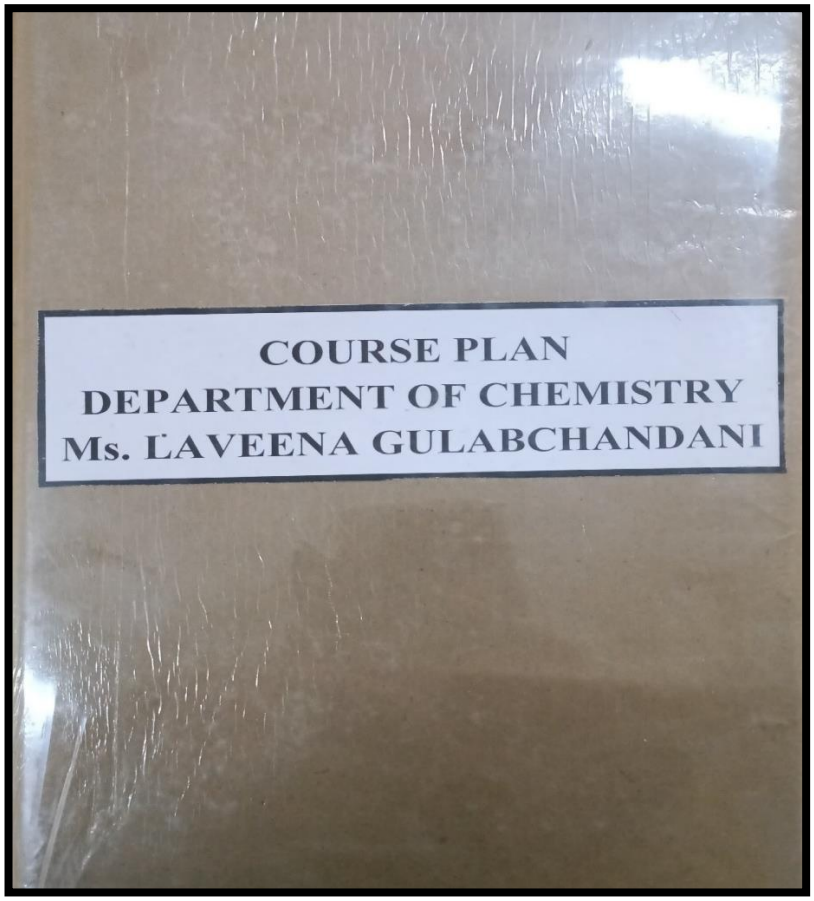
COURSE PLAN
DEPARTMENT OF CHEMISTRY
Ms. LAVEENA GULABCHANDANI

# COURSE PLAN

# U.G. & P.G. Programs

# 2022-23

# ODD SEMSTER

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

## INORGANIC CHEMISTRY (CHE-101)

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 I OCT- NOV | **UNIT II**<br>**Chemical Bonding**<br>Valence bond theory and its limitations, various types of hybridization. Valence shell electron pair repulsion (VSEPR) theory to $NH_3$, $H_3O^+$, $SF_4$, $ClF_3$, $ICl^-_2$, and $H_2O$. MO theory, homonuclear and heteronuclear diatomic molecules, Comparison of VB and MO approaches. | Nature of Bonding according to VBT and MOT | Quiz, PPT, Visual 3-D Models | Summarize nature of covalent bonds and properties of ionic solids. | *Knowledge Based*<br>- Define Hybridization.<br>-What do you understand by n- type Semiconductors<br>*Understanding Based*<br>-Describe Frenkel defect.<br>- Explain hybridization in ammonia molecule<br>*Higher Order Thinking Skills Based*<br>- Explain why He is a monoatomic gas?<br>-Illustrate application of VSEPR Theory for deciding the shape of $SF_4$ molecule. | Knowledge--60<br>Understanding-30<br>Higher Order-10 |
| | **Ionic Solids**<br>Lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule. | Characteristics of Ionic Solids | Audio Visual Tutorials, Diagrams, PPT | | | |

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

## INORGANIC CHEMISTRY (CHE-301)

Max. Marks: 75 (50Ext; 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 III JULY-AUGUST | **UNIT II**<br>**Coordination Compounds**<br>Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes. Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6), limitations of VBT | Basic Concepts and Theories of bonding in Coordination Compounds | Problem Solving, PPT, Visual 3D Models, Projects | Predict chemical properties of Coordination compounds, Lanthanides and Actinides. | *Knowledge Based*<br>- Write the electronic configuration of Cr and Cu.<br>- What is the Coordination number of metal in $[Cr(CN)_6]^{4-}$ and $[Cu(en)_2]^{2+}$ ? | Knowledge--50<br>Understanding-35<br>Higher Order-15 |
| | **Chemistry of Lanthanides**<br>Electronic structure, oxidation states and ionic radii and lanthanide contraction, | Extraction and Properties of lanthanides | Student Presentations, Flow Charts | | | |

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| | complex formation, separation of lanthanides (ion-exchange method only). | | | | *Understanding Based*<br>- Compare the oxidation states of second and third transition series elements with 1st transition series Elements.<br><br>-Classify Acids and Bases according to the Arrhenius and Bronsted Lowry Concept with the help of suitable examples.<br><br>*Higher Order Thinking Skills Based*<br><br>- Calculate the magnetic | |
| | **Chemistry of Actinides**<br>General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides. Comparison of actinides with lanthanides. | General features of Actinides | PPT, Group discussions, E-Content | | | |
| **SEPT** | **UNIT I**<br>**Chemistry of Elements of First, Second and Third Transition Series**<br>Characteristic properties of d-block elements, Periodic variation with special reference to electronic configuration, Atomic radii, Density, Ionisation Potential, Melting Point, variable Oxidation state, colour, magnetic, catalytic properties and ability to form complexes. | Characteristic properties transition series elements and their Comparative Periodic trends | Flipped Classroom, PPT, Assignments | Assess the chemistry of the first, second and third transition series. | | |
| **OCT- NOV** | **UNIT III**<br>**Acids and Bases**<br>Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system | Classification of Acids and Bases | Flow Charts, E-Content, Quiz | Illustrate oxidation reduction behaviour | | |

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| | and Lewis concepts of acids and bases. | | | and aqueous and non - aqueous solvents. | moment of Cu in $[Cu(NH_3)_4]^{2+}$.<br>- Explain why Ionisation Potential of third transition series elements is more than second transition series elements? | |
| | **Non-aqueous Solvents** Physical properties of a solvent, types of solvents and their general characteristics reactions in non-aqueous solvents with reference to liquid $NH_3$ and liquid $SO_2$. | Chemical reactions in non aqueous solvents | Flipped Classroom, PPT | | | |
| | **Oxidation and Reduction** Use of redox potential data- analysis of redox cycle, redox stability in water-Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements. | Analysis of Redox potential data | Problem Solving Activities, Diagrams | | | |

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

**PRACTICAL (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 I JULY | **Inorganic Chemistry**<br>• Calibration of fractional weights, pipettes and burettes.<br>• Preparation of standard solutions.<br>• Dilution 0.1 M to 0.01 M solutions. | Preparation and Dilution of Primary standard solutions | Demonstration using different apparatus and Glassware's | Understand the practical applications of various aspects of chemistry | *Knowledge Based*<br>Practical File Completion<br>*Understanding Based*<br>-To prepare 0.1 M $CuSO_4$ in 100 mL Distilled Water<br>-To estimate alkali content in an antacid tablet using HCl.<br>*Higher Order Thinking Skills Based*<br>Viva Voce | Knowledge—30<br>Understanding-50<br>Higher Order-20 |
| AUGUST - SEP | **Volumetric Analysis**<br>• Determination of acetic acid in commercial vinegar using NaOH.<br>• Determination of alkali content-antacid tablet using HCl.<br>• Estimation of calcium | Volumetric Analysis | Laboratory Experiments | | | |

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| | content in chalk as calcium oxalate by potassium permanganate.<br>• Estimation of hardness of water by EDTA.<br>• Estimation of ferrous and ferric dichromate method.<br>• Estimation of copper using thiosulphate | | | | | |
| OCT - NOV | **Gravimetric Analysis-**<br>• Analysis of Cu as CuSCN<br>• Ni as Ni-dimethylglyoxime. | Gravimetric Analysis. | Demonstration of Laboratory experiments using instruments and apparatus like oven, desiccator, suction pump and crucible. | | | |

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**SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER**
**M.Sc. CHEMISTRY (PREVIOUS)**
**SEMESTER I**
**PHYSICAL CHEMISTRY- I (CHEM-103)**

**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 I | **UNIT III**<br>**Chemical Dynamics**<br>Collision theory of reaction rates, activated complex theory, ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, methods of determining mechanism, isotope effects, Dynamic chain, photochemical (hydrogen-bromine reaction), acid base catalysis, kinetics of enzyme reactions, general features of fast reactions, study of fast reactions by flow method, flash photolysis, dynamics of | Kinetics of various chemical reactions | E-content, PPT, Projects and Assignments | Assess the kinetics of various chemical reactions. | *Knowledge Based*<br>-Define Acid Base Catalysis.<br>- What do you mean by Isotope Effects?<br>*Understanding Based*<br>-Discuss the Kinetics of Enzyme Catalysis.<br>- Summarize postulates of Huckel theory of conjugated systems.<br>*Higher Order Thinking Skills Based*<br>- Estimate the change | Knowledge--25<br>Understanding-45<br>Higher Order-30 |

## SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER
## M.Sc. CHEMISTRY SEMESTER I
## Practicals (CHEM-105)

**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 I | PHYSICAL<br>• Determination of solubility and solubility product of sparingly soluble salts (e.g. $PbSO_4$, $BaSO_4$) conductometrically.<br>• Determination of the strength of strong and weak acids in a given mixure conductometrically.<br>• Determination of strength of acid in gm/l conductometrically using following combinations (i)SA-WB (ii)WA-SB (iii)WA-WB (iv)SA-SB.<br>• Determination of the dissociation constant of monobasic/dibasic acid<br>• Determination of the dissociation constant of acetic acid in DMSO, DMF acetone and dioxane by titrating it with KOH. | Laboratory Techniques and Use of Various Instruments | Laboratory Experiments using different apparatus and instruments like pH meter, Conductivity meter, Demonstration | Understand the practical applications of various aspects of Chemistry | *Knowledge Based*<br>- Practical File Completion<br><br>*Understanding Based*<br>-To Determine the Strength of HCl and $CH_3COOH$ by Conductometric Titration.<br><br>*Higher Order Thinking Skills Based*<br><br>- Viva Voce | Knowledge--20<br>Understanding-40<br>Higher Order-40 |

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| | unimolecular reactions (Lindemann Theory, Hinshelwood Modifications). | | | | in entropy of activation and Frequency factor for an Ionic reaction if $Z_A Z_B$ changes from 3 to 2?<br><br>- Calculate the Bond Order between C-1 and C-2 Carbon atom of butadiene. | |
| | **UNIT - I**<br><br>**Molecular Orbital Theory** Huckel theory of conjugated systems, bond order and charge density calculations. Applications to ethylene, butadiene, cyclopropenyl radical, cyclobutadiene etc. | Application of Huckel Molecular Orbital Theory to Conjugated Systems | Flipped Classroom, Problem Solving, Quizzes | Predict aspects of Quantum Chemistry<br><br>Laveena | | |

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**SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER**
**M.Sc. CHEMISTRY SEMESTER I**
**Practicals (CHEM-105)**

**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 I | PHYSICAL<br>• Determination of solubility and solubility product of sparingly soluble salts (e.g. $PbSO_4$, $BaSO_4$) conductometrically.<br>• Determination of the strength of strong and weak acids in a given mixure conductometrically.<br>• Determination of strength of acid in gm/l conductometrically using following combinations (i)SA-WB (ii)WA-SB (iii)WA-WB (iv)SA-SB.<br>• Determination of the dissociation constant of monobasic/dibasic acid<br>• Determination of the dissociation constant of acetic acid in DMSO, DMF acetone and dioxane by titrating it with KOH. | Laboratory Techniques and Use of Various Instruments | Laboratory Experiments using different apparatus and instruments like pH meter, Conductivity meter, Demonstration | Understand the practical applications of various aspects of Chemistry | *Knowledge Based*<br>- Practical File Completion<br><br>*Understanding Based*<br>-To Determine the Strength of HCl and $CH_3COOH$ by Conductometric Titration.<br><br>*Higher Order Thinking Skills Based*<br><br>- Viva Voce | Knowledge--20<br>Understanding-40<br>Higher Order-40 |

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**SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER**
**M.Sc. CHEMISTRY SEMESTER I**
**Practicals (CHEM-105)**

**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 I | PHYSICAL<br>• Determination of solubility and solubility product of sparingly soluble salts (e.g. $PbSO_4$, $BaSO_4$) conductometrically.<br>• Determination of the strength of strong and weak acids in a given mixure conductometrically.<br>• Determination of strength of acid in gm/l conductometrically using following combinations (i)SA-WB (ii)WA-SB (iii)WA-WB (iv)SA-SB.<br>• Determination of the dissociation constant of monobasic/dibasic acid<br>• Determination of the dissociation constant of acetic acid in DMSO, DMF acetone and dioxane by titrating it with KOH. | Laboratory Techniques and Use of Various Instruments | Laboratory Experiments using different apparatus and instruments like pH meter, Conductivity meter, Demonstration | Understand the practical applications of various aspects of Chemistry | *Knowledge Based*<br>- Practical File Completion<br><br>*Understanding Based*<br>-To Determine the Strength of HCl and $CH_3COOH$ by Conductometric Titration.<br><br>*Higher Order Thinking Skills Based*<br><br>- Viva Voce | Knowledge--20<br>Understanding-40<br>Higher Order-40 |

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**SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER**
**M.Sc. CHEMISTRY SEMESTER I**
**Practicals (CHEM-105)**

**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 I | PHYSICAL<br>• Determination of solubility and solubility product of sparingly soluble salts (e.g. $PbSO_4$, $BaSO_4$) conductometrically.<br>• Determination of the strength of strong and weak acids in a given mixure conductometrically.<br>• Determination of strength of acid in gm/l conductometrically using following combinations (i)SA-WB (ii)WA-SB (iii)WA-WB (iv)SA-SB.<br>• Determination of the dissociation constant of monobasic/dibasic acid<br>• Determination of the dissociation constant of acetic acid in DMSO, DMF acetone and dioxane by titrating it with KOH. | Laboratory Techniques and Use of Various Instruments | Laboratory Experiments using different apparatus and instruments like pH meter, Conductivity meter, Demonstration | Understand the practical applications of various aspects of Chemistry | *Knowledge Based*<br>- Practical File Completion<br><br>*Understanding Based*<br>-To Determine the Strength of HCl and $CH_3COOH$ by Conductometric Titration.<br><br>*Higher Order Thinking Skills Based*<br><br>- Viva Voce | Knowledge--20<br>Understanding-40<br>Higher Order-40 |

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**SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER**
**M.Sc. CHEMISTRY SEMESTER I**
**Practicals (CHEM-105)**

**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 I | PHYSICAL<br>• Determination of solubility and solubility product of sparingly soluble salts (e.g. $PbSO_4$, $BaSO_4$) conductometrically.<br>• Determination of the strength of strong and weak acids in a given mixure conductometrically.<br>• Determination of strength of acid in gm/l conductometrically using following combinations (i)SA-WB (ii)WA-SB (iii)WA-WB (iv)SA-SB.<br>• Determination of the dissociation constant of monobasic/dibasic acid<br>• Determination of the dissociation constant of acetic acid in DMSO, DMF acetone and dioxane by titrating it with KOH. | Laboratory Techniques and Use of Various Instruments | Laboratory Experiments using different apparatus and instruments like pH meter, Conductivity meter, Demonstration | Understand the practical applications of various aspects of Chemistry | *Knowledge Based*<br>- Practical File Completion<br><br>*Understanding Based*<br>-To Determine the Strength of HCl and $CH_3COOH$ by Conductometric Titration.<br><br>*Higher Order Thinking Skills Based*<br><br>- Viva Voce | Knowledge--20<br>Understanding-40<br>Higher Order-40 |

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**SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER**
**M.Sc. CHEMISTRY SEMESTER I**
**Practicals (CHEM-105)**

**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 I | PHYSICAL<br>• Determination of solubility and solubility product of sparingly soluble salts (e.g. $PbSO_4$, $BaSO_4$) conductometrically.<br>• Determination of the strength of strong and weak acids in a given mixure conductometrically.<br>• Determination of strength of acid in gm/l conductometrically using following combinations (i)SA-WB (ii)WA-SB (iii)WA-WB (iv)SA-SB.<br>• Determination of the dissociation constant of monobasic/dibasic acid<br>• Determination of the dissociation constant of acetic acid in DMSO, DMF acetone and dioxane by titrating it with KOH. | Laboratory Techniques and Use of Various Instruments | Laboratory Experiments using different apparatus and instruments like pH meter, Conductivity meter, Demonstration | Understand the practical applications of various aspects of Chemistry | *Knowledge Based*<br>- Practical File Completion<br><br>*Understanding Based*<br>-To Determine the Strength of HCl and $CH_3COOH$ by Conductometric Titration.<br><br>*Higher Order Thinking Skills Based*<br><br>- Viva Voce | Knowledge--20<br>Understanding-40<br>Higher Order-40 |

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

**SPECTROSCOPY (CHEM-301)**

**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 | **UNIT- I**<br><br>**$^{13}$C NMR Spectroscopy**<br><br>Difficulties and solutions for recording $^{13}$C - NMR spectra, recording of $^{13}$C- NMR spectra- scale, solvent, solvent signals, their positions and multiplicity, Chemical shifts in $^{13}$C spectra- correlation chart, chemical shift calculations for alkanes, alkenes, alkynes and aromatic compounds, proton coupled and decoupled, $^{13}$C spectra, $^{13}$C-DEPT Spectra Nuclear Overhauser Effect. | Theoretical and practical aspects of $^{13}$C –NMR Spectroscopy | Audio Visual Tutorials, Diagrams, PPT, Problem Solving Activities | Summarize the concepts of $^{13}$C - NMR spectroscopy | *Knowledge Based*<br>- Define Broad Band Decoupling.<br><br>- What is a metastable peak?<br><br>*Understanding Based*<br>- Discuss important features of mass spectra of alkanes and alkenes with suitable Examples.<br>*- What are the factors affecting* | Knowledge--25<br>Understanding-45<br>Higher Order-30 |

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| | **UNIT- II**<br><br>**Mass Spectroscopy**<br>Introduction, Instrumentation, Isotope abundances, molecular ion, metastable ions, Nitrogen rule, Fragmentation- general modes, factors affecting fragmentation, Mass spectral fragmentation of some classes of organic compounds and common functional groups- Alkanes, cycloalkanes, alkenes, cycloalkenes, alkynes, cycloalkynes, aromatic compounds, Alcohols, Phenols, ethers, ketones, aldehydes, carboxylic acids, esters, amides, amines, nitriles. High Resolution Mass Spectrometry. | Instrumentation and application of Mass Spectroscopy to structure determination | Online Quiz, Diagrams, Charts, PPT | Analyse the mass spectral fragmentation of organic compounds for their structure determination. | fragmentation.<br><br>*Higher Order Thinking Skills Based*<br>- How will you distinguish between three isomeric butanols on the basis of mass spectroscopy?<br>- Calculate the $^{13}C$ chemical shift value for C-2 carbon atom of 2-hexanol. | |

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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 (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 | **UNIT-I**<br>**Electronic Properties and Band Theory**<br>Metals, insulators and semiconductors, electronic structure of solids- band theory. Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junction. | Mechanism of conduction in various solids | Diagrams, Quiz, Student Presentations | Illustrate solid state chemistry | *Knowledge Based*<br>- Define Photoelectric Effect.<br>*Understanding Based*<br>- Differentiate between Conductors, Semiconductors and Insulators.<br>- Discuss Type I and Type II Superconductors<br>-<br>*Higher Order Thinking Skills Based*<br>- Elaborate Hysteresis in Ferromagnetic materials. | Knowledge-25<br>Understanding-45<br>Higher Order-30 |
| | **Super conductors**<br>Definition, types and BCS theory, Optical properties- photoconduction- photoelectric effects. Magnetic properties- Classification of materials- magnetic domains, hysteresis. | Basics of Super conductors and magnetic properties of various materials. | Flipped Classroom, Group Discussion, PPT | | | |

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# COURSE PLAN

# U.G. & P.G. Programs

# EVEN SEMESTER

# 2022-23

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

### PHYSICAL CHEMISTRY (PAPER I) (CHE-201)

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

## COURSE PLAN

| SEM II Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|---|---|---|---|---|---|---|
| SEM II | **UNIT I**<br>**Solid State**<br>Definition of space lattice, unit cell. Laws of crystallography, Symmetry elements in crystals. Weiss parameter system, Millar's indices. X-ray diffraction by crystals. Derivation of Bragg's equation. | Laws of Crystallography, Symmetry in Crystals | Audio Visual Tutorials, 3- D Models, Problem Solving | Predict properties of solid state and colloidal states of matter. | *Knowledge Based*<br>-What do you understand by axis of symmetry?<br>- What are emulsions?<br>*Understanding Based*<br>-Explain laws of crystallography.<br>-Describe Hardy-Schulze Law and explain it with the help of an example.<br>*Higher Order Thinking Skills Based*<br>- Calculate the Millar Indices from the following Weiss | Knowledge--60<br>Understanding-30<br>Higher Order-10 |
| | **Colloidal State**<br>Definition and classification of colloids. Solids in liquids (sols): properties- kinetic, electrical, electrosmosis; stability of colloids, precipitation of colloid, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions); types of emulsions, preparation & application, deemulsification, Emulsifier. Liquids in solids (gels): | Colloids: Basics, Types, Properties and their practical applications | PPT, E-Content, Assignments | | | |

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| | classification, properties and application, general applications of colloids. | | | | indices- (-2a ,b, ∞c).<br><br>-Derive Bragg's equation nλ = 2d sin and discuss its applications in the study of crystal structure. | |

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

### PHYSICAL CHEMISTRY (CHE-401)

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

## COURSE PLAN

| SEM IV Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|---|---|---|---|---|---|---|
| DEC-JAN | UNIT II<br>**Electrochemistry-I**<br>Electrical transport, specific and equivalent conductance, Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes, Transport number, Applications of conductivity measurements in determination of degree of dissociation, Ka of acids, solubility product of a sparingly soluble salt, ionic product of water, hydrolysis constant of a salt, conductometric titrations. | Types of conductance, their measurements and its Applications. Laws explaining Electrolyte behaviour. | Diagrams, PPT, Problem Solving Activities | Review the various types of conductance, factors affecting it and applications of Conductivity measurements. | *Knowledge Based*<br>- What do you mean by degree of dissociation?<br>-State First Law of Thermodynamics.<br>*Understanding Based*<br>- Describe determination of Transport number by Hittorf Method<br>- Explain the | Knowledge-50<br>Understanding-35<br>Higher Order-15 |

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| **FEB** | **UNIT III**<br>**Electrochemistry-II**<br>Electrolytic and Galvanic cells- reversible and irreversible cells, Notations and sign conventions, EMF of a cell and its measurements, Calculation of thermodynamic quantities of cell reactions, Nernst equation, derivation of cell E.M.F. , single electrode potential, standard electrode potential, electrochemical series and its significance. Types of reversible electrodes, standard hydrogen electrode, polarization, over potential. Concentration cell with and without transport, liquid junction potential, application of concentration cells. Potentiometric titrations- qualitative treatment (acid-base and oxidation reduction only), Other Applications of Cell potential. Corrosion- Types, theories & methods of combating it | Understanding of various types of electrodes and electrolytic and galvanic cells and their applications and concept of corrosion | Quiz, Assignments, Audio Visual Tutorials | Discuss various phenomena related to Cells and Corrosion. | Hess's law of heat summation and discuss its applications.<br>*Higher Order Thinking Skills Based*<br>- Calculate the emf of the following cell:<br>Sn \| $SnCl_2$ (.5M) \| AgCl \| Ag<br>-Derive the equation showing variation of G with P and T. | |
| **MARCH -APRIL** | **UNIT I**<br>**Thermodynamics-I**<br>First Law of Thermodynamics: Statement, internal energy and enthalpy, heat capacities at constant volume and constant pressure and | Basic concepts of thermodynamics | PPT, Projects | Summarize the First, Second and third law of thermodynamics and their applications. | | |

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| | their relationship. Joule's law, Joule Thomson coefficient and inversion temperature. | | | | | |
| | **Thermochemistry**<br>Standard state, standard enthalpy of formation-Hess's Law, Heat of reaction at constant pressure and at constant volume, Enthalpy of neutralization, Kirchhoff's equation. | Fundamentals of thermochemistry | Problem Solving, Laboratory Experiments, Flipped Classroom | | | |
| | **Thermodynamics-II**<br>Second law of thermodynamics, Carnot cycle, Carnot theorem, Concept of entropy: entropy as a state function, Entropy change in ideal gases and mixing of gases.<br><br>**Third law of thermodynamics:** Nernst heat theorem, Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, Variation of G with A with P, V and T. | Concepts of second and third law of thermodynamics | Diagrams, E-Content, Quiz | | | |

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

## PRACTICAL (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 | **Organic Chemistry**<br><br>**(A) Chromatography**<br><br>(i) Separation, Rf values and identification of organic compounds.<br><br>(ii) Preparation and separation of 2,4-dinitrophenylhydrozone of acetone,2- butanone, hexan-2- and 3-one using toluene and light petroleum (40:60:).<br><br>(iii) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5) | Separation of organic compounds by chromatographic method | Laboratory Experiments | Understand the practical applications of various aspects of chemistry | *Knowledge Based*<br>Practical File Work<br><br>*Understanding Based*<br>- To determine the transition temperature of the given substance by thermometric method ($MnCl_2,4H_2O$)<br><br>- To Separate Methylene blue and Fluorescein by Paper | Knowledge--30<br>Understanding-50<br>Higher Order-20 |

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| | **(B) Qualitative Analysis**<br><br>Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives. | Identification of an organic compound | Flow Chart, Lab Experiments, | | Chromatography.<br><br>*Higher Order Thinking Skills Based*<br><br>-To identify the given organic compound.<br><br>-Viva Voce | |
| | **Physical Chemistry (Any Four)**<br><br>1. Determination of the transition temperature of the given substance by thermometric method (e.g.$MnCl_2$,$4H_2O$/$SrBr_2$. $2H_2O$)<br><br>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.<br><br>3. 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. | Determination of the transition temperature, enthalpy of neutralization | Practicals with the use of various apparatus and Glassware | | | |

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

**PHYSICAL CHEMISTRY- II (CHEM-203)**

**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 II APRIL-MAY | UNIT I<br>**Electrochemistry**<br>Electrochemistry of solutions, Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Bjerrum model. Semiconductor interfaces-theory of double layer at semiconductor, structure of double layer interfaces. Effect of light at semiconductor solution interface. Overpotential, exchange current density, derivation of Butler-Volmer equation, Tafel Plot. Polarography theory, Ilkovic | Concepts related to Double layer interfaces, Polarography, Over potential and Corrosion. | Diagrams, PPT, Student Projects and Assignments | Explain the electrochemistry. | *Knowledge Based*<br>- Write Ilkovic equation.<br>- What do you mean by reverse micelles?<br>*Understanding Based*<br>- Discuss the Cathodic Protection of Corrosion of metals. | Knowledge-25<br>Understanding-45<br>Higher Order-30 |

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| | equation; half wave potential and its significance. Corrosion – Types, mechanism and inhibition. | | | | - Discuss the Kinetics of addition polymerization. | |
| | **UNIT II**<br>**Adsorption**<br>Pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation without derivation), mechanism of surface catalytic reactions. | Phenomenon of adsorption, Adsorption isotherms and pressure changes as result of curved interfaces. | E-Content, Presentation by students | Summarize the concepts of adsorption and micelles. | *Higher Order Thinking Skills Based*<br>-Calculate the number average molar mass of a polymer containing 20 molecules with a mass of 20,000 and 50 molecules with a mass of 20,000.<br>-Derive Kelvin Equation for Vapour Pressure of Droplets. | |
| | **Micelles**<br>Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization, solubilization, microemulsion, reverse micelles. | Micellization and its applications | Student Presentations, Audio Visual Tutorials, E-Content | | | |
| | **UNIT III**<br>**Macromolecules:**<br>Polymer- definition, types of polymers, kinetics and mechanism | Kinetics and Mechanism of Polymerisation and Molar mass | Problem Solving, Flow Charts, PPT | Assess the chemistry of macromolecules. | | |

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| | of polymerisation. Number and mass average molecular mass, molecular mass determination (osmometry, viscometry, diffusion, sedimentation), chain configuration of macro molecules, calculation of average dimensions of various chain structures. electrically conducting, Fire resistant, liquid crystal polymers. | determination of polymers | | | | |

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**M.Sc. CHEMISTRY (PREVIOUS)**
**SEMESTER II**

## PRACTICALS (CHEM-205)

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

| SEM/ Month | UNIT/TOPIC | Concepts/facts | Teaching Pedagogy | Learning Outcomes | Questions | Marks Weightage (%) |
|---|---|---|---|---|---|---|
| SEM II | **PHYSICAL CHEMISTRY**<br>(i) Determination of strengths of halides in a mixture potentiometrically.<br>(ii) Determination of the strengths of strong and weak acids in a given mixture using a potentiometer/pH meter.<br>(iii) Determination of partition coefficient of $I_2$ between water and $CCl_4$. | Laboratory Techniques and Use of Various Instruments | Laboratory Experiments and Demonstration of working of Various instruments | Understand the practical applications of various aspects of chemistry | *Knowledge Based*<br>- Practical File Completion<br>*Understanding Based*<br>-To determine the strength of Oxalic Acid using Potentiometer.<br>*Higher Order Thinking Skills Based*<br>-Viva- Voce | |

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**SOPHIA GIRLS' COLLEGE (AUTONOMOUS), AJMER**
**M.Sc. CHEMISTRY (FINAL)**
**GROUP-A INORGANIC CHEMISTRY**
**SEMESTER IV**

## INORGANIC POLYMERS - CHEM – 403(A)

**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 (%) |
|---|---|---|---|---|---|---|
| | **UNIT-I**<br>**Basics Concepts**<br>Definition, Classifications by Connectivities, Classifications by Dimensionality, the Metal/Backbone Classification of Metal-Containing Polymers. | Introduction and Classification of Inorganic Polymers | Audio Visual Tutorials, 3D Diagrams | Elaborate basic concepts and synthesis of Inorganic polymers. | *Knowledge Based*<br>- Give one example of Inorganic polymer displaying connectivity 4.<br>-Define Tensile Strength.<br>*Understanding Based*<br>- Summarize the | Knowledge--25<br>Understanding-45<br>Higher Order-30 |
| | **Inorganic Polymer Synthesis**<br>Step Growth synthesis, Chain Polymerization, ring opening polymerization, Reductive coupling and | Synthesis of Inorganic polymers. | Flow Chart, Flipped Classroom, PPT | | | |

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| | other Redox Polymerisation reactions. | | | | method of TG Anlaysis of Polymers.<br><br>- Discuss the Preparation of Silicones by any two methods.<br><br>*Higher Order Thinking Skills Based*<br>- How NMR is used for Stereochemical Configuration of a Macromolecule<br><br>- Calculate P.D.I. of a polymer in which Weight average and number average molar mass is 1, 00,000 and 1, 20,000. | |
| | **UNIT-II**<br><br>**Inorganic Polymer Characterization**<br>Average Molecular Mass and Degree of Polymerization, Methods of Characterizing Average Molecular Mass- Gel Permeation Chromatography, Viscosity, Universal Calibration, Colligative Properties (Freezing point depression, boiling Point elevation and Osmotic Pressure), End-Group Analysis, Ultracentrifugation. | Determination of molecular weight of Inorganic Polymers | Audio Visual Tutorials, Problem Solving | Analyse the Chemical nature of polymers | | |
| | **Analysis and testing of polymers**<br>Chemical analysis of polymers, spectroscopic methods (IR and NMR), X-ray diffraction study, thermal analysis and physical testing-tensile strength, Fatigue, impact, tear resistance, hardness and abrasion resistance. | Various methods for analysis of Polymers | Diagrams, E-content, Assignments | | | |
| | **UNIT-III**<br><br>**Polymers based on Boron** – Borides, Carborane Polymers, Borazine, Boron Nitride | Chemistry of Boron polymers | PPT, Flipped Classrooms | Summarize the Properties of Inorganic Polymers. | | |
| | **Polymers based on Silicon-Silicones-** Preparation and properties of Silicones, Modification of Silicones<br>**Polysilanes and related polymers-** Structure, Synthesis, Physical and electronic properties of polysilanes, Chemical modification of Polysilanes. | Preparation, properties and structure of Silicon Polymers | E-Content, Peer Group Teaching, Projects | | | |

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