**LESSON PLAN (FROM July 2023 TO November 2023)**

**Class: B.Sc. I- Ist Sem Paper: Inorganic Chemistry Code: CCL-104**

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| **Month** | **Contents** |
| July  2023 | **Atomic Structure**  Idea of de Broglie matter waves, Heisenberg’s uncertainty principle, Atomic orbitals, quantum numbers, radial wave functions  Angular wave functions, normal and orthogonal wave functions, Significance of Ψ and Ψ2, Probability distribution curves |
| August  2023 | Shapes of s, p, d, f orbitals, Aufbau and Pauli exclusion principles, Hund’s multiplicity rules, Electronic configuration of elements  Effective nuclear charge, Slater’s rules, Back log of chapter if any, discussion and problems taken  **Periodic table and atomic properties**  Classification of periodic table into s, p, d, f blocks, Atomic and ionic radii Ionisation energy, definition, methods of determination or evaluation  Ionisation energy trend in periodic table (in s and p-block elements), Electron affinity definition, methods of determination or evaluation, Electron affinity trend in periodic table (in s and p-block elements), Electronegativity definition, methods of determination or evaluation |
| September 2023 | Electronegativity, trend in periodic table (in s and p-block elements). Pauling, Mulliken electronegativity scale, Allred Rachow and Mulliken Jaffe’s electronegativity scale,Sanderson’s electron density ratio.  Class test  **Covalent Bond**  Valence bond theory (Heitler-London and Pauling approach) and its limitations, Directional characteristics of covalent bond, various type of hybridisation and  shapes of simple inorganic molecules and ions (BeF2, BF3, CH4, PF5, SF6, IF7,  SO4-2, ClO4-1, NO3-1 )  Valence shell electron pair repulsion (VSEPR) theory to NH3,H3O+, SF4, ClF3, H2O, SnCl2, ClO3-1 and ICl2 |
| October  2023 | Molecular orbital theory of homonuclear (N2, O2) heteronuclear (CO and NO) diatomic molecules and ions, Bond energy, bond angle, bond length and dipole moments  Percentage ionic character from dipole moment and electronegativity difference, Back log of chapter if any, discussion and problems taken  **Ionic Solids**  Ionic structures (NaCl, CsCl, ZnS (Zinc blende), CaF2) size effects, radius ratio rule and its limitations  Madelung constant, Stoichiometric and Non stoichiometric defects in crystals, Lattice energy (mathematical derivation excluded) and Born-Haber cycle |
| November  2023 | Solvation energy and its relation with solubility of Ionic solids  Polarizing power and Polarisability of ions, Fajan’s rule  Back log of chapter if any, discussion and problems taken |

**LESSON PLAN (July 2023 TO November 2023)**

**CLASS: B.Sc.III VthSem**

**Paper: Inorganic Chemistry Part-I**

**Code: CCL-503(ii)**

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| Month | Contents |
| July  2023 | Acids and bases : Bronsted- Lowry concepts, conjugate acids and bases, relative strengths of acids and bases, Effects of substituent and solvent on relative strength of acids and bases  Differentiating and levelling solvents, Lewis acid–base concept, classification of Lewis acids and bases |
| August 2023 | Lux-Flood concept and solvent system concept, hard and soft acids and bases concept and application of HSAB process  General principles and metallurgy: Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon monoxide as reducing agents  Hydrometallurgy with reference to cyanide process for gold and silver, methods of purification of metals like (Al, Pb, Ti, Fe)  Methods of purification of metals like (Cu, Ni, Zn, Au), electrolytic refining, zone refining, van Arkel-de Boer process , Parting, Mond’s and Kroll process |
| September 2023 | s and p block elements: Periodicity with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy  Periodicity of s and p block elements with respect to electro negativity (Pauling scale). General characteristics of s block elements like density, melting and boiling point, flame colour and reducing nature  Oxidation states of s and p block element, inert pair effects, diagonal relationship, Anomalous behaviour of first member of s and p block groups, allotropy in C, P and S |
| October  2023 | Complex forming tendency of s block elements and preliminary idea of crown ethers and cryptates  Structure of basic beryllium acetate, salicylaldehyde/ acetylacetonate complexes of group 1 metals  Solutions of alkali metals in liquid ammonia and their properties, Common features such as ease of formation, solubility and stability of oxides, peroxides, superoxides of s block elements |
| November  2023 | Common features such as ease of formation, solubility and stability of sulphate and carbonates of s block elements,  Revision and discussion on problems |

**LESSON PLAN (July 2023 TO November 2023)**

**CLASS: B.Sc. I -1st Sem**

**PAPER: Organic Chemistry CODE: CCL-105**

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| **Month** | **Contents** |
| July  2023 | **Fundamentals of Organic Chemistry:** Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. |
| August  2023 | Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules, Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.  Strength of organic acids and bases, Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel’s rule.  **Stereochemistry:** Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. |
| September  2023 | Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds).  Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) E / Z Nomenclature (for upto two C=C systems).  **Aliphatic Hydrocarbons-I**: Alkanes: Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe’s synthesis, from Grignard reagent.  Reactions: Free radical Substitution: Halogenation. Alkenes: (Upto 5 Carbons) Preparation: |
| October  2023 | Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff’s rule);  cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. KMnO4) and trans-addition (bromine),  Addition of HX (Markownikoff’s and anti-Markownikoff’s addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.  **Aliphatic Hydrocarbons-II :** Alkynes: Preparation: Acetylene from CaC2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. |
| November  2023 | Formation of metal acetylides, addition of bromine and alk. KMnO4, ozonolysis and oxidation with hot alk. KMnO4 |

**LESSON PLAN (July 2023 TO November 2023)**

**CLASS: B.Sc. III-5thSem PAPER CODE: CCL-504 (ii)**

**PAPER: Chemistry of Main Group Elements II**

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| **Month** | **Contents** |
| July  2023 | Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis and their applications in industrial and environmental chemistry wherever applicable: Diborane and concept of multicentre bonding |
| August  2023 | Structure, bonding and properties of hydrides of Groups 13,14,15, 16, 17  Structure, bonding and properties of Oxides of N and P Oxoacids of P, S and Cl.  Halides and oxohalides of P and S (PCl3, PCl5, SOCl2 and SO2Cl2)  Interhalogen compounds, A brief idea of pseudohalides  Discussion and problems related to unit 1 and 2 |
| September  2023 | **Noble gases:** Rationalization of inertness of noble gases, clathrates  Preparation and properties of XeF2, XeF4, XeF6  Bonding in these compounds using VBT shapes of noble gas compounds using VSEPR Theory and related problems |
| October  2023 | Revision and discussion on problems of Noble Gases  **Inorganic Polymers**: Types of inorganic polymers and comparison with organic polymers, structural features, Classification and important applications of silicates  Synthesis, structural features and applications of silicones  Borazines – preparation, properties and reactions. |
| November  2023 | Cyclophosphazenes – preparation, properties and reactions.  Bonding in (NPCl2)3  Revision and discussion on problems  Revision and discussion on problems |

**LESSON PLAN (July 2023 TO November 2023)**

**B.Sc. III, Sem Vth Paper: Fuel Chemistry Code: CCS: 505 (ii)**

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| Month | Contents |
| July  2023 | Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value. |
| August  2023 | **Coal:** Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses  Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke  Coal gasification, Coal liquefaction and Solvent Refining.  Revision and discussion on problems on Unit-1 and 2  **Petroleum and Petrochemical Industry:** Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), |
| September  2023 | Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels  Fuel from waste, synthetic fuels (gaseous and liquids)  clean fuels.  Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene. |
| October  2023 | Revision and discussion on problems on Unit-3  **Lubricants**- Classification of lubricants, lubricating oils (conducting and nonconducting) Solid and semisolid lubricants  Synthetic lubricants, Properties of lubricants (viscosity index, cloud point, pore point) |
| November  2023 | Determination of lubricants (viscosity index, cloud point, pore point)  Revision and discussion on problems on Unit-4 |

**LESSON PLAN (July 2023 TO November 2023)**

**CLASS: B.Sc. II ,Sem IIIrd  Paper: Organic Chemistry Code: CCL-305**

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| Month | Contents |
| July  2023 | Carboxylic acids (aliphatic and aromatic): *Preparation:* Acidic and Alkaline hydrolysis of esters.  *Reactions:* Hell-Vohlard-Zelinsky Reaction. |
| August  2023 | **Carboxylic acid derivatives (aliphatic):** (Upto 5 carbons)  *Preparation:* Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion.  *Reactions:* Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.  Amines (Aliphatic and Aromatic): (Upto 5 carbons): *Preparation*: from alkyl halides, Gabriel’s Phthalimide synthesis, Hofmann Bromamide reaction |
| September 2023 | *Reactions:* Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO2,Schotten-Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.  **Diazonium salts**: *Preparation:* from aromatic amines. *Reactions:* conversion to benzene, phenol, dyes.  **Amino acids and Proteins:** *Preparation of Amino Acids:* Strecker synthesis using Gabriel’s phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis.  *Reactions of Amino acids*: ester of –COOH group, acetylation of –NH2 group, complexation with Cu2+ ions, ninhydrin test.  Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. |
| October  2023 | Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme).  Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid-phase synthesis.  **Carbohydrates:**  Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation |
| November  2023 | Ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) Polysacharrides (starch and cellulose) excluding their structure elucidation.  Revision of topics |

**LESSON PLAN (July 2023 TO November 2023)**

**CLASS: B.Sc. II , Sem IIIrd  Paper: Physical Chemistry Code: CCL-304**

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| Month | Contents |
| July  2023 | Thermodynamics of ideal solution: Ideal solutions and Raoult’s Law, deviations from Raoult’s law-non ideal solution, Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions, Azeotropes |
| August  2023 | Colligative properties of solutions, thermodynamic derivations of relation between amount of solute and elevation in boiling point and depression in freezing point.  Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids-Principle of steam distillation.  Phase, components and degree of freedom of a system, criteria of phase equilibrium, Gibbs phase rule and its thermodynamic derivation. |
| September  2023 | Derivation of Clausius-Clapeyron equation and its importance in phase equilibria, phase diagrams of one component systems (water and sulphur)  phase diagrams of two component systems involving eutectics, congruent and incongruent melting points (lead-silver and Na-K )  Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number, ionic mobility, Application of conductance measurements: derivation of degree of ionization of weak electrolyte, |
| October  2023 | Solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base), Concept of pH and pKa, buffer solution, Handerson Hazel Blac equation  Reversible and irreversible cells, Concept of EMF of a cell, Measurement of EMF of a cell. Nernst equation and its importance, types of electrodes. Standard electrode potential, Electrochemical series , thermodynamics of reversible cell  Calculation of thermodynamic properties: ∆G,∆H and ∆S from EMF data, calculation of equilibrium constant from EMF data |
| November  2023 | Concentration cells with transference and without transference, Liquid junction potential and salt bridge  pH determination using hydrogen electrode and quinhydrone electrode, potentiometric titrations-qualitative treatment(acid-base and oxidation-reduction only)  Revision of topics |