

LESSON PLAN (FROM August 2022 TO December 2022)

Class: B.Sc. I- Ist Sem

Paper: Inorganic Chemistry

Code: CCL-104

Month	Contents
August 2022	<p>Atomic Structure</p> <p>Idea of de Broglie matter waves, Heisenberg's uncertainty principle, Atomic orbitals, quantum numbers, radial wave functions</p> <p>Angular wave functions, normal and orthogonal wave functions, Significance of Ψ and Ψ^2, Probability distribution curves</p>
September 2022	<p>Shapes of s, p, d, f orbitals, Aufbau and Pauli exclusion principles, Hund's multiplicity rules, Electronic configuration of elements</p> <p>Effective nuclear charge, Slater's rules, Back log of chapter if any, discussion and problems taken</p> <p>Periodic table and atomic properties</p> <p>Classification of periodic table into s, p, d, f blocks, Atomic and ionic radii Ionisation energy, definition, methods of determination or evaluation</p> <p>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</p>

<p>October 2022</p>	<p>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.</p> <p>Class test</p> <p>Covalent Bond</p> <p>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 (BeF_2, BF_3, CH_4, PF_5, SF_6, IF_7, SO_4^{2-}, ClO_4^{-1}, NO_3^{-1})</p> <p>Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, ClF_3, H_2O, SnCl_2, ClO_3^{-1} and ICl_2</p>
<p>November 2022</p>	<p>Molecular orbital theory of homonuclear (N_2, O_2) heteronuclear (CO and NO) diatomic molecules and ions, Bond energy, bond angle, bond length and dipole moments</p> <p>Percentage ionic character from dipole moment and electronegativity difference, Back log of chapter if any, discussion and problems taken</p> <p>Ionic Solids</p> <p>Ionic structures (NaCl, CsCl, ZnS (Zinc blende), CaF_2) size effects, radius ratio rule and its limitations</p> <p>Madelung constant, Stoichiometric and Non stoichiometric defects in crystals, Lattice energy (mathematical derivation excluded) and Born-Haber cycle</p>
<p>December 2022</p>	<p>Solvation energy and its relation with solubility of Ionic solids</p> <p>Polarizing power and Polarisability of ions, Fajan's rule</p> <p>Back log of chapter if any, discussion and problems taken</p>

LESSON PLAN (From August 2022 To December 2022)

CLASS: B.Sc.III VthSem

Paper: Inorganic Chemistry Part-I

Code: CCL-503(ii)

Month	Contents
August 2022	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
<u>September</u> <u>2022</u>	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

<p>October 2022</p>	<p>s and p block elements: Periodicity with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy</p> <p>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</p> <p>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</p>
<p>November 2022</p>	<p>Complex forming tendency of s block elements and preliminary idea of crown ethers and cryptates</p> <p>Structure of basic beryllium acetate, salicylaldehyde/ acetylacetonate complexes of group 1 metals</p> <p>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</p>
<p>December 2022</p>	<p>Common features such as ease of formation, solubility and stability of sulphate and carbonates of s block elements,</p> <p>Revision and discussion on problems</p>

LESSON PLAN (FROM August 2022 TO December 2022)

CLASS: B.Sc. I -1st Sem

PAPER: Organic Chemistry

CODE: CCL-105

Month	Contents
August 2022	Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation.
September 2022	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.
October 2022	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:

November 2022	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. KMnO_4) 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 CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.
December 2022	Formation of metal acetylides, addition of bromine and alk. KMnO_4 , ozonolysis and oxidation with hot alk. KMnO_4

LESSON PLAN (From August 2022 To December 2022)

CLASS: B.Sc. III-5thSem

PAPER CODE: CCL-504 (ii)

PAPER: Chemistry of Main Group Elements II

Month	Contents
August 2022	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
September 2022	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 (PCl_3 , PCl_5 , SOCl_2 and SO_2Cl_2) Interhalogen compounds, A brief idea of pseudohalides Discussion and problems related to unit 1 and 2
October 2022	Noble gases: Rationalization of inertness of noble gases, clathrates Preparation and properties of XeF_2 , XeF_4 , XeF_6 Bonding in these compounds using VBT shapes of noble gas compounds using VSEPR Theory and related problems

November 2022	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.
December 2022	Cyclophosphazenes – preparation, properties and reactions. Bonding in $(\text{NPCl}_2)_3$ Revision and discussion on problems Revision and discussion on problems

LESSON PLAN (From August 2022 To December 2022)

B.Sc. III Semester Vth

Paper: Fuel Chemistry

Code: CCS: 505 (ii)

Month	Contents
August 2022	Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.
September 2022	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),
October 2022	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.
November 2022	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)

December 2022	Determination of lubricants (viscosity index, cloud point, pore point) Revision and discussion on problems on Unit-4
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LESSON PLAN (From August 2022 To December 2022)

CLASS: B.Sc. II Semester IIIrd Paper: Organic Chemistry Code: CCL-305

Month	Contents
August 2022	Carboxylic acids (aliphatic and aromatic): <i>Preparation:</i> Acidic and Alkaline hydrolysis of esters. <i>Reactions:</i> Hell-Vohland-Zelinsky Reaction.
September 2022	Carboxylic acid derivatives (aliphatic): (Upto 5 carbons) <i>Preparation:</i> Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion. <i>Reactions:</i> Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation. Amines (Aliphatic and Aromatic): (Upto 5 carbons): <i>Preparation:</i> from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction

<p>October 2022</p>	<p><i>Reactions:</i> Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO₂, Schotten-Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.</p> <p>Diazonium salts: <i>Preparation:</i> from aromatic amines. <i>Reactions:</i> conversion to benzene, phenol, dyes.</p> <p>Amino acids and Proteins: <i>Preparation of Amino Acids:</i> Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis.</p> <p><i>Reactions of Amino acids:</i> ester of –COOH group, acetylation of –NH₂ group, complexation with Cu²⁺ ions, ninhydrin test.</p> <p>Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins.</p>
<p>November 2022</p>	<p>Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C-terminal (thiohydantoin and with carboxypeptidase enzyme).</p> <p>Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid-phase synthesis.</p> <p>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</p>
<p>December 2022</p>	<p>Ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) Polysacharrides (starch and cellulose) excluding their structure elucidation.</p> <p>Revision of topics</p>

LESSON PLAN (From August 2022 To December 2022)

CLASS: B.Sc. II Semester IIIrd Paper: Physical Chemistry Code: CCL-304

Month	Contents
August 2022	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
September 2022	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.
October 2022	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,

<p>November 2022</p>	<p>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</p> <p>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</p> <p>Calculation of thermodynamic properties: $\Delta G, \Delta H$ and ΔS from EMF data, calculation of equilibrium constant from EMF data</p>
<p>December 2022</p>	<p>Concentration cells with transference and without transference, Liquid junction potential and salt bridge</p> <p>pH determination using hydrogen electrode and quinhydrone electrode, potentiometric titrations-qualitative treatment(acid-base and oxidation-reduction only)</p> <p>Revision of topics</p>