TEACHING PLAN

PREM CHAND MARKANDA COLLEGE FOR WOMEN, JALANDHAR CITY

Re-accredited 'A+' grade (2nd Cycle) by NAAC Bangalore

A unique prestigious Post Graduate Institution of Northern India **DEPARTMENT OF CHEMISTRY**

ODD SEMESTER

B.sc non medical

Session-2024-2025

Semester- Sem-I

Faculty Name- Ms. Pooja singh

Subject- Inorganic chemistry-I (theory)

TOPIC	DURATION	TEACHING TOOLS
Atomic Structure- Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, Quantum numbers, Shapes of s, p, d and f orbitals. Aufbau's and Pauli's Exclusion principle, Hund's multiplicity rule.	July-august	**Lecture based teaching learning** (chalk and talk) **Group discussion,** **jigsaw method,peer teaching,formative assessments,class test**

Electronic configurations of the elements and ions. **Periodic Properties-** Position of elements in the periodic table; effective nuclear charge and its calculations. Details of atomic and ionic radii, ionization energy, electron affinity and electronegativity.		
Ionic Solids: Concept of close packing, Ionic structures, radius ratio rule and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born–Haber cycle. Fajan's rule, Weak Interactions –Hydrogen bonding, van der Waals forces. ***Chemical Bonding-I:*** Covalent Bond–Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, Valence shell electron pair repulsion	september	**Lecture based teaching learning** (chalk and talk) **Group discussion,** **jigsaw method,peer teaching,formative assessments,claas test**

(VSEPR) theory, homonuclear and heteronuclear diatomic molecules. Multicentre bonding in boranes, Percentage ionic character from dipole moment and electronegativity difference.		
s- and p-block elements and their comparative study: General remarks about each group (I-VIII), trends in electronic configuration, atomic and ionic radii, ionization potential, electron affinity, electronegativity, oxidation states, Melting and boiling point, density, electropositive or metallic character, flame colouration. Lattice energies. Photoelectric effect, inert pair effect, catenation and hetero catenation. Anomalies in first and second row elements. Chemical properties in details. ***Acids and Bases:*** Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.	October	**Lecture based teaching learning** (chalk and talk) **Group discussion,** **jigsaw method,peer teaching,formative assessments,** T**echnology based learning** (you tube videos on different topics) **Self study** (library visit) class test.
p-Block Elements: Group	November	**Lecture based teaching learning**

13: General characteristics, Atomic and ionic radii, melting and boiling point, Ionisation energies, Oxidation states, Electropositive character, Tendency to form covalent compounds. Compounds of group 13: Hydrides, Oxides and hydroxides, Oxoacid; Structure and Properties of Boric acid, Preparation, properties and structure of Diborane, Borazine, Boron halides: Boron hydrides (LiBH4, NaBH4), Anomalous behaviour of Boron and its diagonal relationship with Silicon. ***Group 14:*** General characteristics; Atomic radii, Ionisation energies, Melting and boiling point, oxidation state, metallic character, catenation, Allotropy, Tendency to form multiple bonding. Compounds of group 14: Hydrides of silicon: preparation and properties, toxic nature of CO, Dioxide of carbon and silicon. Comparison of carbon tetrachloride and silicon tetrachloride. Chemistry of Fullerenes.		(chalk and talk) **Group discussion,** **jigsaw method,peer teaching,formative assessments,** **Inquiry based learning** **Individual learning** **class test.**

Course outcome

CO.1	Develop Understanding for the concepts of structure and bonding

CO.2	Enrich the knowledge of chemistry related to ionic and covalent compounds
CO.3	Ionic and chemical bonding helps students create mental models that can be applied to predict molecular geometry and explain the properties of substances.
CO.4	Exposure to theories like Lewis dot structures, VSEPR theory, and hybridization helps students visualize how atoms bond and the resulting shapes of molecules.
CO.5	Allows students to identify and explain trends such as atomic radius, electronegativity, and electron affinity across periods and down groups.

B.sc nonmedical

Semester- Semester-III

Faculty Name- Ms. Pooja Singh

Subject- Physical chemistry-II(theory)

TOPIC	DURATION	TEACHING TOOLS
Thermodynamics-I Definition of thermodynamic terms: System, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work. ***First Law of Thermodynamics:*** Statement, definition of internal energy and	July - August	**Lecture based teaching learning** (chalk and talk) **Group discussion,** **jigsaw method,peer teaching,formative assessments,claas test**

enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law, Joule-Thomson coefficient and inversion temperature, Calculation of w,q,dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.		
II.***Thermochemistry*** Standard state, types of enthalpy of reactions, standard enthalpy of formation, Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation. ***Thermodynamics-II*** ***Second Law of Thermodynamics:*** Need	September	**Lecture based teaching learning** (chalk and talk) **Group discussion,** **jigsaw method,peer teaching,formative assessments,claas test**

for the law, different statements of the 2nd law, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. Concept of Entropy : Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.		
Thermodynamics-III ***Third Law of Thermodynamics:*** Nernst heat theorem, statement	October	**Lecture based teaching learning** (chalk and talk) **Group discussion,**

and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P,V and T. Equilibrium V.***Chemical Equilibrium*** Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of Kp, Kc, Kaand their relationship, Clausius-Clapeyron equation, applications. ***Introduction to Phase Equilibrium*** Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water,		**jigsaw method,peer teaching,formative assessments,claas test**

CO_2 and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, NaCl-H_2O, $FaCl_3$-H_2O and $CuSO_4$-H_2O system. Freezing mixtures, acetone-dry ice.		
Partially miscible liquids Phenol-water, triethylamine-water, Nicotine-water System. Lower and upper consulate temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation and applications.	November	**Lecture based teaching learning** (chalk and talk) **Group discussion,** **jigsaw method,peer teaching,formative assessments,claas test**

Course outcome

CO.1	fundamental understanding of thermodynamic principles
CO.2	enhanced problem solving and critical thinking skills
CO.3	Understanding and applying the laws to solve problems involving energy transfers, heat, and work helps students develop critical thinking and quantitative problem-solving skills.
CO.4	student learn to integrate mathematical formulas with theoretical concepts
CO.5	Students develop the ability to interpret phase diagrams, which graphically represent the regions of stability for each phase and the conditions under which phase transitions occur

B.Sc non medical

Semester- Semester-III

Faculty Name- Ms. Muskan kalra

Subject- Organic Chemistry-II(theory)

TOPIC	DURATION	TEACHING TOOLS
Stereochemistry Organic Compounds Concept of isomerism. Types of isomerism.Optical isomerism-elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and	July - August	**Lecture based teaching learning** (chalk and talk) **Group discussion, jigsaw method,peer teaching,formative assessments,claas test**

absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism determination of configuration of geometric isomers. E & Z system of nomenclature. **Conformational isomerism**– conformational analysis of ethane and n–butane; conformation of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.		
Classification and nomenclature. Monohydric alcohols—nomenclature. Acidic nature. Reactions of alcohols, cleavage of O-H bond, C-O bond and dehydration reactions, regioselectivity of dehydration. Dihydric alcohols—nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAC)4] and [HIO4] and pinacol-pinacolone rearrangement. **Phenols** Nomenclature, structure and bonding, Preparation of phenols, physical properties	September	**Lecture based teaching learning** (chalk and talk) **Group discussion, jigsaw method,peer teaching,formative assessments,claas test**

and acidic character, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols—electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Reimer Tiemann reaction.		
Preparation of Aldehydes and Ketones Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. **Properties of Aldehydes and Ketones** Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Witting reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of Ketones,	October	**Lecture based teaching learning** (chalk and talk) **Group discussion, jigsaw method,peer teaching,formative assessments,claas test**

Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, LIAIH4 and NaBH4 reductions. Halogenation of enolizable ketones.		
Coupling reaction using Transition metal/metal complexes (formation of C-C bonds): concept of Homo and Cross coupling reactions with emphasis on Glaser reaction, Ullman reaction, Sonogashira, Suzuki, Hiyama, Negishi and Kumada coupling reaction**s.**	November	**Lecture based teaching learning** (chalk and talk) **Group discussion, jigsaw method,peer teaching,formative assessments,claas test**

CO.1	Students will be able to identify chiral centers and understand the properties of enantiomers, including their mirror-image relationship and how they interact with polarized light.
CO.2	Students will be proficient in the IUPAC rules for naming stereoisomers and the use of R/S (Cahn-Ingold-Prelog) notation for identifying the absolute configuration of chiral centers.
CO.3	Being able to predict reaction pathways, intermediate compounds, and products with a clear understanding of the factors involved.
CO.4	Applying knowledge gained in lectures to practical lab work to reinforce the understanding of organic synthesis and analysis.
CO.5	Students will know about the reactions are used to form carbon-carbon bonds between aromatic compounds, creating complex molecules.

B.sc nonmedical

Semester- Semester-V

Faculty Name- Ms. Pooja Singh

Subject- inorganic chemistry-IV(theory)

TOPIC	DURATION	TEACHING TOOLS
1. ***Metal-ligand Bonding in Transition Metal Complexes*** Limitations of valence bond theory, an elementary idea of crystalfield theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, crystal field stabilization energy for d-orbital electrons in tetrahedral and octahedral complexes, Spectrochemical series, factors affecting the crystalfield parameters, Structural and Thermodynamic effects of inner orbital splittings, Jahn-Teller effects ***Magnetic Properties of Transition Metal Complexes*** Types of magnetic behaviour, methods of determining magnetic susceptibility by Gouy's and Faraday method. Variation of magnetic	July-August	**Lecture based learning** (chalk and talk) **Group teaching and learning, formative assessments,claas test**

susceptibility with temperature, ferromagnetic and antiferromagnetic substances, spin-only formula. L-S coupling, correlation of μs and μeff values, orbital contribution to magnetic moments, application of magnetic moment data for characterization of 3d-metal complexes. Temperature independent paramagnetism, anomalous magnetic moment, paramagnetic and diamagnetic equilibrium.		
Thermodynamic and Kinetic Aspects of Metal Complexes A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, Nucleophilic Substitution reactions in square planar complexes: rate law, Trans- effect, Mechanism of nucleophilic substitution in square planar complexes.	September	**Lecture based teaching learning** Chalk and talk **formative assessments,claas test**

electronic Spectra of Transition Metal Complexes Term symbols and coupling scheme, LS coupling, calculation of ground term state, microstates, Types of electronic transitions, selection rules and relaxations, splitting of Russel-Saunder states in octahedral and tetrahedral, spectrochemical series, Os, Orgel diagram of one electron-one hole system (d1, d4, d6 & d9) and two electron-two hole system (d2, d3, d7 & d8) in octahedral and tetrahedral complexes. Study of electronic transition in Cr3+ (octahedral), Co2+ (octahedral & tetrahedral), Mn2+ (octahedral), Ni2+ (octahedral) complexes. Limitation of Orgel diagram.		

Organometallic Compounds: Definition, nomenclature and classification of organometallic compounds. σ and π complexes, types of organoligands, EAN rule, bonding in organometals, Preparation, properties, bonding and applications of alkyllithium and organoaluminium compounds (AlR3).Metal olefin complexes, bonding in metal-ethylenic complexes,	October	**Lecture based teaching learning** Chalk and talk **Any other** (class tests.) **Self study**
Mechanism of homogeneous hydrogenation reactions of alkene. Metal carbonyls: examples and bonding.	November	Any other (seminar) **Self study**

CO.1	understanding of the fundamental principles of coordination chemistry, including the definition of ligands, coordination number, and the nature of metal-ligand interactions.
CO.2	Students should be able to explain and apply the basic principles of CFT to predict the

	properties of coordination complexes ,such as their color ,magnetism and stability.
CO.3	students learn to solve problems related to calculating the oxidation state of metals in coordination compounds, identifying ligands, and determining the coordination number.
CO.4	Acquire the ability to synthesize organometallic compounds through various methods
CO.5	Understand the applications of organometallic compounds in various fields like organic synthesis, catalysis

B.sc nonmedical

Semester- Semester-V

Faculty Name- Ms. Muskan Kalra

Subject- Physical chemistry - III(Theory)

TOPIC	DURATION	TEACHING TOOLS
Electrochemistry – I Conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution, Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. DebyeHuckel-Onsager's equation for strong electrolytes (elementary treatment only).	July	**Lecture based teaching learning** Chalk and talk **Formative assessment, Class test,**

Migration of ions, Transport number: definition and determination by Hittorf method and moving boundary method, factors affecting transport number. Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility product of sparingly soluble salt, conductometric titrations. Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.Standard electrode potential, standard hydrogen electrode, reference electrodes, sign conventions, electrochemical series and its significance. Nernst equation, derivation of cell E.M.F. and single electrode potential. EMF of a cell and its measurements. Calculation of thermodynamic quantities of cell reactions (ΔG,ΔH and K). Types of reversible electrodes: gas- metal ion, metal ion, metal insoluble salt-anion and redox electrodes. Electrode reactions. EMF of reversible electrodes. **Electrochemistry – II** Polarization, over potential, hydrogen overvoltage and its application. Concept of activities and activity	August	

coefficient. Concentration cells with and without transference, liquid junction potential, application of concentration cells, valency of ions, solubility product and pH determination, potentiometric titrations.		
<u>Nuclear Chemistry</u> Introduction: Radioactivity, Nuclear Structure, Size of Nucleus, Mass Defects and Binding Energy, Nuclear Stability, Nuclear Forces, Nuclear Spin and Moments of Nuclei, Nuclear Models, Nuclear Decay Processes, The Laws of Radioactive Decay, Soddy-Fajans Group Displacement Law, Rate of Nuclear Decay and Half Life Time (Kinetics of Radioactive Decay), Induced Nuclear Reactions, Types of Nuclear Processes, High Energy Nuclear Reactions, Nuclear Reaction Cross-Section, Artificial radioactivity, Detection and Measurement of Radioactivity, Nuclear Fission, Nuclear Fusion, Applications of Radioactivity**.** **Spectroscopy** Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-	September	**Lecture based teaching learning** Chalk and talk **Formative assessment, Class test,**

Oppenheimer approximation, degrees of freedom. **Rotational Spectrum** Diatomic molecules. Energy levels of a rigid rotor (semi classical principles), selection rules, spectral intensity and position of lines, distribution using population distribution (MaxwellBoltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.		
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, effect of an harmonic motion and isotope on the spectrum, vibration-rotation spectra, P, Q and R branches, structural information from IR spectra, idea of vibrational frequencies of different functional groups. Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules, O, Q and S branches. Comparison with IR spectra.. **Electronic Spectrum**	October	**Lecture based teaching learning** Chalk and talk **Formative assessment, Class test,**

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of σ, π, and n M.O., their energy levels and the respective transitions.		
<u>Raman Spectrum</u>: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules, O, Q and S branches. Comparison with IR spectra.	November	**Lecture based teaching learning** Chalk and talk **Formative assessment, Class test,**

CO.1	Comprehend the basic concepts of electrochemistry, including oxidation-reduction reactions, electrochemical cells, and standard electrode potentials.
CO.2	Be able to design and analyze electrochemical cells for practical use in energy storage and conversion.
CO.3	Be able to predict the spontaneity of electrochemical reaction and calculate cell potential
CO.4	Students gain a deeper understanding of the basic principles of nuclear chemistry, including radioactivity, nuclear reactions, radioactive decay, isotopes, and their properties.
CO.5	Students develop a deeper understanding of the electronic, vibrational, and rotational structures of molecules and atoms.

EVEN SEMESTER

B.sc nonmedical

Semester- Semester-II

Faculty Name- Ms.Pooja Singh, Ms. Muskan Kalra

Subject- organic chemistry-I Hydrocarbon and alkyl halides

TOPIC	DURATION	TEACHING TOOLS
Hybridization, localized and delocalized chemical bond, Electron displacement, Use of arrows, Types of reagents, Reactive Intermediates: Carbocations, Carbanions, Free radicals Carbenes, arenes and Nitrenes. Stereochemistry: Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions, Geometrical isomerism, E/Z notations with C.I.P rules, Optical Activity, enantiomeric and diastereomeric excess,	January-February	**Lecture based teaching learning** Chalk and talk **Formative assessment, Class test,**

Chirality/Asymmetry, Enantiomers, Diastereoisomers, Racemic mixture and resolution, optical activity in absence of chiral carbon, Relative and absolute configuration: D/L and R/S designations, ***Chemistry of alkanes:*** methods of formation of alkanes, Free radical substitutions: Halogenation -relative reactivity and selectivity. Cycloalkanes and Conformational Analysis: Baeyer strain theory, Conformation analysis, relative stability and energy diagrams of ethane, propane, butane, cyclohexane and Chair, Boat and Twist boat forms of cyclohexane.		
Chemistry of alkenes/alkynes: Nomenclature and Formation of alkenes and alkynes, Mechanism of E1 and E2 reactions, Saytzeff and Hofmann eliminations. Mechanisms and Reactions of alkenes, reduction, syn and anti-hydroxylation (oxidation), 1,2- and 1,4addition reactions in conjugated dienes and Diels-	March	Lecture based teaching learning Informational based videos Any other (assignment)

Alder reaction, mechanism of allylic and benzylic bromination. Reactions of alkynes. Aromaticity: Huckel's rule, aromatic ions. Nomenclature of benzene derivatives. The aryl group, Aromatic nucleus and side chain. Structure of benzene: Molecular formula and Kekule structure. Stability and C-C bond lengths of benzene, resonance structure. Aromatic electrophilic substitution–general pattern of the mechanism, role of σ and π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reactions		
Energy profile diagrams. Activating and deactivating substituents, reactivity and orientation of disubstitution. Side chain reactions of benzene derivatives. Methods of formation and chemical reactions of alkylbenzenes. ***Alkyl halides:*** Methods of	April	Lecture based teaching learning Technology based learning Self study(library visit) class test

preparation, details of nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent, nucleophilic substitution vs. elimination.		
Aryl halides: Preparation, including preparation from diazonium salts, nucleophilic aromatic substitution in details; SNAr, Benzyne mechanism. Relative reactivity and mechanism of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions in details.	May	Lecture based learning Seminars Self study

CO.1	The students will learn about the basic chemistry of organic compounds along with methods of formation and reactions of alkanes, cycloalkanes, alkenes, alkynes, aromatic compounds, alkyl halides and their derivatives
CO.2	Develop deeper understanding of alkyl halides and aryl halides
CO.3	ability to predict and explain the behavior of aromatic compounds, a strong grasp of reaction mechanisms
CO.4	Develop deeper understanding of Energy profile diagrams, Activating and deactivating substituents, reactivity and orientation of disubstitution
CO.5	Enrich the knowledge of Relative reactivity and mechanism of alkyl, allyl/benzyl, vinyl and aryl halides

B.sc nonmedical

Semester- Semester-IV

Faculty Name- Ms. Muskan Kalra

Subject- Inorganic chemistry-III (Theory)

TOPIC	DURATION	TEACHING TOOLS
Coordination Compound Nomenclature of coordination compounds, Werner's coordination theory and its experimental verification, effective atomic number, polydentate, chelating ligands and chelation, factors affecting stability of chelates, structural and stereoisomerism in coordination compounds with co-ordination number 4 and 6, resolution of racemic mixture, Valence bond theory of transition metal complexes, hybridization and geometry of complexes of Cr ions, Fe and its ions, Co3+, Ni and its ions, Cu2+. Magnetic properties and colour of coordination compounds. Application of coordination	January-February	**Lecture based teaching learning** (Chalk and talk) **Group discussion**

compounds. **<u>Non-aqueous Solvents</u>** Physical properties of a solvent and their role in chemical reaction. Types of solvents and their general characteristics, types of reactions in non-aqueous solvents. Characteristics properties and reactions of liquid NH3 and liquid SO2 as non-aqueous solvents.		
<u>Oxidation and Reduction</u> Oxidation-reduction as electron transfer reaction, oxidation number, redox reactions, Use of redox potential data (electrochemical series), analysis of redox cycle, redox stability in water, brief description and uses of Frost, Latimer and Pourbaix diagrams. **<u>Chemistry of Lanthanide Elements</u>** Electronic structure, general charaters of lanthanide, oxidation states, magnetic properties, atomic and ionic radii, lanthanide contraction, cause and consequences. Methods of separation of lanthanide from each other,	March	**Lecture based teaching learning** (Chalk and talk) **Any other** (assignment) Class test

Electronic absorption and uses of lanthanides.		
Chemistry of Actinides General features and chemistry of actinides, Electronic and magnetic properties of actinides and their general comparison with the lanthanide elements, similarities between the later actinides and the later lanthanides. Use as nuclear fuel, transuranic elements. **Bioinorganic Chemistry** Essential and trace elements in biological processes, essential bulk elements and their role in biological processes. Metalloporphyrins with special reference to haemoglobin and myoglobin. Role and function of haemoglobin and myoglobin. Chemistry of transfer of O2 and CO2.	April	**Lecture based teaching learning** (Chalk and talk) Individual learning
Biological role of alkali (Na+& K+) and alkaline earth metal ions with special reference to Ca2+ and Mg2+. Importance of trace elements in biology.	May	Lecture based teaching learning (Chalk and talk) Revision

CO.1	Students gain a deep understanding of coordination chemistry, including the nature of

	coordinate covalent bonds, ligands, and the central metal atom. They learn about the different types of coordination compounds, their structures, and how to predict their geometry.
CO.2	Gain knowledge about the types of non-aqueous solvents (e.g., organic solvents, ionic liquids, supercritical fluids).
CO.3	Develop skills to select the most appropriate solvent for a given reaction or process based on factors like solvent polarity, reactivity, and environmental impact.
CO.4	Understanding the Concepts of Oxidation and Reduction:
CO.5	Understand the Role of Metal Ions in Biology: Recognize the importance of transition metal ions in biological systems, particularly in enzyme catalysis, electron transport, and oxygen transport (e.g., hemoglobin and myoglobin).

B.Sc Non medical

Semester- Semester-IV

Faculty Name- Ms.Pooja Singh

Subject- Organic Chemistry-III (Theory)

TOPIC	DURATION	TEACHING TOOLS
Carboxylic Acids _____Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. **Carboxylic Acids Derivatives** Structure and nomenclature	January- February	Lecture based teaching learning Group discussion Individual learning

of acid chlorides, esters, amides and acid anhydrides, Relative stability & reactivity of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic). **Ethers and Epoxides** Nomenclature of ethers and methods of their formation, physical properties. Chemical reaction cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.		
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	March	Lecture based teaching learning Informational based videos Any other (assignment)

substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. **<u>Organic Compounds of Nitrogen</u>** Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, Mechanisms of nucleophilic substitution in nitroarenes and their reduction in acidic, neutral and alkaline media. Reactivity, Structure and nomenclature of amines, Methods of preparation of amines by Reductive amination of aldehydic and ketonic compounds,		
Gabriel-phthalimide reaction and Hofmann bromamide reaction. Physical properties Stereochemistry of amines. separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts **<u>Organometallic Compounds</u>** Organomagnesium Compounds: The Grignard reagents formation, structure and chemical reactions. Organolithium Compounds:	April	Lecture based teaching learning Technology based learning Self study(library visit) seminars

Formation and chemical reactions.		
Organozinc and Organo copper Compounds: Nomenclature, structural features, Methods of formation and chemical reactions.	May	Lecture based learning class test Self study

CO.1	The students will learn about the basic chemistry of organic compounds along with methods of formation and reactions of alkanes, cycloalkanes, alkenes, alkynes, aromatic compounds, alkyl halides and their derivatives
CO.2	Students will understand the physical properties of carboxylic acids, such as solubility, boiling points, and acidity.
CO.3	develop knowledge about carboxylic acid derivative , ether and epoxide
CO.4	Students learn about the structure, reactivity, and synthesis of heterocyclic compounds, which are central to fields like medicinal chemistry, materials science, and biochemistry.
CO.5	This helps in recognizing how nitrogen atoms affect polarity, basicity, and reactivity.

B.sc nonmedica

Semester- Semester-VI

Faculty Name- Mrs.Pooja singh

Subject- Physical Chemistry-IV

TOPIC	DURATION	TEACHING TOOLS
Quantum Mechanics-I Black-body radiation, Planck's radiation law, Photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. de Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box, quantization of energy levels, extension to two and three dimensional boxes, degeneracy. **Quantum Mechanics-II** Simple harmonic oscillator model of vibrational motion, setting up Schrodinger equation and discussion of solution and wave functions	January-February	Lecture based teaching learning Group discussion Formative assessment class test
Rigid rotator model of rotation of diatomic molecules transformation to spherical polar coordinates spherical harmonics and their discussion. Qualitative	March	Lecture based teaching learning Informational based videos Class test assignment

investigation H-atom, setting up Schrodinger equation, radial and angular part, radial distribution functions of 1s, 2s, 2p, 3s, 3p and 3d. **Solid State** Definition of space lattice and unit cell, Law of crystallography- (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) Symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg's Law in Reciprocal space. Determination of crystal structure of NaCl, KCl by use of Powder method; Laue's method.		
Photochemistry Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus–Drapper law, Stark–Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of flourescence, phosphorescence, non–radiative processes (internal conversion, intersystem	April	Lecture based teaching learning Technology based learning Self study Assignment

crossing),		
quantum yield, photosensitized reactions– energy transfer processes (simple examples)	May	Lecture based learning Learning through problem solving Revision class test

CO.1	Students will have a deep understanding of key concepts such as wave-particle duality, the Schrödinger equation, superposition, entanglement, and quantum measurement.
CO.2	Students should be able to grasp fundamental concepts such as crystal structures, bonding, and symmetry, as well as understand how these properties affect the physical characteristics of materials.
CO.3	Students will be able to interpret the physical meaning of mathematical solutions in terms of observables, probability distributions, and measurement outcomes.
CO.4	Students gain a deeper understanding of how light interacts with matter and initiates chemical reactions. This knowledge can extend to applications like photosynthesis, photodimerization, and photodegradation.
CO.5	Students should be able to comprehend and apply the principles of advanced quantum mechanics, such as perturbation theory, quantum scattering, and the theory of identical particles.

B.Sc non medical

Semester- Semester-VI

Faculty Name- Ms. Pooja Singh

Subject- Organic Chemistry-IV (Theory)

TOPIC	DURATION	TEACHING TOOLS
Spectroscopy Nuclear Magnetic Resonance (NMR) spectroscopy. Magnetic properties of nuclei, Principle of NMR, Proton Magnetic Resonance (1HNMR) spectroscopy, equivalent and non-equivalent protons, nuclear shielding and deshielding, choosing solvent, chemical shift and factors affecting chemical shift, spin-spin splitting, areas and peak intensity of signals, Application of PMR, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. **Electromagnetic Spectrum:**	January-February	Lecture based teaching learning Informational based videos Inquiry based learning

Absorption Spectroscopy-I Infrared (IR) Absorption spectroscopy – Introduction and principle of IR spectroscopy, Hooke's law, Fundamental vibrations, Selection rules, intensity and IR bands, factors affecting vibration frequencies, characteristic absorption of various function groups, interpretation of IR spectra of simple organic compounds.		
Electromagnetic Spectrum: Absorption Spectroscopy-II Ultraviolet (U.V.) absorption spectroscopy introduction- Beer-Lambert law, molar absorptivity, types of electronic transitions, Concept of chromophores and auxochrome, Bathochrome, hypsochrome, hyperchrome, hypochromic shifts, solvent effect on electronic transition, UV spectra of conjugated compounds, Woodward-Fieser Rule, application of UV spectroscopy. Problems based on spectroscopy	March	Lecture based teaching learning Informational based videos Inquiry based learning class test

Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques. 5. Organic Synthesis via Enolates Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.		
Carbohydrates 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 into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+)-glucose.	April	Lecture based teaching learning Technology based learning Self study assessment

Mechanism of mutarotation. Structures of ribose and deoxyribose An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. **<u>Amino Acids, Peptides, Proteins and Nucleic Acids;</u>** Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides.		
Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation. Nucleic acids: Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.	May	Lecture based learning Learning through problem solving Individual learning class test

CO.1	Students learn how to identify and troubleshoot issues with spectroscopic equipment and data interpretation.
CO.2	Students should understand the basic principles of NMR, including the behavior of nuclear spins in a magnetic field, the concept of resonance, and how energy transitions correspond to the detection of signals.
CO.3	Students should be able to explain the principles of IR spectroscopy, including the interaction between infrared radiation and molecular vibrations (stretching, bending, etc.).
CO.4	Students should be able to define carbohydrates and describe their structure, types (monosaccharides, disaccharides, and polysaccharides), and functions.
CO.5	Learners should appreciate how DNA and RNA are crucial for genetic information storage, replication, and the synthesis of proteins.