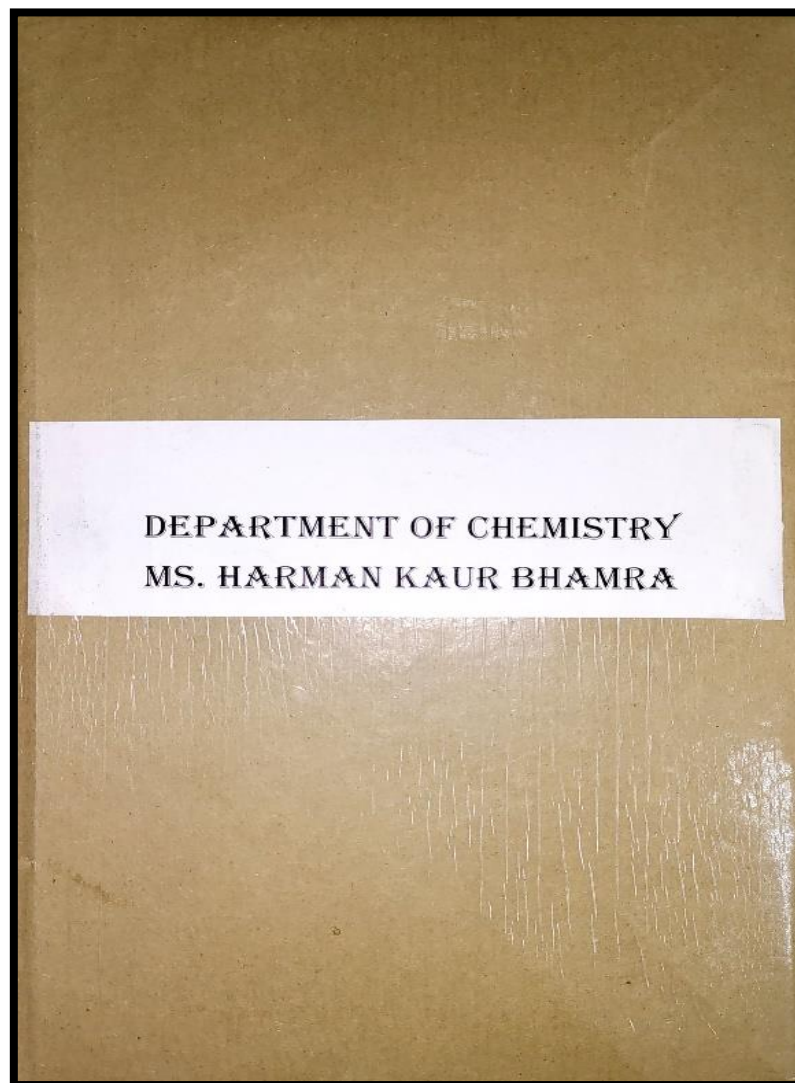




SOPHIA GIRLS' COLLEGE(AUTONOMOUS), AJMER



COURSE_PLAN_2019-20_MS_HARMAN_KAUR_BHAMRA



COURSE PLAN

SESSION-2019-20

B.Sc. PART - I , III

SEMESTER - I , V

M.Sc. - PREVIOUS & FINAL

SEMESTER - I , III

Ms. HARMAN KAUR BHAMRA


DEPT. OF CHEMISTRY




SOPHIA GIRLS' COLLEGE, AJMER (AUTONOMOUS)
B.Sc. (Part-I) SEMESTER - I

ORGANIC CHEMISTRY (PAPER II) (CHE-102)

| SEM I Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|----------------|--|---|--|---|---|--|
| JULY | Unit – I Structure and Bonding Hybridization, bond characteristics, Vander Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects. | Structure and electronic effects in reference to organic molecules. | PPT, Demonstration, Flipped Classroom, Flow Chart, | Predict structure and bonding in common organic molecules and mechanism of organic reactions. | <u>Knowledge Based</u> - Define Saytzeff rule. - Why peroxide effect is observed in addition of H-Br and not for H-Cl and H-I ? <u>Understanding Based</u> - Arrange the following alkenes in the decreasing order of their stabilities explain with reason $\text{CH}_2=\text{CH}_2$, $\text{R}_2\text{C}=\text{CH}_2$, $\text{R}_2\text{C}=\text{CR}_2$ - Compare the | Knowledge--60 Understanding-30 Higher Order-10 |
| | Mechanism of Organic Reactions Curved arrow notation, Types of reagents, Types of organic reactions. Energy considerations. Reactive intermediates, carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with example). Assigning formal charges. | Reagents and Intermediate in various Organic reactions | | | | |

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|  AUGUST | Unit – II Alkanes Methods of preparation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity. | Structure and reactivity of alkanes | PPT, Demonstration, Flipped Classroom | Review the preparation and chemical reactions of alkanes and cycloalkanes | stability of cyclopropane and cyclohexane. <u>Higher Order Thinking Skills Based</u> -Justify the unequal formation of 1,2 and 1,4 products in 1,3-Butadiene at different temperatures. - Evaluate Substitution at the allylic and vinylic positions of alkenes. | |
| | Cycloalkanes Nomenclature, methods of preparation. chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. cyclopropane ring: banana bonds. | Structure , stability and reactivity of cycloalkanes | | | | |
| SEPTEMBER- | Unit – III Alkenes Nomenclature of alkenes, methods of preparation, | | | | | |



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|  | <p>mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. Saytzeff rule, Hoffmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes- mechanisms involved in hydrogenation, electrophilic and free radical additions, Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes.</p> | <p>Structure and reactivity in context to regioselectivity in different alkenes.</p> | <p>Group Discussions, Diagrams, Models</p> | <p>Summarize the chemical behaviour of alkenes, dienes and alkynes.</p> | | |
| | <p>Alkynes Nomenclature, structure and bonding in alkynes. Methods of preparation, chemical reactions of alkynes- hydrogenation, halogenation, hydrohalogenation, hydration, hydroboration and hydroxylation, ozonolysis of alkynes, acidity of alkynes, mechanism of electrophilic and nucleophilic addition reactions, metal-ammonia reductions, oxidation and polymerization, acidity of alkynes, characteristics of terminal alkynes.</p> | <p>Electrophilic addition and reactions of alkynes</p> | <p>Diagrams, Models, Demonstration, Flow Charts</p> | | | |



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| | Dienes- Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene method of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels-Alder reaction. | Structure of dienes and thermodynamic and kinetic control of reactions | PPT, Demonstration, Flipped Classroom | | | |
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B.Sc. (Part-III) SEMESTER - V

ORGANIC CHEMISTRY (PAPER II) (CHE-502)

COURSE PLAN

| SEM/ Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|---------------|--|--|--|---|---|--|
| SEM I JULY | UNIT I Nuclear Magnetic resonance (NMR) spectroscopy. Proton magnetic resonance (^1H 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, 1,1,2,2-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques. | Structural elucidation of organic compounds. | PPT, Flipped classrooms, Group discussions | 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) $\text{CH}_3\text{CH}_2\text{Cl}$ (ii) $\text{CH}_3\text{CH}_2\text{OH}$ - What are chemically equivalent protons. Explain with suitable examples. <u>Understanding Based</u> - Compare the advantage of Ziegler-Natta catalyst over addition | Knowledge--40 Understanding--40 Higher Order--20 |



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UNIT II

Organometallic Compounds

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.

polymerisation.
- Why alkyllithium are called Super Grignard reagent ?

Higher Order Thinking Skills Based

- Give the structural formula of the compounds on the basis of PMR data.



9.1 ppm (5H), Singlet, 2.3 ppm (3H), Singlet

- Explain how alkylation of DEM is helpful in designing organic synthesis?

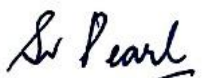
Diagrams, Charts

Synthetic Polymers

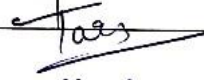
Definition of monomers and polymers. Classification of polymers. Different types of processes for polymerization and their mechanisms (ionic, free radical and Ziegler-Natta catalyst). Preparation and uses of some polymers viz., nylons, polyesters, polyvinyl chloride, Teflon, Bakelite, urea and melamineformaldehyde resins. Natural rubber (isolation, structure and vulcanization). Synthetic elastomers – buna -S, butyl rubber and polyurethane.



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| | 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. | | | | | |
| SEPTEMBER- OCTOBER | UNIT III Organic Synthesis via Enolates Acidity of α -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. | 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, AJMER (AUTONOMOUS)
M.SC CHEMISTRY (PREVIOUS)
Practicals (CHEM-105)

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|-------------------------------------|---|-----------------|--|---|--|--|
| SEPTEMBER R- OCTOBER | PHYSICAL <ul style="list-style-type: none">• Determination of solubility and solubility product of sparingly soluble salts (e.g. PbSO_4, BaSO_4) conductometrically.• Determination of the strength of strong and weak acids in a given mixture conductometrically.• To construct the phase diagram for three component system (e.g., chloroform-acetic acid-water).• Determination of the dissociation constant of acetic acid in DMSO, DMF acetone and dioxane by titrating it with KOH.• Determination of the dissociation constant of monobasic/dibasic acid | 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 study the strength of strong and weak acids in a given mixture conductometrically. <u>Higher Order Thinking Skills Based</u> - Viva Voce | |
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COURSE PLAN

SESSION - 2019-20

B.Sc. PART - I, III

SEMESTER - II, VI

M.Sc. - PREVIOUS & FINAL

SEMESTER - II, IV



B.Sc. (PART- I) SEMESTER- II

ORGANIC CHEMISTRY (PAPER II) (CHE-202)

| SEM II Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|-----------------------|---|--------------------------------------|--|--|---|--|
| DECEMBER - JANUARY | Unit – I Stereochemistry Concept of isomerism. Types of isomerism. elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration. Geometric isomerism- determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism- ethane, n-butane, cyclohexane, Qualitative treatment of stability of chair and boat conformations of cyclohexane. Newman projection and | Stereochemistry of Organic Compounds | PPT, Diagrams Visual 3- D Models | Identify the stereochemistry of organic compounds. | <u>Knowledge Based</u> - Define Geometric Isomerism. - What is retention of configuration? <u>Understanding Based</u> - Give the ortho-para directing effect of Chlorine on Benzene. - Compare the stability of Chair and boat conformations of cyclohexane. | Knowledge--60 Understanding-30 Higher Order-10 |



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| | Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation. | | | | <u>Higher Order Thinking Skills Based</u> - Discuss the relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. | |
| FEBRUARY | 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. Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. 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 | Quiz, Flipped Classroom | Assess the aromaticity of arenes and electrophilic substitution reactions. | - Explain Birch reduction. | |
| | 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 | Electrophilic substitution reaction of Aromatic Compounds | Demonstration, Diagrams | | | |



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| | ratio. | | | | | |
| MARCH- APRIL | Unit – III Alkyl and Aryl Halides Nomenclature and classification of alkyl halides, Methods of preparation, chemical reaction. Mechanisms of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of preparation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC. | Preparation and reactivity of alkyl and aryl halides. | Group Discussions, Flow Chart | Compare the reactivity of alkyls and aryl halides. | | |

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B.Sc.(PART-III) SEMESTER- VI

ORGANIC CHEMISTRY (PAPER II) (CHE-602)

COURSE PLAN

| SEM VI Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|----------------------|---|---|--|---|---|--|
| DECEMBER- JANUARY | UNIT I Carbohydrates 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 (maltose, sucrose and lactose) and polysaccharides(starch and cellulose) without involving structure determination. | 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 glucose. <u>Understanding Based</u> - What is the relation between a nucleoside and nucleotide? - Compare pyridine and pyrrole on the basis of the following properties: (i) Basic nature (ii) Nucleophilic substitution | Knowledge--40 Understanding-40 Higher Order-20 |

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|---|---|--|------------------------------------|---|--|--|
|  FACULTY | UNIT II Amino Acids, Peptides, Proteins and Nucleic Acids Classification, structure and stereochemistry of amino acids. Acid base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α - 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. Nucleic acids: Introduction, Constitution of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA | 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. | (iii) Electrophilic substitution <u>Higher Order Thinking Skills Based</u> - Describe double helical structure of DNA. - Discuss the comparative aromatic nature of pyrrole, thiophene and furan. | |
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| MARCH- APRIL | UNIT III Heterocyclic compounds 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. Comparision 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, AJMER (AUTONOMOUS)
M.Sc. CHEMISTRY (FINAL)
ORGANIC SPECIALISATION
SEMESTER IV

NATURAL PRODUCTS- CHEM-403(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 DECEMBER- JANUARY | Unit-I Terpenoids and Carotenoids Classification, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules: Citral, Geraniol, α -Terpineol, Menthol, Farnesol, Santonin, Phytol, Abietic acid and β -Carotene. | Structural determination and chemical aspects of Terpenoids and Carotenoids. | Charts, PPT, Tables | 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 |



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| | Alkaloids 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. | |
| FEBRUARY | Unit-II Prostaglandins Occurrence, Nomenclature, Classification, biogenesis and physiological effects. Synthesis of PGE ₂ and PGF _{2α} | Classification and reactions of Prostaglandins | Diagrams, Quiz | Illustrate chemical aspects of prostaglandins, pyrethroids, rotenones and steroids. | <u>Higher Order Thinking Skills Based</u> - Elaborate the synthesis of Cholesterol. - Explain Biosynthesis of flavonoids. | |



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| | Pyrethroids and Rotenones Synthesis and reactions of Pyrethroids and Rotenones | Nomenclature and reactions of Pyrethroids and Rotenones | PPT, Charts | | | |
| | Steroids 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 Pigments

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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SOPHIA GIRLS' COLLEGE, AJMER (AUTONOMOUS)
M.Sc. CHEMISTRY (FINAL)
ELECTIVE (ORGANIC & INORGANIC)
SEMESTER IV

ANALYTICAL CHEMISTRY- CHEM-404(A, B)

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 (%) |
|-----------------|--|--|---|---|---|--|
| MARCH- APRIL | Unit-III Chromatographic Techniques Introduction, classification instrumentation and applications of chromatographic techniques - Paper chromatography, Column Chromatography, Thin Layer Chromatography, Gas Chromatography. | Understanding different Chromatographic techniques <i>Harman Kaur</i> | PPT, Flow charts, Diagrams, Demonstration | Separate various mixtures with the help of different chromatographic techniques | <u>Higher Order Thinking Skills Based</u> - Explain instrumentation and applications of TLC. -Elaborate the technique of Paper Chromatography. | <i>Taxi</i> Head Department of Chemistry Sophia Girls' College (Autonomous), Ajmer |

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SOPHIA GIRLS' COLLEGE, AJMER (AUTONOMOUS)
M.SC CHEMISTRY (PREVIOUS)
Practicals (CHEM-205)

| SEM/ Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|--------------------------------|---|---|---|---|--|--|
| SEM II DECEMBER- JANUARY | INORGANIC PREPARATIONS 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 | Knowledge--20 Understanding-40 Higher Order-40 |
| FEBRUARY | Organic Chemistry (a) Organic synthesis (any five) (i) Acetylation: Acetylation of cholesterol and separation of cholesteryl acetate by column chromatography. (ii) Oxidation: Adipic acid by chromic acid oxidation of cyclohexanol. (iii) Aldol condensation: | Organic synthesis and Quantitative Analysis | Demonstration of the organic synthesis reaction | | <u>Understanding Based</u> - Mechanism of various Chemical reactions. - To analyse the concept of DO, BOD and COD. | |



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| | <p>Dibenzal acetone from benzaldehyde.</p> <p>(iv) Sandmeyer reaction: p-chlorotoluene from p-toluidine.</p> <p>(v) Cannizzaro reaction: 4-chlorobenzaldehyde as substrate.</p> <p>(vi) Friedel Crafts Reaction: β-Benzoylpropionic acid from succinic anhydride and benzene.</p> <p>(vii) Aromatic electrophilic substitutions: Synthesis of p-nitroaniline and p-bromoaniline</p> <p>(b) Quantitative Analysis (any two)</p> <p>(i) Determination of DO of a water sample.</p> <p>(ii) Determination of COD of a water sample.</p> <p>(iii) Determination of BOD of a water sample</p> | | | | <p><u>Higher Order Thinking Skills Based</u></p> <p>- Viva Voce</p> | |
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MARCH-
APRIL

PHYSICAL CHEMISTRY

(Students are required to perform at least five experiments from the following experiments.)

- (i) Determination of strengths of halides in a mixture potentiometrically.
- (ii) Determination of the strengths of strong and weak acids in a given mixture using a potentiometer/pH meter.
- (iii) Determination of partition coefficient of I_2 between water and CCl_4 .
- (iv) Determination of equivalent conductance of a strong electrolyte such as KCl , $AgNO_3$ etc. at several concentrations and hence verify the Onsager's Equation.
- (v) To construct the phase diagram for three component system (e.g., chloroform-acetic acid-water).

Instrumentation

Exercises with
Use of different
Apparatus,
instruments like
pH meter,
conductivity
meter

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