Course Title: Physical Chemistry-I

Course Code: CC-A3

Course ID: 240/CHE/CC/103

Faculty: Khushbu Jain

July/August 2025

Atomic and Molecular Structure - I

Planck's black body radiation: Understanding the quantization of energy and its implications for the emission of radiation from black bodies. Compton effect: Understanding the scattering of X-rays by electrons and its significance in demonstrating the particle nature of light. Photoelectric effect: Explaining the emission of electrons from metal surfaces when exposed to light and its experimental observations. Bohr's theory of the hydrogen atom: Describing the quantized nature of electron orbits and energy levels. de Broglie postulate: Introducing wave-particle duality and the de Broglie wavelength for matter waves. Heisenberg's Uncertainty Principle: Explaining the fundamental limits on the precision of simultaneous measurements of position and momentum.

Test: **Atomic and Molecular Structure - I**

September 2025

Quantum Mechanics - I

Postulates of quantum mechanics: Providing the foundational principles and axioms underlying the theory. State function (wave function) postulate: Describing the state of a quantum system. Observable postulate: Introduction to operators and measurable quantities. Measurement postulate: Collapse of the wave function and eigenvalue equations. Normalized and orthogonal wave functions: Explaining their significance in quantum systems and the properties of orthogonality and normalization. Normalization condition: Ensuring total probability equals one. Orthogonality of wave functions: Importance in quantum mechanics. Complex conjugate: Role in normalization and orthogonality

Assignment: Postulates of quantum mechanics, Normalized and orthogonal wave functions, Photoelectric effect

October 2025

Quantum Mechanics - II

Probability density function (Ψ^2): Describing the probability interpretation of the wave function and its use in predicting measurement outcomes. Radial probability distribution: For hydrogen-like atoms. Operators in quantum mechanics: Including their mathematical properties and physical significance. Radial and angular wave functions for the hydrogen atom: Explaining their derivation and significance in describing the atom's electron distribution. Radial probability distribution: Analyzing the probability of finding an electron at various distances from the nucleus. Schrödinger's wave equation: Including its derivation and applications to simple systems. Time-independent Schrödinger equation: Focusing on stationary states. Particle in a one-dimensional box: Solutions and energy quantization. Harmonic oscillator: Basic concepts and applications

Test: **Quantum Mechanics**

November 2025

Atomic and Molecular Structure - II

Energy spectrum of the hydrogen atom: Including the derivation and significance of energy levels and spectral lines. Shapes of s, p, d, and f orbitals: Describing the spatial distribution and nodal structures of these atomic orbitals. Pauli's Exclusion Principle: Discussing its role in determining the electronic configuration of atoms. Hund's rule of maximum multiplicity: Explaining its application in filling electron orbitals in multi-electron atoms.

Assignment: Shapes of s, p, d, and f orbitals

RECOMMENDED BOOKS

1. "Physical Chemistry" by P. Bahadur

2. "Principles of Physical Chemistry" by Puri, Sharma, and Pathania

3. "Physical Chemistry" by A.K. Nag

4. "Advanced Practical Physical Chemistry" by J.B. Yadav

5. "Experiments in Physical Chemistry" by C. N. R. Rao and U. C. Agarwala 6. "Vogel's Textbook of Quantitative Chemical Analysis" by G. H. Jeffery, J. Bassett, J. Mendham, and R.C. Denney

Course Title: Chemistry-III

Course Code: CC-A3

Course ID: 240/CHE/CC/301

Faculty: Khushbu Jain

July/August 2025

Non-aqueous solvents

Physical properties of solvents, Properties and uses of non-aqueous solvents, Self-ionization, physical properties and chemical reactions in non-liquid NH_3

p-Block Elements

Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation).

Boron family (13th group):- Diborane – properties and structure (as an example of electron-deficient compound and multicentre bonding), Borazine – chemical properties and structure Trihalides of Boron – Trends in lewis acid character, structure of aluminum (III) chloride.

Carbon Family (14th group): Catenation, p π– d π bonding (an idea), silicates, silicones – general methods of preparations, properties and uses.

Test: 13th and 14th family

September 2025

Chemistry of Halogenated Hydrocarbons

Alkyl halides: Methods of preparation and properties, nucleophilic substitution reactions-SN^1, SN^2 and SN^i mechanisms with stereochemical aspects, effect of solvent and energy profile diagrams, nucleophilic substitution *vs.* elimination.

Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SNAr, Benzyne mechanism

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Hydrogen bonding, Acidic nature, Bouveault-Blanc Reduction, Pinacol-Pinacolone rearrangement.

Assignment: Benzyne mechanism, Bouveault-Blanc Reduction, Pinacol-Pinacolone rearrangement

October 2025

Phenols: Preparation and properties; Acidity and affecting factors, Ring substitution reactions, Reimer-Tiemann and Kolbe's-Schmidt Reactions.

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols and $LiAlH_4$.

Carbonyl Compounds

Structure, reactivity, preparation and properties; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism. Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, oxidations and reductions (Clemmensen, Wolff Kishner, $LiAlH_4$). Addition reactions of α, β-unsaturated carbonyl compounds: Michael addition.

Test: Mechanism of all Carbonyl Compounds

November 2025

Chemical Thermodynamics and Chemical equilibrium

Mathematical treatment of thermodynamics, Reversible and irreversible processes, First and Second Laws of Thermodynamics, Thermochemistry, Thermodynamic functions: enthalpy, entropy, and Gibbs free energy, Relationships between thermodynamic functions, Partial molar quantities, Dependence of thermodynamic parameters on composition, Gibbs-Duhem equation, Chemical potential.

Chemical equilibrium:

Law of mass action: Describing the relationship between the concentrations of reactants and products at equilibrium. Equilibrium constants (K_p, K_c, K_x, and K_n): Discussing their definitions, units, and calculations. Effect of temperature on equilibrium: Analyzing the temperature dependence and its implications for reaction conditions. Le-Chatelier principle: Explaining the principle and its applications in predicting the response of equilibrium systems to changes in conditions.

Assignment: Gibbs-Duhem equation, Chemical potential. Le-Chatelier principle

RECOMMENDED BOOKS

1. "Non-Aqueous Solvents" by J.J. Lagowski
2. "Inorganic Chemistry: Principles of Structure and Reactivity" by James E. Huheey, Ellen A. Keiter, and Richard L. Keiter
3. "Inorganic Chemistry" by Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr
4. "Concise Inorganic Chemistry" by J.D. Lee
5. "Inorganic Chemistry" by Puri, Sharma, and Kalia
6. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson

Education).
7. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
8. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Ahluwalia, V.K.; Bhagat, P.; Aggarwal, R.; Chandra, R. (2005), Intermediate for Organic Synthesis, I.K.International.
10. Solomons, T. W. G.; Fryhle, C. B. ; Snyder, S. A. (2016),Organic Chemistry, 12th Edition, Wiley.
11. "Vogel's Textbook of Quantitative Chemical Analysis" by A.I. Vogel (Adapted by G.H. Jeffery)

LESSON PLAN 2025-26

Course: BSc Life Science I semester (section A)

Course Title: Chemistry-I

Course Code: CC-A1

Course ID: 240/CHE/CC/101

Faculty: Dr. Pooja Singh

July

Atomic Structure & Periodic Properties

Quantum numbers, Aufbau and Pauli exclusion principles, Hund's rules of maximum multiplicity. Periodic classification of elements into s, p d & f block elements and electronic configuration.

August

Atomic Structure & Periodic Properties

screening effect, effective nuclear charge and Slater's rules, discussion and trends of the following properties of representative elements (s & p block): atomic and ionic radii, ionization enthalpy, electron gain enthalpy and electronegativity (Pauling's/ Mulliken's/ Allred Rachow's scale).

Chemical Bonding

Part I Ionic Bonding: Lattice energy, Born-Haber cycle, ionic radii; Metallic Bonding: conductors, semiconductors, and insulators.

Test of Atomic Structure & Periodic Properties.

September

Chemical Bonding

Weak forces: Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, instantaneous dipole-induced dipole interactions, hydrogen bonding. Covalent Bonding:

Valence bond theory (Heitler-London approach) and its limitation, directional characteristics of covalent bond, type of hybridization and shapes of simple inorganic molecules and ions (BeF2, BF3, CH4, PF5, SF6, IF7, SO4 -2 , ClO4 - 1 , NO3 -1).

Basic Concepts in Organic Chemistry

Classification and Nomenclature of organic compounds,Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation.

Test of Chemical Bonding.

October

Basic Concepts in Organic Chemistry

Comparision and applications of Inductive, electromeric, resonance and mesomeric effects, hyperconjugation, Reaction intermediates: Carbocations, Carbanions, Free radicals, Carbenes, arynes and nitrenes (Types, shape, structure, Mechanistic study and relative stability).

Stereochemistry and Conformational Analysis Isomerism:

Types of isomerism, Optical isomerism, Elements of symmetry, Optical Activity, Molecular chirality/asymmetry, Enantiomers, Diastereoisomers, Meso compounds. Racemic mixture and resolution. Relative and absolute configuration: D/L designation, Geometric isomerism: Cis-Trans and E & Z nomenclature, Conformational isomerism: Conformational analysis of ethane and n-butane; chair, boat, half chair and twist boat conformations of cyclohexane (interconversions and energy level diagram).

Test of Basic Concepts in Organic Chemistry.

November

Quantum Mechanics:

Planck's black body radiation, Photoelectric effect, Bohr's theory, de Broglie postulate, Heisenberg's Uncertainty Principle; Schrödinger's wave equation (including mathematical treatment), postulates of quantum mechanics, normalized and orthogonal wave functions, its complex conjugate (idea of complex numbers) and significance of Ψ2 ; Operators; Particle in one-dimension box, radial and angular wave functions for hydrogen atom, radial probability distribution; Finding maxima of distribution functions (idea of maxima and minima), energy spectrum of hydrogen atom; Shapes of s, p, d and f orbitals.

Test of Stereochemistry and Conformational Analysis Isomerism.

Test of Quantum Chemistry.

Assignment.

RECOMMENDED BOOKS

1. "Inorganic Chemistry" by J.D. Lee

2. "Inorganic Chemistry" by Puri, Sharma, and Kalia

3. "Quantitative Inorganic Analysis" by A. I. Vogel

4. "Principles of Physical Chemistry" by Puri, Sharma, and Pathania

5. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 6. J. E. McMurry, Fundamentals of Organic Chemistry, 7thEdition, Cengage Learning India, 2013.

7. P. S. Kalsi, Stereochemistry Conformation and Mechanism, New Age International, 2005.

LESSON PLAN 2025-26

Course: BSc Life Science III semester (section A)

Course Title: Chemistry-III

Course Code: CC-A3

Course ID: 240/CHE/CC/301

Faculty: Dr. Pooja Singh

July/August 2025

Non-aqueous solvents

Physical properties of solvents, Properties and uses of non-aqueous solvents, Self-ionization, physical properties and chemical reactions in non-liquid NH_3

p-Block Elements

Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation).

Boron family (13th group):- Diborane – properties and structure (as an example of electron-deficient compound and multicentre bonding), Borazine – chemical properties and structure Trihalides of Boron – Trends in lewis acid character, structure of aluminum (III) chloride.

Carbon Family (14th group): Catenation, p π– d π bonding (an idea), silicates, silicones – general methods of preparations, properties and uses.

Test

September 2025

Chemistry of Halogenated Hydrocarbons

Alkyl halides: Methods of preparation and properties, nucleophilic substitution reactions-SN^1, SN^2 and SN^i mechanisms with stereochemical aspects, effect of solvent and energy profile diagrams, nucleophilic substitution *vs.* elimination.

Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SNAr, Benzyne mechanism

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Hydrogen bonding, Acidic nature, Bouveault-Blanc Reduction, Pinacol-Pinacolone rearrangement.

Assignment

October 2025

Phenols: Preparation and properties; Acidity and affecting factors, Ring substitution reactions, Reimer-Tiemann and Kolbe's-Schmidt Reactions.

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols and $LiAlH_4$.

Carbonyl Compounds

Structure, reactivity, preparation and properties; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism. Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, oxidations and reductions (Clemmensen, Wolff Kishner, $LiAlH_4$). Addition reactions of α, β-unsaturated carbonyl compounds: Michael addition.

Test

November 2025

Chemical Thermodynamics and Chemical equilibrium

Mathematical treatment of thermodynamics, Reversible and irreversible processes, First and Second Laws of Thermodynamics, Thermochemistry, Thermodynamic functions: enthalpy, entropy, and Gibbs free energy, Relationships between thermodynamic functions, Partial molar quantities, Dependence of thermodynamic parameters on composition, Gibbs-Duhem equation, Chemical potential.

Chemical equilibrium:

Law of mass action: Describing the relationship between the concentrations of reactants and products at equilibrium. Equilibrium constants (K_p, K_c, K_x, and K_n): Discussing their definitions, units, and calculations. Effect of temperature on equilibrium: Analyzing the temperature dependence and its implications for reaction conditions. Le-Chatelier principle: Explaining the principle and its applications in predicting the response of equilibrium systems to changes in conditions.

Assignment

RECOMMENDED BOOKS

1. "Non-Aqueous Solvents" by J.J. Lagowski
2. "Inorganic Chemistry: Principles of Structure and Reactivity" by James E. Huheey, Ellen A. Keiter, and Richard L. Keiter
3. "Inorganic Chemistry" by Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr
4. "Concise Inorganic Chemistry" by J.D. Lee
5. "Inorganic Chemistry" by Puri, Sharma, and Kalia
6. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
7. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
8. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Ahluwalia, V.K.; Bhagat, P.; Aggarwal, R.; Chandra, R. (2005), Intermediate for Organic Synthesis, I.K.International.
10. Solomons, T. W. G.; Fryhle, C. B. ; Snyder, S. A. (2016),Organic Chemistry, 12th Edition, Wiley.
11. "Vogel's Textbook of Quantitative Chemical Analysis" by A.I. Vogel (Adapted by G.H. Jeffery)

Course Title: Organic Chemistry-I

Course Code: CC-A2

Course ID: 240/CHE/CC/102

Faculty: Sonam Baghel

July/August 2025

Basic Concepts in Organic Chemistry Classification, and Nomenclature of organic compounds, Hybridization: Shapes of molecules, influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their comparison & applications. Mechanism of Organic Reactions: Curly arrow rules, formal charges, Electrophiles and Nucleophiles, Homolytic and Heterolytic fission with suitable examples. Reaction intermediates: Carbocations, Carbanions, Free radicals, Carbenes, arynes and nitrenes (Types, shape, structure, Mechanistic study and relative stability) Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values.

Assignments: Resonance Structures of various Compounds

Test- Class Test of All electronic Displacements and Reactions Intermediates

September 2025

Stereochemistry and Conformational Analysis Isomerism: Types of isomerism, Optical isomerism: elements of symmetry, Optical Activity, Specific Rotation, Molecular chirality/asymmetry, Enantiomers, chiral and achiral molecules with two stereogeniccentres, Diastereoisomers, Meso compounds, Racemic mixture and resolution. Relative and absolute configuration: CIP rules, D/L and R/S designations. Geometric isomerism: Configuration of geometric isomers. Cis-Trans and E & Z nomenclature, Conformational isomerism: Conformational analysis of ethane and n-butane; chair, boat, half chair and twist boat conformations of cyclohexane (interconversions and energy level diagram). Interconversions of Newman projection and Sawhorse formulae, Wedge Formula and Fischer representations (Erythrose, Threose and Tartaric acid), Difference between configuration and conformation.

Assignment: Chiral And Achiral of All albhabets, ***R/S designations of Some coumpounds***

October 2025

Hydrocarbons (Alkanes and Alkenes-1) Alkanes: Physical (Boiling point, melting point, solubility) and chemical properties (Combustion, cracking, and reforming) of alkanes, general methods of preparation: Wurtz

reaction, Kolbe reaction, Corey-House 11 35 reaction and decarboxylation of carboxylic acids, Reactivity and Mechanisms: Free radical substitutions, halogenation: relative reactivity and selectivity. Alkenes: Structure and isomerism, physical (Boiling point, melting point, solubility) and chemical properties (Stability, reactivity).

Test: **General methods of preparation**

Assignment: Reactivity and Mechanisms: Free radical substitutions, halogenation: relative reactivity and selectivity

November 2025

Hydrocarbons (Alkenes-1I and Alkynes) Alkenes: Formation, Mechanism of elimination reactions (E1, E2, E1cb), Saytzeff and Hoffmann elimination, Reactions of alkenes: Electrophilic additions their mechanisms (Markownikov/ Anti Markownikov addition), mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). Alkynes: General methods of preparation, reactions of alkynes: acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, alkylation of terminal alkynes.

Assignment: Mechanism of oxymercuration-demercuration, hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical),

Test : Reactions of alkenes: Electrophilic additions their mechanisms (Markownikov/ Anti Markownikov addition

SUGGESTED BOOKS 1. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

2. J. E. McMurry, Fundamentals of Organic Chemistry, 7thEdition, Cengage Learning India, 2013.

3. R. N. Boyd, R. T. Morrison and S. K. Bhattcharjee, Organic Chemistry, 7thEdition, Pearson, 2014.

4. P. S. Kalsi, Stereochemistry Conformation and Mechanism, New Age International, 2005.

5. J. Singh, L.D.S. Yadav, Organic Chemistry (Volume I), 14th Edition, Pragati Prakashan, 2019.

6. E. L. Eliel & S. H. Wilen, Stereochemistry of Organic Compounds, Wiley: London, 1994.

7. S. M. Mukerji, S. P. Singh, K.P.Kapoor and R. Das, Organic Chemistry (Volume I), 2nd Edition, New Age International Publishers, 2010.

8. S. M. Mukerji, S. P. Singh, K.P. Kapoor and R. Das, Organic Chemistry (Volume II), 2nd Edition, New Age International Publishers, 2012.

9. B.S. Furniss ; A. J. Hannaford ; P.W.G. Smith ; A. R. Tatchell, Practical Organic Chemistry, 5th Edition., Pearson, 2012.
10. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, Pearson, 2009.
11. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R.(2012),Vogel's textbook of Practical Organic Chemistry, Pearson.

Course Title: Chemistry-III

Course Code: CC-A3

Course ID: 240/CHE/CC/301

Faculty: Sonam Baghel

July/August 2025

Non-aqueous solvents

Physical properties of solvents, Properties and uses of non-aqueous solvents, Self-ionization, physical properties and chemical reactions in non-liquid NH_3

p-Block Elements

Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation).

Boron family (13th group):- Diborane – properties and structure (as an example of electron-deficient compound and multicentre bonding), Borazine – chemical properties and structure Trihalides of Boron – Trends in lewis acid character, structure of aluminum (III) chloride.

Carbon Family (14th group): Catenation, p π– d π bonding (an idea), silicates, silicones – general methods of preparations, properties and uses.

Test: 13th and 14th family

September 2025

Chemistry of Halogenated Hydrocarbons

Alkyl halides: Methods of preparation and properties, nucleophilic substitution reactions-SN^1, SN^2 and SN^i mechanisms with stereochemical aspects, effect of solvent and energy profile diagrams, nucleophilic substitution *vs.* elimination.

Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SNAr, Benzyne mechanism

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Hydrogen bonding, Acidic nature, Bouveault-Blanc Reduction, Pinacol-Pinacolone rearrangement.

Assignment: Benzyne mechanism, Bouveault-Blanc Reduction, Pinacol-Pinacolone rearrangement

October 2025

Phenols: Preparation and properties; Acidity and affecting factors, Ring substitution reactions, Reimer-Tiemann and Kolbe's-Schmidt Reactions.

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols and $LiAlH_4$.

Carbonyl Compounds

Structure, reactivity, preparation and properties; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism. Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, oxidations and reductions (Clemmensen, Wolff Kishner, $LiAlH_4$). Addition reactions of α, β-unsaturated carbonyl compounds: Michael addition.

Test: Mechanism of all Carbonyl Compounds

November 2025

Chemical Thermodynamics and Chemical equilibrium

Mathematical treatment of thermodynamics, Reversible and irreversible processes, First and Second Laws of Thermodynamics, Thermochemistry, Thermodynamic functions: enthalpy, entropy, and Gibbs free energy, Relationships between thermodynamic functions, Partial molar quantities, Dependence of thermodynamic parameters on composition, Gibbs-Duhem equation, Chemical potential.

Chemical equilibrium:

Law of mass action: Describing the relationship between the concentrations of reactants and products at equilibrium. Equilibrium constants (K_p, K_c, K_x, and K_n): Discussing their definitions, units, and calculations. Effect of temperature on equilibrium: Analyzing the temperature dependence and its implications for reaction conditions. Le-Chatelier principle: Explaining the principle and its applications in predicting the response of equilibrium systems to changes in conditions.

Assignment: Gibbs-Duhem equation, Chemical potential. Le-Chatelier principle

RECOMMENDED BOOKS

1. "Non-Aqueous Solvents" by J.J. Lagowski
2. "Inorganic Chemistry: Principles of Structure and Reactivity" by James E. Huheey, Ellen A. Keiter, and Richard L. Keiter
3. "Inorganic Chemistry" by Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr
4. "Concise Inorganic Chemistry" by J.D. Lee
5. "Inorganic Chemistry" by Puri, Sharma, and Kalia
6. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
7. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
8. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Ahluwalia, V.K.; Bhagat, P.; Aggarwal, R.; Chandra, R. (2005), Intermediate for Organic Synthesis, I.K.International.
10. Solomons, T. W. G.; Fryhle, C. B. ; Snyder, S. A. (2016),Organic Chemistry, 12th Edition, Wiley.
11. "Vogel's Textbook of Quantitative Chemical Analysis" by A.I. Vogel (Adapted by G.H. Jeffery)

LESSON PLAN 2025-26

Course: BSc Life Science I semester (section B)

Course Title: Chemistry-I

Course Code: CC-A1

Course ID: 240/CHE/CC/101

Faculty: Dr. Ritu Malik

July

Atomic Structure & Periodic Properties

Quantum numbers, Aufbau and Pauli exclusion principles, Hund's rules of maximum multiplicity. Periodic classification of elements into s, p d & f block elements and electronic configuration.

August

Atomic Structure & Periodic Properties

screening effect, effective nuclear charge and Slater's rules, discussion and trends of the following properties of representative elements (s & p block): atomic and ionic radii, ionization enthalpy, electron gain enthalpy and electronegativity (Pauling's/ Mulliken's/ Allred Rachow's scale).

Chemical Bonding

Part I Ionic Bonding: Lattice energy, Born-Haber cycle, ionic radii; Metallic Bonding: conductors, semiconductors, and insulators.

Test of Atomic Structure & Periodic Properties.

September

Chemical Bonding

Weak forces: Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, instantaneous dipole-induced dipole interactions, hydrogen bonding. Covalent Bonding: Valence bond theory (Heitler-London approach) and its limitation, directional characteristics of covalent bond, type of hybridization and shapes of simple inorganic molecules and ions (BeF2, BF3, CH4, PF5, SF6, IF7, SO4 -2 , ClO4 - 1 , NO3 -1).

Basic Concepts in Organic Chemistry

Classification and Nomenclature of organic compounds,Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation.

Test of Chemical Bonding.

October

Basic Concepts in Organic Chemistry

Comparision and applications of Inductive, electromeric, resonance and mesomeric effects, hyperconjugation, Reaction intermediates: Carbocations, Carbanions, Free radicals, Carbenes, arynes and nitrenes (Types, shape, structure, Mechanistic study and relative stability).

Stereochemistry and Conformational Analysis Isomerism:

Types of isomerism, Optical isomerism, Elements of symmetry, Optical Activity, Molecular chirality/asymmetry, Enantiomers, Diastereoisomers, Meso compounds. Racemic mixture and resolution. Relative and absolute configuration: D/L designation, Geometric isomerism: Cis-Trans and E & Z nomenclature, Conformational isomerism: Conformational analysis of ethane and n-butane; chair, boat, half chair and twist boat conformations of cyclohexane (interconversions and energy level diagram).

Test of Basic Concepts in Organic Chemistry.

November

Quantum Mechanics:

Planck's black body radiation, Photoelectric effect, Bohr's theory, de Broglie postulate, Heisenberg's Uncertainty Principle; Schrödinger's wave equation (including mathematical treatment), postulates of quantum mechanics, normalized and orthogonal wave functions, its complex conjugate (idea of complex numbers) and significance of Ψ2 ; Operators; Particle in one-dimension box, radial and angular wave functions for hydrogen atom, radial probability distribution; Finding maxima of distribution functions (idea of maxima and minima), energy spectrum of hydrogen atom; Shapes of s, p, d and f orbitals.

Test of Stereochemistry and Conformational Analysis Isomerism.

Test of Quantum Chemistry.

Assignment.

RECOMMENDED BOOKS

1. "Inorganic Chemistry" by J.D. Lee

2. "Inorganic Chemistry" by Puri, Sharma, and Kalia

3. "Quantitative Inorganic Analysis" by A. I. Vogel

4. "Principles of Physical Chemistry" by Puri, Sharma, and Pathania

5. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 6. J. E. McMurry, Fundamentals of Organic Chemistry, 7thEdition, Cengage Learning India, 2013.

7. P. S. Kalsi, Stereochemistry Conformation and Mechanism, New Age International, 2005.

LESSON PLAN 2025-26

SUBJECT:- INORGANIC CHEMISTRY **FACULTY:-Dr RITU MALIK**

COURSE:- B.Sc Major in Chemistry 1st Semester

COURSE CODE :- 240/CHE/CC/101

COURSE ID :- CC-A1

JULY

UNIT 1

Periodic Properties

Quantum numbers, Aufbau and Pauli exclusion principles, Hund's rules of maximum multiplicity. Periodic classification of elements into s, p d & f block elements and electronic configuration.

AUGUST

UNIT 1

Periodic Properties

Screening effect, effective nuclear charge and Slater's rules, discussion and trends of the following properties of representative elements (s & p block): atomic and ionic radii, ionization enthalpy, electron gain enthalpy and electronegativity (Pauling's/ Mulliken's/ Allred Rachow's scale).

ASSIGNMENT (unit1)

TEST (unit1)

UNIT 2

Chemical Bonding-I

Ionic Bonding: Lattice energy, Born-Haber cycle.

SEPTEMBER

UNIT 2

Chemical Bonding-I

Solvation energy, and ionic radii; Metallic Bonding: Band theory, conductors, semiconductors, and insulators; Weak forces: Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, instantaneous dipole-induced dipole interactions, hydrogen bonding.

PRESENTATION (unit 2)

ASSIGNMENT (unit 2)

UNIT 3

Chemical Bonding-II

Covalent Bonding: Valence bond theory (Heitler-London approach) and its limitation.

OCTOBER

UNIT 3

Chemical Bonding-II

Directional characteristics of covalent bond, type of hybridization and shapes of simple inorganic molecules and ions (BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7, SO_4^{-2}, ClO_4^{-1}, NO_3^{-1}) . Valence shell electron pair repulsion (VSEPR)s theory to NH_3, H_3O^+, SF_4, ClF_3, ICl_2^{-1}, $SnCl_2$, ClO_3^{-1} and H_2O.

ASSIGNMENT (Unit 3)

TEST (unit 3)

NOVEMBER

UNIT 4

Extractions of Metals

General modes of occurrence of metals. Ellingham diagrams for the reduction of metal oxides using carbon and carbon monoxide as reducing agents. Electrolytic Reduction, Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Parting process, van Arkel-de Boer process and Mond's process, Zone refining.

TEST (unit 4)

ASSIGNMENT (unit 4)

BOOKS FOR REFERENCE

1. "Concise Inorganic Chemistry" by J.D. Lee, Sudarshan Guha (Indian Adaptation)

2. "Inorganic Chemistry" by Puri, Sharma, and Kalia

3. "Principles of Inorganic Chemistry" by B.R. Puri, L.R. Sharma, and K.C. Kalia

4. "Extractive Metallurgy" by T. Rosenqvist, Terkel Rosenqvist (Indian Edition)

Course Title: Green Chemistry

Course Code: MIC-1

Course ID: 240/CHE/MI/101

Faculty: Dr. Neeru Singal

July/August 2025

Introduction to Green Chemistry-I

Overview of Green Chemistry: Definition and scope of green chemistry, History and evolution of green chemistry. Principles of Green Chemistry (The 12 principles of green chemistry, importance of each principle in sustainable chemical design).

Assignment

September 2025

Introduction to Green Chemistry-II

Sustainability in Chemistry [Concept of sustainability, Role of chemistry in achieving sustainable development goals (SDGs)]. Environmental Impact of Chemical Processes: Pollution and its sources, Life cycle assessment (LCA) of chemical products.

October 2025

Green Chemistry Techniques and Tools

Green Synthesis Methods: Alternative solvents and reaction conditions, Use of renewable feedstocks; Catalysis in Green Chemistry: Types of catalysis (homogeneous, heterogeneous, biocatalysis), Benefits of using catalysts in reducing waste and energy consumption.

Test

November 2025

Future Trends and Research

Emerging Technologies: Advances in green chemistry research and technology, Nanotechnology and its applications in green chemistry.

Revision

Subject: Inorganic Chemistry (theory)

Class: B.Sc. Pass Course (Non-Medical)

Semester: 5th sem

Faculty: Neeru Singal

Paper ID (Theory): 180PA503331A

16th July to August 2025:

Metal-ligand bonding in transition metal complexes

Limitations of valance bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planer complexes, factors affecting the crystal field parameter.

September 2023

Thermodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes of Pt(II).

Assignment given of this chapter.

October 2023

Magnetic properties of transition metal complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

Test of Metal-ligand bonding in transition metal complexes.

November 2023

Electronic spectra of transition metal complexes

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d_1 and d_9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Full syllabus test.

LESSON PLAN 2025-26

Course: BSc Life Science I semester (section c)

Course Title: Chemistry-I

Course Code: CC-A1

Course ID: 240/CHE/CC/101

Faculty: Dr. Pinku

July

Atomic Structure & Periodic Properties

Quantum numbers, Aufbau and Pauli exclusion principles, Hund's rules of maximum multiplicity. Periodic classification of elements into s, p d & f block elements and electronic configuration.

August

Atomic Structure & Periodic Properties

screening effect, effective nuclear charge and Slater's rules, discussion and trends of the following properties of representative elements (s & p block): atomic and ionic radii, ionization enthalpy, electron gain enthalpy and electronegativity (Pauling's/ Mulliken's/ Allred Rachow's scale).

Chemical Bonding

Part I Ionic Bonding: Lattice energy, Born-Haber cycle, ionic radii; Metallic Bonding: conductors, semiconductors, and insulators.

Test of Atomic Structure & Periodic Properties.

September

Chemical Bonding

Weak forces: Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, instantaneous dipole-induced dipole interactions, hydrogen bonding. Covalent Bonding: Valence bond theory (Heitler-London approach) and its limitation, directional characteristics of covalent bond, type of hybridization and shapes of simple inorganic molecules and ions (BeF2, BF3, CH4, PF5, SF6, IF7, SO4 -2 , ClO4 - 1 , NO3 -1).

Basic Concepts in Organic Chemistry

Classification and Nomenclature of organic compounds,Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation.

Test of Chemical Bonding.

October

Basic Concepts in Organic Chemistry

Comparision and applications of Inductive, electromeric, resonance and mesomeric effects, hyperconjugation, Reaction intermediates: Carbocations, Carbanions, Free radicals, Carbenes, arynes and nitrenes (Types, shape, structure, Mechanistic study and relative stability).

Stereochemistry and Conformational Analysis Isomerism:

Types of isomerism, Optical isomerism, Elements of symmetry, Optical Activity, Molecular chirality/asymmetry, Enantiomers, Diastereoisomers, Meso compounds. Racemic mixture and resolution. Relative and absolute configuration: D/L designation, Geometric isomerism: Cis-Trans and E & Z nomenclature, Conformational isomerism: Conformational analysis of ethane and n-butane; chair, boat, half chair and twist boat conformations of cyclohexane (interconversions and energy level diagram).

Test of Basic Concepts in Organic Chemistry.

November

Quantum Mechanics:

Planck's black body radiation, Photoelectric effect, Bohr's theory, de Broglie postulate, Heisenberg's Uncertainty Principle; Schrödinger's wave equation (including mathematical treatment), postulates of quantum mechanics, normalized and orthogonal wave functions, its complex conjugate (idea of complex numbers) and significance of Ψ2 ; Operators; Particle in one-dimension box, radial and angular wave functions for hydrogen atom, radial probability distribution; Finding maxima of distribution functions (idea of maxima and minima), energy spectrum of hydrogen atom; Shapes of s, p, d and f orbitals.

Test of Stereochemistry and Conformational Analysis Isomerism.

Test of Quantum Chemistry.

Assignment.

RECOMMENDED BOOKS

1. "Inorganic Chemistry" by J.D. Lee

2. "Inorganic Chemistry" by Puri, Sharma, and Kalia

3. "Quantitative Inorganic Analysis" by A. I. Vogel

4. "Principles of Physical Chemistry" by Puri, Sharma, and Pathania

5. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education). 6. J. E. McMurry, Fundamentals of Organic Chemistry, 7thEdition, Cengage Learning India, 2013.

7. P. S. Kalsi, Stereochemistry Conformation and Mechanism, New Age International, 2005.

LESSON PLAN 2025-26

Course: BSc Life Science III semester (section B)

Course Title: Chemistry-III

Course Code: CC-A3

Course ID: 240/CHE/CC/301

Faculty: Dr. Pinku

July/August 2025

Non-aqueous solvents

Physical properties of solvents, Properties and uses of non-aqueous solvents, Self-ionization, physical properties and chemical reactions in non-liquid NH_3

p-Block Elements

Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation).

Boron family (13th group):- Diborane – properties and structure (as an example of electron-deficient compound and multicentre bonding), Borazine – chemical properties and structure Trihalides of Boron – Trends in lewis acid character, structure of aluminum (III) chloride.

Carbon Family (14th group): Catenation, p π– d π bonding (an idea), silicates, silicones – general methods of preparations, properties and uses.

Test

September 2025

Chemistry of Halogenated Hydrocarbons

Alkyl halides: Methods of preparation and properties, nucleophilic substitution reactions-SN^1, SN^2 and SN^i mechanisms with stereochemical aspects, effect of solvent and energy profile diagrams, nucleophilic substitution *vs.* elimination.

Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SNAr, Benzyne mechanism

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Hydrogen bonding, Acidic nature, Bouveault-Blanc Reduction, Pinacol-Pinacolone rearrangement.

Assignment

October 2025

Phenols: Preparation and properties; Acidity and affecting factors, Ring substitution reactions, Reimer-Tiemann and Kolbe's-Schmidt Reactions.

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols and $LiAlH_4$.

Carbonyl Compounds

Structure, reactivity, preparation and properties; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism. Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisen-Schmidt, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, oxidations and reductions (Clemmensen, Wolff Kishner, $LiAlH_4$). Addition reactions of α, β-unsaturated carbonyl compounds: Michael addition.

Test

November 2025

Chemical Thermodynamics and Chemical equilibrium

Mathematical treatment of thermodynamics, Reversible and irreversible processes, First and Second Laws of Thermodynamics, Thermochemistry, Thermodynamic functions: enthalpy, entropy, and Gibbs free energy, Relationships between thermodynamic functions, Partial molar quantities, Dependence of thermodynamic parameters on composition, Gibbs-Duhem equation, Chemical potential.

Chemical equilibrium:

Law of mass action: Describing the relationship between the concentrations of reactants and products at equilibrium. Equilibrium constants (K_p, K_c, K_x, and K_n): Discussing their definitions, units, and calculations. Effect of temperature on equilibrium: Analyzing the temperature dependence and its implications for reaction conditions. Le-Chatelier principle: Explaining the principle and its applications in predicting the response of equilibrium systems to changes in conditions.

Assignment

RECOMMENDED BOOKS

1. "Non-Aqueous Solvents" by J.J. Lagowski
2. "Inorganic Chemistry: Principles of Structure and Reactivity" by James E. Huheey, Ellen A. Keiter, and Richard L. Keiter
3. "Inorganic Chemistry" by Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr
4. "Concise Inorganic Chemistry" by J.D. Lee
5. "Inorganic Chemistry" by Puri, Sharma, and Kalia
6. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson

Education).
7. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
8. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Ahluwalia, V.K.; Bhagat, P.; Aggarwal, R.; Chandra, R. (2005), Intermediate for Organic Synthesis, I.K.International.
10. Solomons, T. W. G.; Fryhle, C. B. ; Snyder, S. A. (2016),Organic Chemistry, 12th Edition, Wiley.
11. "Vogel's Textbook of Quantitative Chemical Analysis" by A.I. Vogel (Adapted by G.H. Jeffery)

Course Title: Introductory Chemistry-I

Course Code: MDC-1

Course ID: 240/CHE/MD/101

Faculty: Dr. Sudesh Kumari

July/August 2025

Food Preservatives: Elementary idea of natural and synthetic food preservatives, rancidity, uses and properties, different food preservation processes (pickle, jam), artificial sweeteners, uses and properties.

Test

September 2025

States of Matter: Classification of matter: elements, compounds and mixtures, physical and chemical properties, atomic models, structure of the atom: protons, neutrons and electrons, atomic number and mass number, some important compounds (baking soda, washing soda, plaster of Paris, gypsum, glass).

Assignment

October 2025

The Periodic Table: Periodic table, Organization of the periodic table, groups and periods, classification of elements, physical and chemical aspects of metals and non-metals, Ore and minerals of Iron, Copper, Aluminium, alloys.

Test

November 2025

Renowned Indian Scientists: Brief Biography of Indian Scientists (Hargobind Khurana, Dr. P.C. Ray, Sir C.V. Raman, Dr. A.P.J. Abdul Kalam, C.N.R. Rao, Dr. Vikram Sara Bhai, Dr. Homi Jahangir Bhabha, Dr. J.C. Bose, Dr. S.N. Bose)

Revision

Course Title: Human Values and Ethics

Course Code: VAC-1

Course ID: UG-VAC-1-1

Faculty: Dr. Sudesh Kumari

July/August 2025

Human Values: Definition and types of values: personal, social and cultural, Core Values.

Presentation by students

September 2025

Ethics: Definition, Ethics vs. Values, Importance of Ethics, The role of ethics in society, Integrity: Meaning and its role in personal life.

Test

October 2025

Ethical Dilemma: Meaning and nature, common ethical dilemmas, ethical decision making: meaning and steps in ethical decision making: identifying the problem, considering options, evaluating consequences, making a decision.

Assignment

November 2025

Challenges for ethical practices in institutions: Ragging, suicide and need for educational counseling, violence and peaceful protest, conflict resolution.

Revision

Class: B.Sc. III Medical (Semester V)

Course Title: Physical Chemistry

Course ID:

Faculty: Dr. Sudesh Kumari

July/August 2025

Spectroscopy-I

Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Born Oppenheimer approximation, Degrees of freedom.

Rotational Spectrum of Diatomic molecules: Energy levels of rigid rotator (semi-classical principles), selection rules, spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect.

September 2025

Spectroscopy-II

Vibrational (IR) spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effects of anharmonic motion and isotopic effect on the spectra., idea of vibrational frequencies of different functional groups.

Raman Spectrum: Concept of polarizibility , pure rotational and pure vibrational Raman spectra of diatomic molecules, selectin rules, Quantum theory of Raman spectra.

Test

October 2025

Quantum Mechanics

Black-body radiation, Plank's radiation law, photoelectric effect, heat capacity of solids, Compton effect, wave function and its significance of Postulates of quantum mechanics , quantum mechanical operator, commutation relations, Hamiltonian operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a particle in one dimensional box, Pictorial representation and its significance.

Assignment

November 2025

Physical Properties and Molecular Structure

Optical activity, polarization – (Clausius – Mossotti equation). Orientation of dipoles in an electric field, dipole moment, included dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties – para magnetism, diamagnetism and ferro magnetics.

Revision

5th Semester

Organic Chemistry

Name of Faculty:- Ms. Payal Arora

Class :- B.Sc. III Non Medical

July-August

NMR Spectroscopy-I

Principle of nuclear magnetic resonance, the PMR spectrum,number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift,shielding and deshielding of protons, proton counting ,splitting of signals and coupling constants, magnetic equivalence of protons.

Test

September

NMR Spectroscopy-II

Discuss ion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide,

1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone..Simple problems on PMR spectroscopy for structure determination of organic compounds.

Assignment on NMR Spectroscopy-ll.

Test of NMR Spectroscopy.

October

Carbohydrates-I

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 threodiastereomers. Conversion of glucose in to mannose. Formation of glycos ides, ethers and esters.

Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism ofmutarotation. Structures of ribose and deoxyribose.

November

Carbohydrates-II

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Organometallic Compounds .

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.

Revision.

Reference Books:

1. **Modern Organic Chemistry, BSc part 3, Semester 5, by Dr. J.M. Seghal.**
2. **Pradeep's Organic Chemistry, Vol. 3, Semester 5, by Dr. S.N. Dhawan.**

Course Title: Chemistry Lab Operation and Safety Measures

Course Code: SEC-1

Course ID: 240/CHE/SE/101

Faculty: Ms. Payal Arora

July-August

Introduction to Laboratory Operations; Overview of laboratory types and functions; Organization of a chemistry laboratory; Common laboratory equipment and their uses; Standard operating procedures (SOPs); Good Laboratory Practices (GLP)

September

Laboratory Safety Principles; Importance of laboratory safety; Safety data sheets (SDS); Personal protective equipment (PPE); Laboratory ventilation and fume hoods; Chemical hygiene plan

Assignment

October

Chemical Handling and Disposal; Proper storage of chemicals; Labelling and documentation; Handling of hazardous chemicals; Waste management and disposal procedures; Spill response and cleanup

Class Test

November

Emergency Procedures and First Aid; Fire safety and emergency exits; Use of fire extinguishers and fire blankets; First aid procedures for chemical exposure; Emergency eyewash and shower stations; Reporting accidents and incidents

Revision

Reference Books :

1. "Laboratory Techniques in Organic Chemistry" by S. V. Sharma
2. "Laboratory Safety: Theory and Practice" by S. S. Mathur
3. Manual of Laboratory Safety by Nigam R. And nigam P., Laxmi Publications

Faculty Name – Ms. Bhagyashree Date

Theory Classes **1. Core Course 3rd sem (Inorganic Chemistry)**

2. Minor Course 1st sem (Green Chemistry)

3. Human Value Ethics 1st sem

SUBJECT: CORE COURSE – CORE COURSE [INORGANIC CHEMISTRY]

CLASS: B.SC. LIFE SCIENCE 3RD SEM (MEDICAL)

COURSE CODE: CC-A3

PAPER ID (THEORY): 240/CHE/CC/301

16th July to August 2025:

Non-aqueous solvents

Physical properties of solvents, Properties and uses of non-aqueous solvents, Self-ionization, physical properties and chemical reactions in non-liquid NH_3

September 2023

p-Block Elements

Emphasis on comparative study of properties of p-block elements (including diagonal relationship and excluding methods of preparation).

Assignment given of this chapter.

October 2023

Boron family (13th group):- Diborane – properties and structure (as an example of electron-deficient compound and multicentre bonding), Borazine – chemical properties and structure Trihalides of Boron – Trends in lewis acid character, structure of aluminum (III) chloride.

Class test

November 2023

Carbon Family (14th group): Catenation, pπ– dπ bonding (an idea), silicates, silicones – general methods of preparations, properties and uses.

Full syllabus test.

COURSE TITLE: GREEN CHEMISTRY

CLASS: B.SC. BIOTECH 1ST SEM AND B. SC. PHY (HONS.) 1ST SEM

COURSE CODE: MIC-1

COURSE ID: 240/CHE/MI/101

16th July to August 2025:

Introduction to Green Chemistry-I

Overview of Green Chemistry: Definition and scope of green chemistry, History and evolution of green chemistry. Principles of Green Chemistry (The 12 principles of green chemistry, importance of each principle in sustainable chemical design).

Assignment

September 2025

Introduction to Green Chemistry-II

Sustainability in Chemistry [Concept of sustainability, Role of chemistry in achieving sustainable development goals (SDGs)]. Environmental Impact of Chemical Processes: Pollution and its sources, Life cycle assessment (LCA) of chemical products.

October 2025

Green Chemistry Techniques and Tools

Green Synthesis Methods: Alternative solvents and reaction conditions, Use of renewable feedstock; Catalysis in Green Chemistry: Types of catalysis (homogeneous, heterogeneous, biocatalysis), Benefits of using catalysts in reducing waste and energy consumption.

Test

November 2025

Future Trends and Research

Emerging Technologies: Advances in green chemistry research and technology, Nanotechnology and its applications in green chemistry.

Revision

COURSE TITLE: HUMAN VALUES AND ETHICS

CLASS - B. SC. PHYSICAL SCIENCE (ROLL NO. 1-80))

COURSE CODE: VAC-1

COURSE ID: UG-VAC-1-1

July/August 2025

Human Values: Definition and types of values: personal, social and cultural, Core Values.

Presentation by students

September 2025

Ethics: Definition, Ethics vs. Values, Importance of Ethics, The role of ethics in society, Integrity: Meaning and its role in personal life.

Test

October 2025

Ethical Dilemma: Meaning and nature, common ethical dilemmas, ethical decision making: meaning and steps in ethical decision making: identifying the problem, considering options, evaluating consequences, making a decision.

Assignment

November 2025

Challenges for ethical practices in institutions: Ragging, suicide and need for educational counseling, violence and peaceful protest, conflict resolution.

Revision

Course Title: Human Values and Ethics

Course Code: VAC-1

Course ID: UG-VAC-1-1

Faculty: Ms. DYPSY Khapra

July/August 2025

Human Values: Definition and types of values: personal, social and cultural, Core Values.

Presentation by students

September 2025

Ethics: Definition, Ethics vs. Values, Importance of Ethics, The role of ethics in society, Integrity: Meaning and its role in personal life.

Test

October 2025

Ethical Dilemma: Meaning and nature, common ethical dilemmas, ethical decision making: meaning and steps in ethical decision making: identifying the problem, considering options, evaluating consequences, making a decision.

Assignment

November 2025

Challenges for ethical practices in institutions: Ragging, suicide and need for educational counseling, violence and peaceful protest, conflict resolution.

Revision

5th Semester

Organic Chemistry

Name of Faculty:- DYPSY KHAPRA

Class :- B.Sc. III Biotech.

July-August

NMR Spectroscopy-I

Principle of nuclear magnetic resonance, the PMR spectrum,number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift,shielding and deshielding of protons, proton counting ,splitting of signals and coupling constants, magnetic equivalence of protons.

Test

September

NMR Spectroscopy-II

Discuss ion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide,

1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone..Simple problems on PMR spectroscopy for structure determination of organic compounds.

Assignment on NMR Spectroscopy-ll.

Test of NMR Spectroscopy.

October

Carbohydrates-I

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 threodiastereomers. Conversion of glucose in to mannose. Formation of glycos ides, ethers and esters.

Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism ofmutarotation. Structures of ribose and deoxyribose.

November

Carbohydrates-II

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Organometallic Compounds .

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.

Revision.

Reference Books:

1. **Modern Organic Chemistry, BSc part 3, Semester 5, by Dr. J.M. Seghal.**
2. **Pradeep's Organic Chemistry, Vol. 3, Semester 5, by Dr. S.N. Dhawan.**

Faculty Name : Rustam Singh
Class: B.Sc. Physical Science 1st Sem
Subject : Chemistry
Course Code: 240/CHEP/CC/101

July August 2025

Unit 1 :Atomic Structure & Periodic Properties

Quantum numbers, Aufbau and Pauli exclusion principles, Hund's rules of maximum multiplicity. Periodic classification of elements into s, p d & f block elements and electronic configuration, screening effect, effective nuclear charge and Slater's rules, discussion and trends of the following properties of representative elements (s & p block): atomic and ionic radii, ionization enthalpy, electron gain enthalpy and electronegativity (Pauling's/ Mulliken's/ Allred Rachow's scale).

Problem solving and Lesson Test

September

UNIt II :Chemical Bonding - Part I

Ionic Bonding: Lattice energy, Born-Haber cycle, ionic radii; Metallic Bonding: conductors, semiconductors, and insulators; Weak forces: Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, instantaneous dipole-induced dipole interactions, hydrogen bonding. Covalent Bonding: Valence bond theory (Heitler-London approach) and its limitation, directional characteristics of covalent bond, type of hybridization and shapes of simple inorganic molecules and ions (BeF2, BF3, CH4, PF5, SF6, IF7, SO4-2 , ClO4-1, NO3-1)

Problem solving Numerical Analysis and Lesson test

October

UNIT III

Basic Concepts in Organic Chemistry

Classification and Nomenclature of organic compounds. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their comparison & applications. Reaction intermediates: Carbocations, Carbanions, Free radicals, Carbenes, arynes and nitrenes (Types, shape, structure, Mechanistic study and relative stability)

Stereochemistry and Conformational Analysis

Isomerism: Types of isomerism, Optical isomerism: elements of symmetry, Optical Activity, Molecular chirality/asymmetry, Enantiomers, Diastereoisomers, Assignment of chapter 3

November

Meso compounds, Racemic mixture and resolution. Relative and absolute configuration: D/L designation, Geometric isomerism: Cis-Trans and E & Z nomenclature, Conformational isomerism: Conformational analysis of ethane and n-butane; chair, boat, half chair and twist boat conformations of cyclohexane (interconversions and energy level diagram).

UNIT IV

Quantum Mechanics:

Planck's black body radiation, Photoelectric effect, Bohr's theory, de Broglie postulate, Heisenberg's Uncertainty Principle; Schrödinger's wave equation (including mathematical treatment), postulates of quantum mechanics, normalized and orthogonal wave functions, its complex conjugate (idea of complex numbers) and significance of $\Psi 2$

Problem solving Numerical Analysis and Lesson test

December

Operators; Particle in one-dimension box, radial and

angular wave functions for hydrogen atom, radial probability distribution; Finding

maxima of distribution functions (idea of maxima and minima), energy spectrum

of hydrogen atom; Shapes of s, p, d and f orbitals

Revision and problem solving

Mid term exam of complete syllabus

Name of Faculty: Rustam Singh

Class: B.Sc. Non Medical, 5th sem

Physical Chemistry

Class :- B.Sc (Non med) A+B

Subject code:- CH-502

July to 31 Aug

Quantum Mechanics-I

Black-body radiation, Plank's radiation law, photoelectric effect, heat capacity of solids, Compton effect,wave function and its significance of Postulates of quantum mechanics ,

September

mechanical operator, commutation relations, Hamiltonial operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a partic le in one dimensional box, Pictorial representation and its significance.

Problem solving Numerical Analysis and Lesson test

October

Section-B

Physical Properties and Molecular Structure

Optica l activity, polarization – (clausius – Mossotti equation). Orientation of dipoles in an electric field, dipole moment, included dipole moment, measurement of dipole moment, temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination.Applica tion of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetics.

Problem solving and Assignment

November

Section-C

Spectroscopy-I

Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Bornoppenheimer approximation, Degrees of freedom.

Rotational Spectrum

Diatomic molecules. Energy levels of rigid rotator (semi-classical principles), selection rules, spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Spectroscopy-II

Vibrational spectrum

Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effects of anharmonic motion and isotopic effect on the spectra., idea of vibrational frequencies of different functional groups.

Problem solving and lesson test

December

Raman Spectrum:

Concept of polarizibility, pure rotational and pure vibrational Raman spectra of diatomic molecules, selectin rules, Quantum theory of Raman spectra.

Problems from entire syllabus and numerical discussion

Test of entire syllabus of physical chemistry

Course Title: Human Values and Ethics

Course Code: VAC-1

Course ID: UG-VAC-1-1

Faculty: Dr. Deepak Kumar

July/August 2025

Human Values: Definition and types of values: personal, social and cultural, Core Values.

Presentation by students

September 2025

Ethics: Definition, Ethics vs. Values, Importance of Ethics, The role of ethics in society, Integrity: Meaning and its role in personal life.

Test

October 2025

Ethical Dilemma: Meaning and nature, common ethical dilemmas, ethical decision making: meaning and steps in ethical decision making: identifying the problem, considering options, evaluating consequences, making a decision.

Assignment

November 2025

Challenges for ethical practices in institutions: Ragging, suicide and need for educational counseling, violence and peaceful protest, conflict resolution.

Revision

Subject: Inorganic Chemistry (Theory)

Class: B.Sc. Pass Course (Non-Medical)

Semester: 5th Semester

Faculty: Dr Deepak Kumar

Paper ID (Theory): 180PA503331A

16th July to August 2025:

Metal-ligand bonding in transition metal complexes

Limitations of valance bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planer complexes, factors affecting the crystal field parameter.

September 2023

Thermodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes of Pt(II).

Assignment

October 2023

Magnetic properties of transition metal complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

Test of Metal-ligand bonding in transition metal complexes.

November 2023

Electronic spectra of transition metal complexes

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d_1 and d_9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Test.

5th Semester

Physical Chemistry

Name of Faculty:- Mrs. Pooja

Class :- Biotechnology

16 July to 31 August

Quantum Mechanics-I
Black-body radiation, Plank's radiation law, photoelectric effect, heat capacity of solids, Compton effect, wave function and its significance of Postulates of quantum mechanics ,

September

mechanical operator, commutation relations, Hamiltonian operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a particle in one dimensional box, Pictorial representation and its significance.

October
Section-B
Physical Properties and Molecular Structure

Optical activity, polarization – (clausius – Mossotti equation). Orientation of dipoles in an electric field, dipole moment, included dipole moment, measurement of dipole moment, temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties – Para magnetism, diamagnetism and ferromagnetics.

Section-C

Spectroscopy-I

Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Bornoppenheimer approximation, Degrees of freedom.

November

Rotational Spectrum
Diatomic molecules. Energy levels of rigid rotator (semi-classical principles), selection rules, spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Spectroscopy-II

Vibrational spectrum
Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effects of anharmonic motion and isotopic effect on the spectra., idea of vibrational frequencies of different functional groups

Raman Spectrum:
Concept of polarizibility, pure rotational and pure vibrational Raman spectra of diatomic molecules, selectin rules, Quantum theory of Raman spectra.

3rd Semester

MINOR (Bioinorganic Chemistry)

Name of Faculty:- Mrs. Pooja

Class :- B.Sc. physical Science

16 July to August

Carbohydrates-I

Occurrence, classification and their biological importance. Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projection and conformational structures; Interconversion of aldoses and ketoses; Killiani-Fischer synthesis and Ruff Degradation

September

Carbohydrates-II

Disaccharides – Structure elucidation of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch, cellulose and glycogen.

Lipids

Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity

Assignment on Carbohydrates (I And II) and Test of unit 1 and II

OCTOBER

Nucleic Acids-I

Structure of components of nucleic acids: Bases, Sugars, Nucleosides and Nucleotides. Nomenclature of nucleosides and nucleotides, structure of polynucleotides: DNA (Watson-Crick model, Chargaff's rules) and RNA (m-RNA, r-RNA and t-RNA)., concept of DNA duplex formation and its characterization. Biological roles of DNA and RNA.

NOVEMBER

Nucleic Acids-II

Genetic Code and its charactersitics, codon-anticodon pairing (Wobble hypothesis).

Replication of DNA: Maselson-Stahl experiment, mechanism of replication (Initiation, Elongation and Termination).

Transcription: Promoters site, Initiation, Elongation, Termination.

Translation: Activation of amino acids, Initiation, Elongation, Termination.

Problem Solving and the test of unit 3 and 4

5th Semester

Organic Chemistry

Name of Faculty:- Ms. Navita

Class :- B.Sc. III Medical

July-August

NMR Spectroscopy-I

Principle of nuclear magnetic resonance, the PMR spectrum,number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift,shielding and deshielding of protons, proton counting ,splitting of signals and coupling constants, magnetic equivalence of protons.

Test

September

NMR Spectroscopy-II

Discuss ion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide,

1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone..Simple problems on PMR spectroscopy for structure determination of organic compounds.

Assignment on NMR Spectroscopy-ll.

Test of NMR Spectroscopy.

October

Carbohydrates-I

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 threodiastereomers. Conversion of glucose in to mannose. Formation of glycos ides, ethers and esters.

Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism ofmutarotation. Structures of ribose and deoxyribose.

November

Carbohydrates-II

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Organometallic Compounds .

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.

Revision.

Reference Books:

3. **Modern Organic Chemistry, BSc part 3, Semester 5, by Dr. J.M. Seghal.**
4. **Pradeep's Organic Chemistry, Vol. 3, Semester 5, by Dr. S.N. Dhawan.**

Course Title: Human Values and Ethics

Course Code: VAC-1

Course ID: UG-VAC-1-1

Faculty: Ms. Navita

July/August 2025

Human Values: Definition and types of values: personal, social and cultural, Core Values.

Presentation by students

September 2025

Ethics: Definition, Ethics vs. Values, Importance of Ethics, The role of ethics in society, Integrity: Meaning and its role in personal life.

Test

October 2025

Ethical Dilemma: Meaning and nature, common ethical dilemmas, ethical decision making: meaning and steps in ethical decision making: identifying the problem, considering options, evaluating consequences, making a decision.

Assignment

November 2025

Challenges for ethical practices in institutions: Ragging, suicide and need for educational counseling, violence and peaceful protest, conflict resolution.

Revision

Course Title: Chemistry Lab Operation and Safety Measures

Course Code: SEC-1

Course ID: 240/CHE/SE/101

Faculty: Ms. Navita

July-August

Introduction to Laboratory Operations; Overview of laboratory types and functions; Organization of a chemistry laboratory; Common laboratory equipment and their uses; Standard operating procedures (SOPs); Good Laboratory Practices (GLP)

September

Laboratory Safety Principles; Importance of laboratory safety; Safety data sheets (SDS); Personal protective equipment (PPE); Laboratory ventilation and fume hoods; Chemical hygiene plan

Assignment

October

Chemical Handling and Disposal; Proper storage of chemicals; Labelling and documentation; Handling of hazardous chemicals; Waste management and disposal procedures; Spill response and cleanup

Class Test

November

Emergency Procedures and First Aid; Fire safety and emergency exits; Use of fire extinguishers and fire blankets; First aid procedures for chemical exposure; Emergency eyewash and shower stations; Reporting accidents and incidents

Revision

Reference Books :

4. "Laboratory Techniques in Organic Chemistry" by S. V. Sharma
5. "Laboratory Safety: Theory and Practice" by S. S. Mathur
6. Manual of Laboratory Safety by Nigam R. And nigam P., Laxmi Publications

5th Semester

Physical Chemistry

Name of Faculty:- Mrs. Rupali

Class :- Biotechnology

16 July to 31 August

Quantum Mechanics-I

Black-body radiation, Plank's radiation law, photoelectric effect, heat capacity of solids, Compton effect, wave function and its significance of Postulates of quantum mechanics ,

September

mechanical operator, commutation relations, Hamiltonian operator, Hermitian operator, average value of square of Hermitian as a positive quantity, Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a particle in one dimensional box, Pictorial representation and its significance.

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3rd Semester

MINOR (Bioinorganic Chemistry)

Name of Faculty:- Mrs. Rupali

Class :- B.Sc. physical Science

16 July to August

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Problem Solving and the test of unit 3 and 4