, Nazarov, Shapiro reaction.	General mechanism of rearrangement	Animated videos, Group discussion, PPT	Elaborate the mechanism of various rearrangement reactions.  <i>Dys</i>		<i>Taty</i>  Head Department of Chemistry Sophia Girls' College (Autonomous), Ajmer

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

**PRACTICALS (CHEM-305)**

Max. Marks: 100 (70 Ext; 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	<b>ORGANIC CHEMISTRY</b>				<u>Knowledge Based</u> - Practical File Work	
Nov	<b>Qualitative Analysis</b>  Separation and identification of the compound of mixture of three organic compounds (three solids and/or two solids and liquid) by Water, NaHCO <sub>3</sub> , NaOH. Prepare derivatives, wherever possible.	To detect the organic Compound from the given mixture.	Laboratory experiments.	Understand the practical applications of various aspects of chemistry	<u>Understanding Based</u> -To separate and identify the components of the given organic ternary mixture. <u>Higher Order Thinking Skills Based</u>  -Viva- Voce	Knowledge--20 Understanding-40 Higher Order-40

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**SOPHIA GIRLS' COLLEGE, (AUTONOMOUS) AJMER**  
**M.SC CHEMISTRY (PREVIOUS)**  
**Practicals (CHEM-105)**

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM I	<b>Organic Chemistry</b> <b>Qualitative Analysis</b> Separation, purification and identification of compounds of binary mixture (two solids). <b>Quantitative Analysis</b> (a) Determination of Iodine value of an oil sample. (b) Determination of Acid Value of an oil sample. (c) Determination of Saponification value of an oil sample.	Qualitative Analysis and Quantitative Analysis  <i>DP</i>	Demonstration of the exercise	Understand the practical applications of various aspects of chemistry	<u>Knowledge Based</u> - Practical File Work <u>Understanding Based</u> - To separate and identify the components of the given organic ternary mixture.  <u>Higher Order Thinking Skills Based</u> - Viva Voce	Knowledge--20 Understanding-40 Higher Order-40  <i>TC</i>  Head Department of Chemistry Sophia Girls' College (Autonomous), Ajmer

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**COURSE PLAN**  
**U.G. & P.G Programs**  
**2021-22**  
**EVEN SEMESTER**





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

**ORGANIC CHEMISTRY (PAPER II) (CHE-602)**

Max. Marks: 75 (50 Ext; 25 Int)

Min. Marks: 30(20 Ext; 10 Int)

Credit: 03

**COURSE PLAN**

SEM VI Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM VI	<b>UNIT I</b> <b>Carbohydrates</b> Definition, Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Determination of ring size of monosaccharides. Cyclic structure of D(+)- glucose. Mechanism of mutarotation. An introduction to disaccharides	Structural and functional analysis of Carbohydrates	PPT, Flipped classrooms, Group discussions	Summarize the properties of carbohydrates	<u>Knowledge Based</u> -Define Carbohydrates. -Draw the Haworth projection formula of Fructose.  <u>Understanding Based</u> - What is a nucleoside and nucleotide? - Compare Furane and pyrrole on the basis of the following properties: (i) Basic nature (ii) Nucleophilic	Knowledge --40 Understanding-40 Higher Order-20



	(maltose, sucrose and lactose) and polysaccharides( starch and cellulose) without involving structure determination.				substitution (iii)Electrophilic substitution	
	<b>UNIT II</b> <b>Amino Acids, Peptides, Proteins and Nucleic Acids</b> Classification, structure and stereochemistry of amino acids. Acid base behaviour, isoelectric point and electrophoresis. Preparation and reactions of $\alpha$ -amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and structures of proteins. Proteins denaturation/renaturation.	Structure, classification, properties and synthesis of amino acid, peptides, proteins and nucleic acid	Flipped classrooms, Quiz, Diagrams	Explain the nature and behavior of amino acids and nucleic acids.	<u>Higher Order Thinking Skills Based</u> - Describe double helical structure of DNA. -Discuss the comparative aromatic nature of pyrrole, thiophene and furan.	

	Nucleic acids: Introduction, Constitution of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA					
 <b>PRINCIPAL</b> <b>SOPHIA GIRLS' COLLEGE</b> <b>(AUTONOMOUS)</b> <b>AJMER</b>	<b>UNIT III</b>  <b>Heterocyclic compounds</b>  Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.	Aromatic characteristics, preparation and chemical reactions of five membered and six membered heterocyclic compounds	PPT, Group discussions, Charts	Assess the reactivity and stability of heterocyclic compounds.		

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

GROUP THEORY AND SPECTROSCOPY (CHEM-204)

MAX. MARKS: 100 (70 EXT; 30 INT)

MIN. MARKS: 40 (28 EXT; 12 INT)

COURSE PLAN

SEM/ Month	Unit/Topic	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM II	<b>Unit – I</b> <b>Symmetry and Group theory in Chemistry</b> Symmetry elements and Symmetry operation, definitions of group, sub-group, relation between orders of finite group and its subgroup, Conjugacy relation and classes. Point symmetry group. Group multiplication table ( $C_2$ , $C_{2h}$ , $C_{2v}$ , $C_{3v}$ )	Symmetry and Group theory.	Diagrams, Tables, Chart, ppt, Models.	Interpret the symmetry and group theory in chemical science.	<u>Knowledge Based</u> -What are the basic principles of ESR? -Define Group Theory.  <u>Understanding Based</u> -Differentiate between Improper axis of Symmetry and Axis of Symmetry.	Knowledge-25 Understanding-45 Higher Order-30





	<b>Raman Spectroscopy</b> Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle. Resonance Raman spectroscopy, coherent anti Stokes Raman spectroscopy (CARS).	Raman Spectroscopy and its applications.	PPT, Diagrams		-Explain Resonance Raman effect.  <u>Higher Order Thinking Skills Based</u> - Construct group multiplication table of $C_{2v}$ using appropriate example. -Derive classical theory of Raman effects	
	<b>Unit - II</b> <b>Photoelectron spectroscopy</b> Basic principles, photo-electric effect, ionization process, Koopman's theorem. Photoelectron spectra of simple molecules. ESCA. Chemical information from ESCA. Auger electron spectroscopy-basic idea. Photoacoustic Spectroscopy: Basic principle of photoacoustic spectroscopy(PAS), PAS-gases and condensed systems, chemical and surface applications.	Photoelectron and Photoacoustic spectroscopy.	PPT, Chart	Analyse the molecular photoelectron spectroscopy.		Dr. P. K. Taly H <sub>r</sub>

*Dr. P. K. Taly*



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M.SC CHEMISTRY (PREVIOUS)  
SEMESTER II

Practicals (CHEM-205)

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM II	<b>INORGANIC PREPARATIONS</b>  Separation and determination of two metal ions Cu-Ni, Ni-Mg, Cu-Fe, Cu-Ba etc. involving volumetric and gravimetric methods.	Methods of separation and determination of two metal ions	Demonstration of the exercise	Understand the practical applications of various aspects of chemistry	<u>Knowledge Based</u> - Practical File Work <u>Understanding Based</u> - Mechanism of various Chemical reactions. - To analyse the concept of DO, BOD and COD.  <u>Higher Order Thinking Skills Based</u> - Viva Voce	Knowledge--20 Understanding-40 Higher Order-40   

  
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SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER  
M.Sc. CHEMISTRY (FINAL)  
GROUP-B ORGANIC CHEMISTRY  
SEMESTER IV

NATURAL PRODUCTS -CHEM-401(B)

MAX MARKS: 100 (70EXT; 30 INT)

MIN. MARKS: 40 (28 EXT; 12 INT)

COURSE PLAN

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM IV  JANUARY	<b>Unit-I</b>  <b>Terpenoids and Carotenoids</b> Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules: Citral, Geraniol, $\alpha$ -Terpineol, Menthol, Farnesol, Santonin, Phytol, Abietic acid and $\beta$ -Carotene.	Structural determination and chemical aspects of Terpenoids and Carotenoids.	Charts, Tables, PPT,	Explain the synthesis of various types of terpenoids, carotenoids and alkaloids.	<u>Knowledge Based</u> - What is Diel's hydrocarbon?  -Give the structure of Geraniol.	Knowledge-25 Understanding-45 Higher Order-30



	<b>Alkaloids</b> Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry, synthesis and biosynthesis of the following:  Ephedrine, Nicotine, Atropine, Quinine and Morphine	Classification, structure elucidation, synthesis and stereochemical aspects of Alkaloids	Diagrams, Group discussion		<u>Understanding Based</u> - Summarize the nomenclature and classification of Prostaglandins.  - Discuss the synthesis and stereochemistry of Ephedrine.  <u>Higher Order Thinking Skills Based</u>	
FEBRUARY	<b>Unit-II</b>  <b>Prostaglandins</b> Occurrence, Nomenclature, Classification, biogenesis and physiological effects. Synthesis of PGE <sub>2</sub> and PGF <sub>2α</sub>	Classification and reactions of Prostaglandins	Diagrams, Quiz	Illustrate chemical aspects of prostaglandins, pyrethroids, rotenones and steroids.	- Elaborate the synthesis of Cholesterol.  - Explain Biosynthesis of flavonoids.	





	<b>Pyrethroids and Rotenones</b> Synthesis and reactions of Pyrethroids and Rotenones	Nomenclature and reactions of Pyrethroids and Rotenones	PPT, Charts			
	<b>Steroids</b> Occurrence, nomenclature and basic skeleton, Diel's hydrocarbon and stereochemistry, isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone. Biosynthesis of Steroids.	Basic skeleton, constitution and synthesis of Steroids	Flow charts, Diagrams			



MARCH-  
APRIL

### Unit-III

#### Plant Pigment

Occurrence, nomenclature and general methods of structure determination, isolation and synthesis of Quercetin, Myricetin, Diadzein, Butein, Cyanidin, Hirsutidin.

Biosynthesis of flavonoids; Acetate pathway and Shikimic acid pathway.

Nomenclature and synthesis of plant pigments.

PPT, Models

Analyse plant pigments and porphyrins

#### Porphyrins

Structure and synthesis of Haemoglobin and Chlorophyll

Chemical aspects of Porphyrins

Diagrams, Flipped Classrooms

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**M.SC CHEMISTRY (FINAL)**  
**PRACTICALS (CHEM-405) (FOR GROUP –A,B,C)**

SEM/ Month	UNIT/TOPIC	Concepts/facts	Teaching Pedagogy	Learning Outcomes	Questions	Marks Weightage (%)
SEM III JULY	<b>PHYSICAL CHEMISTRY</b> <ul style="list-style-type: none"> <li>Determination of pKa of indicator (e.g. Phenolphthalein).</li> <li>Determination of stoichiometry and stability constant of inorganic (e.g. ferric-salicylic acid) organic (e.g. amine and iodine) complexes.</li> <li>Characterisation of complexes by electronic and IR spectral data.</li> <li>To obtain solubility curve for a ternary system of liquids, water-acetic acid, acid-chloroform system.</li> <li>To estimate oxalic acid by carrying out suitable conductometric titration in the following solutions.               <ol style="list-style-type: none"> <li>A solution of pure Oxalic acid.</li> <li>A solution of Oxalic acid</li> </ol> </li> </ul>	Instrumentation	Exercises with Use of different Apparatus, instruments like pH meter, conductivity meter	Understand the practical applications of various aspects of chemistry	<u>Knowledge Based</u> -- Practical File Work  <u>Understanding Based</u> -To Separate and identify of Pb and Cd by Paper Chromatography and determination of Rf values. -To Isolate of caffeine from tea leaves.  <u>Higher Order Thinking Skills Based</u>	Knowledge--20 Understanding-40 Higher Order-40



	and HCl. iii. A solution of Oxalic acid and $\text{CH}_3\text{COOH}$				-Viva- Voce	<i>Divya</i>
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