INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Science

Lesson Plan (Session 2026-2027)

Class: B.Sc. Physical Science + Life Science — Semester: **1**
Name of the Course: **Chemistry-I** — Course Code: B23-CHE-101
Dates: 1August, 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 — Time: 3 hours
End Term Exam Marks: 70 Marks — Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	**Atomic Structure:** Dual behaviour of matter and radiation, de Broglie's relation, Heinsenberg's uncertainty principle, concept of atomic orbitals, significance of quantum numbers, radial and angular wave functions, normal and orthogonal wave functions, significance of Ψ and Ψ2, shapes of s, p, d, f orbitals, Rules for filling electrons in various orbitals, effective nuclear charge, Slater's rules. **Periodic table and atomic properties:** Classification of periodic table, definition of atomic and ionic radii, ionisation energy, electron affinity and electronegativity, trend in periodic table (in s and p-block elements), Pauling, Mulliken, Allred Rachow and Mulliken Jaffe's electronegativity scale, Sanderson's electron density ratio.	14
Unit: II	**Gaseous State:** Kinetic theory of gases, Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity, and most probable velocity. Collision diameter, collision number, collision frequency and mean free path (Derivations excluded), Deviation of Real gases from ideal behaviour, Derivation of Van der Waal' s Equation of State, its application in the calculation of Boyle' s temperature (compression factor). **Critical Phenomenon:** Concept of Critical temperature, critical pressure, critical volume, relationship between critical constants and Van der Waal' s constants (Derivation excluded).	14
Unit: III	**Structure and Bonding:** Localized and delocalized chemical bond, Van der Waals interactions. Concept of resonance and its applications, hyperconjugation, inductive effect, Electromeric effect and their comparison. **Mechanism of Organic Reactions:** Curved arrow notation, homolytic and heterolytic bond fission.Types of reagents: electrophiles and nucleophiles. Types of organic reactions: Substitution, Addition, Condensation, Elimination, Rearrangement, Isomerization and Pericyclic reactions. free radicals, carbenes (structure & stability).	16
Unit: IV	**Liquid State:** Structure of liquids, Properties of liquids – surface tension, refractive index, viscosity, vapour pressure and optical rotation. **Solid State:** Classification of solids, Law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry and symmetry elements, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of Laue method, rotating crystal method and powder pattern method.	16
V	1. Acid/Base titration: Determination of strength of oxalic acid using NaOH. 2. Redox titrations: Determination of Fe^{2+} ions using $KMnO_4$. 3. To determine the surface tension of given liquid using Stalagmometer by drop no. methods. 4. Preparation of *m*-Dinitrobenzne from Nitrobenzene (use 1:2 conc. HNO_3-H_2SO_4 mixture if fuming HNO_3 is not available). 5. Preparation of p-Bromoacetanilide from Acetanilide.	

Text Books:

1. Clayden, J.; Greeves, N.; Warren, S. (2012), Organic Chemistry, Oxford.
2. Dr. S. P. Jauhar, Dr. J. M. Seghal, Modern Approach to Chemistry-1

Course Outcomes

After completing this course, the learner will be able to:

1. Understand the need for Quantum Mechanics, Heisenberg's uncertainty principle, time dependent and time independent Schrodinger equation, expectation values of position and momentum, particle confined in one dimensional box.
2. To know about the crystalline state, basis, crystal lattices, Reciprocal lattice to sc, bcc and fcc lattices.
3. Analyze the Hydrogen atom problem based on Sommerfeld theory, Vector Atom Model,LS&JJ coupling.

Lesson Plan

SR. No	Date	Course Content	
		Theory (2)	**Practical (2)**
1	1August 2026	Dual behaviour of matter and radiation,	-----
2	3 August -8 August	De Broglie's relation, Heinsenberg's uncertainty principle, concept of atomic orbitals, significance of quantum numbers, radial and angular wave functions, normal and orthogonal wave functions.	-----
3	10 August - 14 August	Significance of Ψ and Ψ2, shapes of s, p, d, f orbitals, Rules for filling electrons in various orbitals, effective nuclear charge, Slater's rules.	Basic laboratory techniques.
4	17 August - 22August	Classification of periodic table, definition of atomic and ionic radii, ionisation energy.	Acid/Base titration: Determination of strength of oxalic acid using NaOH.
5	24 August -29 August	Electron affinity and electronegativity, trend in periodic table (in s and p-block elements).	Acid/Base titration: Determination of strength of oxalic acid using NaOH.
6	31August. - 5 Sept.	Pauling, Mulliken, Allred Rachow and Mulliken Jaffe's electronegativity scale, Sanderson's electron density ratio.	Redox titrations: Determination of Fe^{2+} ions using $KMnO_4$.
7	7 Sept. - 12 Sept.	Kinetic theory of gases, Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity, and most probable velocity.	Redox titrations: Determination of Fe^{2+} ions using $KMnO_4$.
8	14 Sept. -19 Sept.	Collision diameter, collision number, collision frequency and mean free path (Derivations excluded).	To determine the surface tension of given liquid using Stalagmometer by drop no. methods.
9	21 Sept. - 26 Sept.	Deviation of Real gases from ideal behaviour, Derivation of Van der Waal' s Equation of State, its application in the calculation of Boyle' s temperature (compression factor).	To determine the surface tension of given liquid using Stalagmometer by drop no. methods.
10	28 Sept.- 3 Oct.	Concept of Critical temperature, critical pressure, critical volume, relationship between critical constants and Van der Waal' s constants (Derivation excluded).	Preparation of *m*-Dinitrobenzne from Nitrobenzene (use 1:2 conc. HNO_3-H_2SO_4 mixture if fuming HNO_3 is not available).
11	5 Oct.- 10 Oct.	Localized and delocalized chemical bond, Van der Waals interactions. Concept of resonance and its applications, hyperconjugation, inductive effect.	Preparation of *m*-Dinitrobenzne from Nitrobenzene (use 1:2 conc. HNO_3-H_2SO_4 mixture if fuming HNO_3 is not available).
12	12 Oct.- 17 Oct.	Electromeric effect and their comparison. Curved arrow notation, homolytic and heterolytic bond fission. Types of reagents: electrophiles and nucleophiles.	Preparation of p-Bromoacetanilide from Acetanilide.
13	19 Oct. - 24 Oct.	Types of organic reactions: Substitution, Addition, Condensation, Elimination, Rearrangement, Isomerization and Pericyclic reactions. free radicals, carbenes (structure & stability).	Preparation of p-Bromoacetanilide from Acetanilide.
14	26 Oct.- 31 Oct.	Structure of liquids, Properties of liquids – surface tension, refractive index, viscosity, vapour pressure and optical rotation.	Practice of synthesis
15	10 Nov-14 Nov	Classification of solids, Law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry and symmetry elements.	Practice of titration
16	16 Nov -21 Nov	Seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law.	Practice of titration
17	23 Nov.- 28 Nov.	A simple account of Laue method, rotating crystal method and powder pattern method.	Practice of surface tension measurement
18	30 Nov.- 5 Dec.2026	Revision and test of unit 3^{rd} and 4^{th}.	

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Science

Lesson Plan (Session 2025-2026)

Class: B. Sc. Physical Science
Semester: **I**
Name of the Course: **Minor Chemistry-I**
Course Code: B23-CHE-103
Dates: 1August, 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 50 Marks
Time: 3 hours
End Term Exam Marks: 20
Assessment: =30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	**Covalent Bond** Shapes of simple inorganic molecules and ions based on valence shell electron pair repulsion (VSEPR) theory and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.	4
Unit: II	**Chemical Kinetics** Concept of reaction rates, factors influencing the rate of reaction, Order and molecularity of a reaction, integrated rate expression for zero and first order reactions	4
Unit: III	**Alkanes (upto 5 carbon atoms)** Alkanes, nomenclature, classification of carbon atoms in alkanes. Isomerism in alkanes, methods of formation: Wurtz Corey-House reaction and reaction, Kolbe reaction, decarboxylation of carboxylic acids.	4
Unit: IV	**Metallic Bond and semiconductors** Metallic bond Qualitative idea of Band theory of metallic bond (conductors, semiconductors, insulators).	3
V	1. To determine the melting point of given organic compound. 2. To prepare a pure sample of dibenzalacetone from benzaldehyde. 3. Acid/Base Titration: Determination of strength of HCl using NaOH. 4. To determine the refractive index of given liquid. 5. To study the process of sublimation of camphor or phthalic acid.	30

Text Books:

1. Dhawan S.N., Organic Chemistry, Vol 1 Pardeep Publication.

2. Ms. Kanika Sikri, Dr. Pallavi, Dr. Ekta Arora, Dr. Priyanka, Unique Publication Minor Chemistry

Course Outcomes

After completing this course, the learner will be able to:

1. To understand the basics of Covalent bonding in simple molecules.

2. To get the basics of rates of chemical reactions and factors affecting it.

3. To learn about the nomenclature, classification and methods of preparation of alkenes.

4. To learn about qualitative knowledge of conductors, semiconductors and insulates.

Lesson Plan

SR. No	Date	Course Content	
		Theory (2)	**Practical (2)**
1	1August 2026	Shapes of simple inorganic molecules and ions based on valence shell-electron pair repulsion (VSEPR) theory	-----
2	3 August -8 August	Shapes of simple inorganic molecules and ions based on valence shell electron pair repulsion (VSEPR) theory	-----
3	10 August - 14 August	Hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.	Basic laboratory techniques.
4	17 August - 22August	Hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.	To determine the melting point of given organic compound.
5	24 August -29 August	Concept of reaction rates, factors influencing the rate of reaction.	To determine the melting point of given organic compound.
6	31August. - 5 Sept.	Revision and test of unit 1st.	To prepare a pure sample of dibenzalacetone from benzaldehyde.
7	7 Sept. - 12 Sept.	Order and molecularity of a reaction.	
8	14 Sept. -19 Sept.	Integrated rate expression for zero and firstorder reactions.	Acid/Base Titration: Determination of strength of HCl using NaOH.
9	21 Sept. - 26 Sept.	Revision and test of unit 2nd.	Acid/Base Titration: Determination of strength of HCl using NaOH.
10	28 Sept.- 3 Oct.	Alkanes, nomenclature, classification of carbon atoms in alkanes.	To determine the refractive index of given liquid.
11	5 Oct.- 10 Oct.	Isomerism in alkanes, methods of formation: Wurtz Corey-House reaction and reaction.	To determine the refractive index of given liquid.
12	12 Oct.- 17 Oct.	Kolbe reaction, decarboxylation of carboxylic acids.	To study the process of sublimation of phthalic acid.
13	19 Oct. - 24 Oct.	Revision and test of unit 3rd.	To study the process of sublimation of camphor.
14	26 Oct.- 31 Oct.	Metallic bond Qualitative idea of Band theory of metallic bond	Practice of acid-base titration
15	10 Nov-14 Nov	Conductors, semiconductors, insulators.	Practice of preparation of compound
16	16 Nov -21 Nov	Revision and test of unit 4th.	
17	23 Nov.- 28 Nov.	Revision and test.	
18	30 Nov.- 5 Dec.2026	Revision and test.	

Signature of Teacher **Head of Department**

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Department Of Science

Lesson Plan (Session 2026-2027)

Class: B. Sc. Physical Science + Life Science — Semester: **3rd**
Name of the Course: **Chemistry-III** — Course Code: B23- CHE-301
Dates: 1August, 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 — Time: 3 hours
End Term Exam Marks: 70 Marks — Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	**s and p-Block Elements** Salient features of hydrides, oxides, halides, hydroxides of s-block elements (methods of preparation excluded). Structure, preparation and properties of Diborane and Borazine. Catenation, carbides, fluorocarbons, silicates (structural aspects), structure of oxides of Nitrogen and Phosphorous, structure of white and red phosphorus. Structure of oxyacids of Nitrogen, phosphorous, sulphur and chlorine and comparison of acidic strength of oxyacids, low chemical reactivity of noble gases, chemistry of xenon, structure and bonding in fluorides, oxides and oxyfluorides of xenon.	12
Unit: II	**Electrochemistry-I** Electrolytic conduction, factors affecting electrolytic conduction, specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Application of Kohlrausch' s Law in calculation of conductance of weak electrolytes at infinite dilution (Numerical) Concepts of pH and pK_a, Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action. **Electrochemistry-II** Reversible & irreversible cells, Calculation of thermodynamic quantities of cell reaction (▲G, ▲H & K). Types of reversible electrodes – metal- metal ion, gas electrode, metal – insoluble salt- anion and redox electrodes. Nernst equation, Standard Hydrogen electrode, reference electrodes, Applications of EMF measurement in solubility product and potentiometric titrations using glass electrode.	11
Unit: III	**Alkynes** Nomenclature and its structure. Methods of formation: using Calcium carbide, dehydrohalogenation, Kolbe's electrolysis. Chemical reactions: Mechanism of electrophilic and nucleophilic addition reactions, formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis. Acidity of alkynes. **Stereochemistry of Organic Compounds** Concept of isomerism: Structural and Stereoisomerism. Symmetry elements, enantiomers, optical activity, properties of enantiomers, chiral and achiral molecules (up-to 2asymmetric centres), diastereomers, threo- and erythron nomenclature, meso-compounds, Relative and absolute configuration, sequence rules, R and S system of nomenclature. Cis- Trans isomerism, E & Z system of nomenclature, Conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds. Newman and Sawhorse projection formulae.	11
Unit: IV	**Benzene and its derivatives:** Nomenclature, Aromatic nucleus and side chain, Huckels' rule of aromaticity. Aromatic electrophilic substitution, mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts reaction. Energy profile diagrams. Activating, deactivating substituents and orientation. **Alkyl halides:** Nomenclature, methods of formation: from alkenes and alcohol, nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. **Aryl halides**: Methods of formation: halogenation, Sandmeyer reaction. The addition-elimination, and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl, and aryl halides.	11
V	1. **Gravimetriic Analysis:** Estimation of Ni2+ as Ni(dimethylglyoxime) and Al3 + as Al-oxinate. 2. **Colorimetry:** To verify Beer-Lambert law for KMnO4 /K2Cr 2O7 and determine the unknown concentration of the given solution of KMnO4 /K2Cr 2O7 solution. 3. To prepare acidic and basic buffer solutions of pH 5 and 9 respectively. 4. Preparation of Cuprous chloride, tetra ammine cupric sulphate. 5. To determine the CST of phenol-water system. 6. To determine the solubility of Benzoic acid at various temperatures and to determine the ΔH of the dissolution process. 7. To determine the Enthalpy of neutralisation of strong base Vs strong acid and weak acid/weak base Vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base 8. Determine the rate constant of hydrolysis of ethyl acetate.	30

Text Books:

1. Finar, I. L. Organic Chemistry (Volume 1& 2), Dorling Kindersley (India) Pvt. Ltd.

2. Dr. S. P. Jauhar, Dr. B. K. Vermani, Sakshi Kiran, Kavya, Modern Approach to Chemistry.

Course Outcomes

After completing this course, the learner will be able to:

1. To learn about the structure of S and P-block elements, their properties and discuss their use in daily life as well as industrial applications.

2. To understand about various laws and theories related to eletrochemistry-I and know about their thermodynamic properties.

3. To understand about variation of conductance studies with concentration and explain with many phenomenon.

4. The fundamental properties, structures and reactivity of organic compounds such alkene, alkyne arenes, alkyl and aryl halide etc.

Lesson Plan

SR. No	Date	Course Content	
		Theory (2)	**Practical (2)**
1	1August 2026	Salient features of hydrides, oxides, halides, hydroxides of s-block elements (methods of preparation excluded).	-----
2	3 August -8 August	Structure, preparation and properties of Diborane and Borazine.	-----
3	10 August - 14 August	Catenation, carbides, fluorocarbons, silicates (structural aspects), structure of oxides of Nitrogen and Phosphorous, structure of white and red phosphorus. Structure of oxyacids of Nitrogen, phosphorous, sulphur and chlorine.	Basic laboratory techniques.
4	17 August - 22August	Comparison of acidic strength of oxyacids. low chemical reactivity of noble gases, chemistry of xenon, structure and bonding in fluorides, oxides and oxyfluorides of xenon.	Estimation of Ni2+ as Ni(dimethylglyoxime) and Al3 + as Al-oxinate.
5	24 August -29 August	Electrolytic conduction, factors affecting electrolytic conduction, specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration.	Estimation of Ni2+ as Ni(dimethylglyoxime) and Al3 + as Al-oxinate.
6	31August. - 5 Sept.	Application of Kohlrausch' s Law in calculation of conductance of weak electrolytes at infinite dilution (Numerical) Concepts of pH and pK_a, Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action.	To verify Beer-Lambert law for KMnO4 /K2Cr 2O7 and determine the unknown concentration of the given solution of KMnO4 /K2Cr 2O7 solution.
7	7 Sept. - 12 Sept.	Reversible & irreversible cells, Calculation of thermodynamic quantities of cell reaction (▲G, ▲H & K). Types of reversible electrodes – metal- metal ion, gas electrode, metal – insoluble salt- anion and redox electrodes.	To verify Beer-Lambert law for KMnO4 /K2Cr 2O7 and determine the unknown concentration of the given solution of KMnO4 /K2Cr 2O7 solution.
8	14 Sept. -19 Sept.	Nernst equation, Standard Hydrogen electrode, reference electrodes, Applications of EMF measurement in solubility product and potentiometric titrations using glass electrode.	To prepare acidic and basic buffer solutions of pH 5 and 9 respectively.
9	21 Sept. - 26 Sept.	Nomenclature and its structure. Methods of formation: using Calcium carbide, dehydrohalogenation, Kolbe's electrolysis. Chemical reactions: Mechanism of electrophilic and nucleophilic addition reactions.	Preparation of Cuprous chloride, tetra ammine cupric sulphate.
10	28 Sept.- 3 Oct.	Formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis. Acidity of alkynes. Concept of isomerism: Structural and Stereoisomerism. Symmetry elements, enantiomers, optical activity, properties of enantiomers, chiral and achiral molecules (up-to 2 asymmetric centres),	To determine the CST of phenol-water system.
11	5 Oct.- 10 Oct.	Diastereomers, threo- and erythron nomenclature, meso-compounds, Relative and absolute configuration, sequence rules, R and S system of nomenclature. Cis-Trans isomerism, E & Z system of nomenclature.	To determine the solubility of Benzoic acid at various temperatures and to determine the ΔH of the dissolution process.
12	12 Oct.- 17 Oct.	Conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds.	To determine the solubility of Benzoic acid at various temp. and to determine the ΔH of the dissolution process.
13	19 Oct. - 24 Oct.	Newman and Sawhorse projection formulae. Nomenclature, Aromatic nucleus and side chain, Huckels' rule of aromaticity. Aromatic electrophilic substitution.	To determine the Enthalpy of neutralisation of strong base Vs strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
14	26 Oct.- 31 Oct.	Mechanism of nitration, halogenation, sulphonation, and Friedel- Crafts reaction. Energy profile diagrams. Activating, deactivating substituents and orientation.	To determine the Enthalpy of neutralisation of weak acid/weak base Vs. strong base/strong acid and determine the enthalpy of ionisation.
15	10 Nov-14 Nov	Nomenclature, methods of formation: from alkenes and alcohol, nucleophilic substitution reactions of alkyl halides.	Determine the rate constant of hydrolysis of ethyl acetate.
16	16 Nov -21 Nov	SN2 and SN1 reactions with energy profile diagrams. Methods of formation: halogenation, Sandmeyer reaction.	
17	23 Nov.- 28 Nov.	The addition-elimination, and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl, and aryl halides.	
18	30 Nov.- 5 Dec.2026	Revision and test of unit 3rd and 4th.	

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

Affiliated to Kurukshetra University, Kurukshetra

Department Of Science

Lesson Plan (Session 2025-2026)

Class: B. Sc. Physical Science — Semester: **III**
Name of the Course: **Minor Chemistry-III** — Course Code: B23- CHE-304
Dates: 1August, 2026 – 5 Dec., 2026

SYLLABUS

Maximum Marks: 100 — Time: 3 hours
End Term Exam Marks:70 Marks — Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	**s and p-Block Elements** Salient features of hydrides, oxides, halides, hydroxides of s-block elements (methods of preparation excluded). Structure, preparation and properties of Diborane and Borazine. Structure of oxyacids of Nitrogen, phosphorous, sulphur and chlorine and comparison of acidic strength of oxyacids. low chemical reactivity of noble gases	12
Unit: II	**Electrochemistry-I** Electrolytic conduction, factors affecting electrolytic conduction, specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration. Application of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution, Concepts of pH, Buffer solution (Numerical)	11
Unit: III	**Thermodynamics-I** Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Thermodynamic equilibrium, Concept of heat and work. First law of thermodynamics: statement, concepts of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship	11
Unit: IV	**Mechanism of Organic Reactions** Curved arrow notation, homolytic and heterolytic bond fission. Types of reagents: electrophiles and nucleophiles. Types of organic reactions: Substitution, Addition, Condensation, Elimination, Rearrangement, Isomerization and Pericyclic reactions. Reactive intermediates: Carbocations, carbanions, free radicals, carbenes (structure & stability).	11
V	1. Synthesis of soap from vegetable oil. 2. Synthesis of any one of the following: Sanitizer / Liquid Soap / Talcum Powder. 3. Preparation of tetra ammine cupric sulphate. 4. To determine the solubility of Benzoic acid at various temperatures and to determine the ΔH of the dissolution process. 5. To determine the Enthalpy of neutralization of strong base Vs strong acid and weak acid/weak base Vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base. 6. To prepare isobenzylthiouronium salt. 7. Identification of following organic compounds: urea, oxalic acid and *m*-dinitrobenzene.	30

Text Books:

1. Dr. S. P. Jauhar, Dr. B. K. Vermani, Sakshi Kiran, Modern Approach to Chemistry

2. Dr. S. P. Jauhar, Dr. B. K. Vermani, Sakshi Kiran, Kavya, Modern Approach to Chemistry

3. Dr. S. P. Jauhar, Dr. J. M. Seghal, Sakshi Kiran, Modern Approach to Chemistry

Course Outcomes

After completing this course, the learner will be able to:

1. To learn about the structure of S and P-block elements, their properties and discuss their use in daily life as well as industrial applications.

2. To understand about various laws and theories related to electrochemistry-I and know about their thermodynamic properties.

3. To understand the concepts of thermodynamics.

4. To understand and apply the fundamental concepts and thermodynamic properties of reactions/systems involved in physical/chemical transformations including types of reactions and reactive intermediates.

Lesson Plan

SR. No	Date	Course Content	
		Theory (2)	**Practical (2)**
1	1August 2026	Introduction of s and p-block elements	-----
2	3 August -8 August	Salient features of hydrides, oxides, halides, hydroxides of s-block elements (methods of preparation excluded).	-----
3	10 August - 14 August	Structure, preparation and properties of Diborane	Basic laboratory techniques.
4	17 August - 22August	Structure, preparation and properties of borazine	Synthesis of soap from vegetable oil.
5	24 August -29 August	Structure of oxyacids of Nitrogen, phosphorous, sulphur and chlorine.	Synthesis of Sanitizer
6	31August. - 5 Sept.	Comparison of acidic strength of oxyacids, Low chemical reactivity of noble gases.	Preparation of tetra ammine cupric sulphate.
7	7 Sept. - 12 Sept.	Electrolytic conduction, factors affecting electrolytic conduction,	Preparation of tetra ammine cupric sulphate.
8	14 Sept. -19 Sept.	Specific conductance, molar conductance, equivalent conductance and relation among them, their variation with concentration.	To determine the solubility of Benzoic acid at varioustemperatures and to determine the ΔH of the dissolution process.
9	21 Sept. - 26 Sept.	Application of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution, Concepts of pH, Buffer solution (Numericals)	To determine the solubility of Benzoic acid at various temperatures and to determine the ΔH of the dissolution process.
10	28 Sept.- 3 Oct.	Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials	To determine the Enthalpy of neutralization of strong base Vs strong acid and weak acid/weak base Vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
11	5 Oct.- 10 Oct.	Thermodynamic process. Thermodynamic equilibrium, Concept of heat and work.	To determine the Enthalpy of neutralization of strong base Vs strong acid and weak acid/weak base Vs. strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
12	12 Oct.- 17 Oct.	First law of thermodynamics: statement, concepts of internal energy and enthalpy	Identification of urea.
13	19 Oct. - 24 Oct.	Heat capacity, heat capacities at constant volume and pressure and their relationship	Identification of oxalic acid.
14	26 Oct.- 31 Oct.	Curved arrow notation, homolytic and heterolytic bond fission. Types of reagents: electrophiles and nucleophiles.	Identification of *m*-dinitrobenzene.
15	10 Nov-14 Nov	Types of reagents: electrophiles and nucleophiles. Types of organic reactions: Substitution, Addition, Condensation, Elimination, Rearrangement.	Practice of preparation of compounds
16	16 Nov -21 Nov	Isomerization and Pericyclic reactions	
17	23 Nov.- 28 Nov.	Reactive intermediates: Carbocations, carbanions, free radicals, carbenes (structure & stability).	
18	30 Nov.- 5 Dec.2026	Revision and test.	

Signature of Teacher **Head of Department**

INDIRA GANDHI (P.G.) MAHILA MAHAVIDYALAYA, KAITHAL

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Department Of Science

Lesson Plan (Session 2026-2027)

Class: B.Sc. Physical Science + Life Science — Semester: **5th**
Name of the Course: **Chemistry-V** — Course Code: B23-CHE-501
Dates: 1August, 2026 –5 Dec., 2026

SYLLABUS

Maximum Marks: 100 — Time: 3 hours
End Term Exam Marks: 70 Marks — Assessment: 30 Marks

Note: Examiner will be required to set nine questions in all. First question will be compulsory, consisting of short type question covering the entire syllabus in addition to that eight more questions will be set, two question from each unit. Students will be required to attempt in all. In addition to the compulsory question, student will have to attempt four more questions selecting one question from each unit.

Unit	Topics	Contact Hours
Unit: I	**Coordination Compounds**: Werner's theory of coordination compounds, EAN, chelates, nomenclature of coordination compounds, isomerism in coordination compounds. Metal Ligand Bonding in Transition Metal Complexes: Valence bond theory, applications and their Limitation, Elementary idea of CFT (Only structural aspects), Crystal field splitting in octahedral, tetrahedral and square planer complexes. Magnetic properties of transition metal complexes: Types of magnetic materials, magnetic susceptibility, method of determination, spin only formula, basic idea of L-S coupling	14
Unit: II	**Thermodynamics-II:** Third Law of Thermodynamics, Nernst Heat Theorem, Statement of concept of residual entropy, evaluation absolute entropy from heat capacity data. Gibbs function and Helmholtz Function as thermodynamic quantities. Criteria for thermodynamic equilibrium and spontaneity. Variation of G with P, V and T, Partial molar properties, concept of chemical potential (numerical included) **Phase Equilibria**: Statement and the meaning of terms-phase component and degree of freedom, Thermodynamic derivation of Gibbs phase rule, Phase equilibria of one component system-water system, phase equilibria of two component systems solid-liquid equilibria, simple Eutectic Pb-Ag system**.**	14
Unit: III	**Quantum Mechanics-I:** Black body radiation, plank's radiation law, Explanation of spectral distribution of black body radiation on the basis of classical mechanics and quantum mechanics, Heat capacity of solids, Need of quantum mechanics, postulates of quantum mechanics, quantum mechanical operator, Commutation relations, Hamiltonian operator, Role of operators to derive Schrodinger wave equation, Application Schrodinger wave equation in determination of wave function and energy of a particle in one dimensional box **Spectroscopy-I:** Electromagnetic radiations, reasons of electromagnetic spectrum, basic features of spectroscopy, introduction to molecular spectroscopy and its difference from atomic spectroscopy, signal to noise ratio, resolving power of spectrophotometer, Born Oppenheimer approximation, Concept of degree of freedom. Rotational Spectrum: Energy levels of rigid rotator of diatomic molecules, selection rules, spectral intensity distribution using Maxwell-Boltzmann distribution, Determination of bond length and concept of isotopic effect.	16
Unit: IV	**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. **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. Comparison of basicity of pyridine, piperidine and pyrrole	16
V	1. Systematic identification (detection of extra elements, Functional Groups, determination of Melting Point and preparation of atleast one solid derivative) of the following simple mono-functional organic compounds: Naphthalene, p-dichlorobenzene, m-dinitrobenzene, α & β naphthol, Oxalic acid, succinic acid, benzoic acid, phthalic acid, Benzamide, urea, thiourea, glucose, fructose and sucrose. 2. Determine the solubility product of $Ca(OH)_2$ at room temperature by titrating it against 0.5 N HCl solution volumetrically. 3. Determine electrode potential of Zinc and Copper electrode in 0.1 M and 0.01M solution and calculate E value for these electrodes.	

Text Books:

1. Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. (2010), Inorganic Chemistry, 5th Edition, W. H. Freeman and Company.

2. Dr. S. P. Jauhar, Dr. B. K. Vermani, Sakshi Kiran, Kavya, Modern Approach to Chemistry.

Course Outcomes

After completing this course, the learner will be able to:

1. Enable to understand the basis of coordination chemistry of complexes.
2. To learn about role of thermodynamics and equilibrium in predicting various physical properties of systems.
3. Get knowledge about the quantum mechanical properties and analysis of diatomic molecules by spectroscopy.
4. To understand the synthesis and mechanism of some organic reactions and heterocyclic compounds.

Lesson Plan

SR. No	Date	Course Content	
		Theory (2)	**Practical (2)**
1	1August 2026	Coordination Compounds: Werner's theory of coordination compounds	-----
2	3 August -8 August	EAN, chelates, nomenclature of coordination compounds, isomerism in coordination compounds.	-----
3	10 August - 14 August	Metal Ligand Bonding in Transition Metal Complexes: Valence bond theory, applications and their Limitation, Elementary idea of CFT (Only structural aspects), Crystal field splitting in octahedral, tetrahedral and square planer complexes.	Basic laboratory techniques.
4	17 August - 22August	Magnetic properties of transition metal complexes: Types of magnetic materials, magnetic susceptibility, method of determination, spin only formula, basic idea of L-S coupling.	Systematic identification (detection of extra elements, Functional Groups, determination of Melting Point and preparation of one solid derivative) of oxalic acid.
5	24 August -29 August	Thermodynamics-II: Third Law of Thermodynamics, Nernst Heat Theorem, Statement of concept of residual entropy, evaluation absolute entropy from heat capacity data.	Systematic identification (detection of extra elements, Functional Groups, determination of Melting Point and preparation of one solid derivative) of benzoic acid.
6	31August. - 5 Sept.	Variation of G with P, V and T, Partial molar properties, concept of chemical potential (numerical included) Phase Equilibria: Statement and the meaning of terms-phase component and degree of freedom, Thermodynamic derivation of Gibbs phase rule.	Systematic identification (detection of extra elements, Functional Groups, determination of Melting Point and preparation of one solid derivative) of benzoic acid.
7	7 Sept. - 12 Sept.	Phase equilibria of one component system-water system, phase equilibria of two component systems solid-liquid equilibria, simple Eutectic Pb-Ag system**.**	Systematic identification of benzoic acid.
8	14 Sept. -19 Sept.	Quantum Mechanics-I: Black body radiation, plank's radiation law, Explanation of spectral distribution of black body radiation on the basis of classical mechanics and quantum mechanics.	Systematic identification of benzoic acid.
9	21 Sept. - 26 Sept.	Heat capacity of solids, Need of quantum mechanics, postulates of quantum mechanics, quantum mechanical operator, Commutation relations, Hamiltonian operator, Role of operators to derive Schrodinger wave equation.	Systematic identification of benzoic acid.
10	28 Sept.- 3 Oct.	Application Schrodinger wave equation in determination of wave function and energy of a particle in one dimensional box. Electromagnetic radiations, reasons of electromagnetic spectrum, basic features of spectroscopy, introduction to molecular spectroscopy and its difference from atomic spectroscopy, signal to noise ratio.	Systematic identification of benzoic acid.
11	5 Oct.- 10 Oct.	Resolving power of spectrophotometer, Born-Oppenheimer approximation, Concept of degree of freedom.	Systematic identification of benzoic acid.
12	12 Oct.- 17 Oct.	Energy levels of rigid rotator of diatomic molecules, selection rules, spectral intensity distribution using Maxwell-Boltzmann distribution, Determination of bond length and concept of isotopic effect.	Systematic identification (detection of extra elements, Functional Groups, determination of Melting Point and preparation of one solid derivative) of benzoic acid.
13	19 Oct. - 24 Oct.	Organic Synthesis via Enolates Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation.	Determine the solubility product of Ca(OH)2 at room temperature by titrating it against 0.5 N HCl solution volumetrically.
14	26 Oct.- 31 Oct.	Keto-enol tautomerism of ethyl acetoacetate. Heterocyclic Compounds Introduction: Molecular orbital picture and revision of unit 1^{st}.	Determine electrode potential of Zinc and Copper electrode in 0.1 M and 0.01M solution and calculate Eo value for these electrodes.
15	10 Nov-14 Nov	Aromatic characteristics of pyrrole, furan, thiophene and pyridine and methods of synthesis and revision of unit 2^{nd}.	Practice for identification of organic compounds.
16	16 Nov -21 Nov	Chemical reactions with particular emphasis on the mechanism of electrophilic substitution of pyridine, piperidine and pyrrole.	Practice for identification of organic compounds.
17	23 Nov.- 28 Nov.	Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.	
18	30 Nov.-5 Dec.2026	Revision and test of unit 3^{rd} and 4^{th}.	

Signature of Teacher **Head of Department**