

## Lesson Plan

B. Sc. Ist Year (Ist Semester)

Paper-I (CH-101) Inorganic Chemistry (Theory)

Teacher name: Mr Amit Kumar

October 2021

**Oct. Week 3,4 :** Atomic Structure: Idea of de Broglie matter waves, Heisenberg's uncertainty principle, atomic orbitals, quantum numbers, radial and angular wave functions, normal and orthogonal wave functions, significance of  $\Psi$  and  $\Psi^2$ , probability distribution curves, shapes of s, p, d, f orbitals, Aufbau and Pauli exclusion principles, Hund's multiplicity rules,

November 2021

**Nov. Week 1,2 :** Electronic configuration of elements, effective nuclear charge, Slater's rules. Periodic table and atomic properties Classification of periodic table into s, p, d, f blocks, atomic and ionic radii.,

**Nov. Week 3,4 :** ionisation energy, electron affinity and electronegativity definition, methods of determination or evaluation, trend in periodic table (in s and p-block elements), Pauling, Mulliken, Allred Rachow and Mulliken Jaffe's electronegativity scale, Sanderson's electron density ratio.

December 2021

**Dec. Week 1,2 :** Covalent Bond Valence bond theory (Heitler-London and Pauling approach) and its limitation, directional characteristics of covalent bond,

**Dec. Week 3,4 :** various type of hybridisation and shapes of simple inorganic molecules and ions ( $\text{BeF}_2$ ,  $\text{BF}_3$ ,  $\text{CH}_4$ ,  $\text{PF}_5$ ,  $\text{SF}_6$ ,  $\text{IF}_7$ ,  $\text{SO}_4^{2-}$ ,  $\text{ClO}_4^-$ ,  $\text{NO}_3^-$ ) valence shell electron pair repulsion (VSEPR) theory to  $\text{NH}_3$ ,  $\text{H}_3\text{O}^+$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{SnCl}_2$ ,  $\text{ClO}_3^-$  and  $\text{ICl}_2^-$ .

January 2022

**Jan. Week 1,2 :** Molecular orbital theory of homonuclear ( $\text{N}_2$ ,  $\text{O}_2$ ) heteronuclear ( $\text{CO}$  and  $\text{NO}$ ) diatomic molecules and ions, bond energy, bond angle, bond length and dipole moments, percentage ionic character from dipole moment and electronegativity difference.

**Jan. Week 3,4 :** 4 Ionic Solids Ionic structures ( $\text{NaCl}$ ,  $\text{CsCl}$ ,  $\text{ZnS}$  (Zinc blende),  $\text{CaF}_2$ ) 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, Solvation energy and its relation with solubility of Ionic solids, Polarizing power and Polarisability of ions, Fajan's rule

February 2021

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# Lesson Plan

B. Sc. 1st Year (1st Semester)

Paper-II (CH-102) Physical Chemistry

Teacher name: Mr Amit Kumar

October 2021

**Oct. Week 3,4 :** Kinetic Molecular Theory of Gases, Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity.,

November 2021

**Nov. Week 1,2 :** Collision diameter, collision number, collision frequency and mean free path (Derivations excluded), Deviation of Real gases from ideal behavior.  
**Nov. Week 3,4 :** Derivation of Van der Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor) Critical Phenomenon Critical temperature

December 2021

**Dec. Week 1,2 :** critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states.  
**Dec. Week 3,4 :** the isotherms of Van der Waal's equation, relationship between critical constants and Van der Waal's constants. Critical compressibility factor.

January 2022

**Jan. week 1,2 :** The Law of corresponding states. Section-B (22 Periods) Liquid States Structure of liquids, Properties of liquids – surface tension, refractive index, viscosity, vapour pressure and optical rotation. Solid State Classification of solids, Law of constancy of interfacial angles, law of rational indices,  
**Jan. Week 3,4 :** Miller indices, elementary ideas of symmetry and symmetry elements, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of Laue method, rotating crystal method and powder pattern method.

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# Lesson Plan

B. Sc. 1st Year (1st Semester)

Paper-III (CH-103) Organic Chemistry

Teacher name: Mr Amit Kumar

October 2021

**Oct. Week 3,4 :** Structure and Bonding Localized and delocalized chemical bond, Van der Waal's interactions, resonance: conditions, resonance effect and its applications, hyperconjugation, inductive effect, Electromeric effect & their comparison. Stereochemistry of Organic Compounds Concept of isomerism. Types of isomerism.

November 2021

**Nov. Week 1,2 :** elements of symmetry, molecular chirality,—Optical isomerism enantiomers, stereogeniccentre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythrodiastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization Relative and absolute configuration, sequence rules, R & S systems of nomenclature.

**Nov. week 3,4 :** determination of configuration of—Geometric isomerism geometric isomers. E & Z system of nomenclature, conformational analysis of ethane—Conformational isomerism and n-butane, conformations of cyclohexane, axial and equatorial bonds. Newman projection and Sawhorse formulae, Difference between configuration and conformation.

December 2021

**Dec. Week 1,2 :** Mechanism of Organic Reactions Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions.

**Dec. Week 3,4 :** carbocations, carbanions, free radicals,—Reactive intermediates carbenes,(formation, structure & stability). 7 Alkanes and Cycloalkanes IUPAC nomenclature of branched and unbranched alkanes, classification of carbon atoms in alkanes. Isomerism in alkanes, sources,

January 2022

**Jan. week 1,2 :** methods of formation of alkanes: Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids, physical properties.

**Jan. Week 3,4 :** Mechanism of free radical halogenation of alkanes: reactivity and selectivity. nomenclature, synthesis of cycloalkanes and their derivatives —Cycloalkanes -dihalides.  $\omega, \alpha$  photochemical (2+2) cycloaddition reactions, , dehalogenation of pyrolysis of calcium or barium salts of dicarboxylic acids, Baeyer's strain theory and its limitations., theory of strainless rings.

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Lesson Plan  
B.Sc. Ist Year (IInd Semester)  
Paper-IV (CH-104) Inorganic Chemistry

Teacher name: Mr Amit Kumar

March-April 2022

**March-Week-3,4:**Hydrogen Bonding and Van der Waals forces Hydrogen Bonding – Definition, types, effects of hydrogen bonding on properties of substances,  
**April- Week 1,2:** application Brief discussion of various types of Van der Waals forces. Metallic Bond and semiconductors Metallic bond – Qualitative idea of valence bond and Band theories of metallic bond (conductors, semiconductors, insulators). Semiconductors – Introduction,  
**April- Week 3,4:** types and applications. s-Block elements Comparative study of the elements including diagonal relationship, Anomalous behaviour of Lithium and Beryllium compared to other elements in the same group,

May 2022

**May- Week 1,2 :** salient features of hydrides, oxides, halides, hydroxides ( methods of preparation excluded), behaviour of solution in liquid NH<sub>3</sub>. Chemistry of Noble Gases General physical properties, low chemical reactivity, chemistry of xenon, structure and bonding in fluorides,  
**May- Week 3,4:** oxides and oxyfluorides of xenon. p-Block elements: Electronic configuration, atomic and ionic size, metallic character, melting point, ionization energy, electron affinity, electronegativity, inert pair effect and diagonal relationship

June 2022

**June- Week 1,2 :** 9 Boron family ( 13th group): Diborane: Preparation, properties and structure ( as an example of electron deficient compound and multicenter bonding), Borazine chemical properties and structure, relative strength of Trihalide of Boron as lewis acids, structure of aluminium(III) chloride.  
**June- Week 3,4 :** Carbon family and Nitrogen family ( 14th and 15th group): Catenation, Carbides, fluoro carbons, silicates (structural aspects). Oxides: Structure of oxides of nitrogen and phosphorus, Oxyacids : Structure and relative acid strength of oxy acids of nitrogen and phosphorus, structure of white and Red phosphorus. Oxygen family ( 16th group): Oxy acids of sulphur – structure and acidic strength,

July 2022

**July- Week 1,2**Hydrogen Peroxide – properties and uses. Halogen family ( 17th group): Interhalogen compounds (their properties and structures), Hydra and oxy acids of chlorine – structure and comparison of acid strength, cationic nature of Iodine.

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## Lesson Plan

B. Sc. Ist Year (IInd Semester)  
Paper-VI (CH-106) Organic Chemistry

Teacher name: Mr. Amit Kumar

March- April 2022

**March Week 3,4:** Nomenclature of alkenes, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halide. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes.

**April Week 1,2 :** mechanisms involved in—Chemical reactions of alkenes hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$ .

**April Week 3,4 :** Arenes and Aromaticity Nomenclature of benzene derivatives: Aromatic nucleus and side chain. Aromaticity: the Huckel rule, aromatic ions, annulenes up to 10 carbon atoms, aromatic, anti-aromatic and non-aromatic compounds.

May 2022

**May-Week 1,2 :** general pattern of the—Aromatic electrophilic substitution mechanism, mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts reaction. Energy profile diagrams. Activating, deactivating substituents and orientation. Dienes

**May-Week 3,4 :** Alkynes Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of butadiene. Chemical reactions 1,2 and 1,4 additions (Electrophilic & free radical mechanism), Diels-Alder reaction, Nomenclature, structure and bonding in alkynes. Methods of formation.,

June 2022

**June Week 1,2 :** Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation of alkynes. 12 Alkyl and Aryl Halides Nomenclature and classes of alkyl halides,

**June Week 3,4 :** methods of formation, chemical reactions. Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides,  $\text{S}_{\text{N}}2$  and  $\text{S}_{\text{N}}1$  reactions with energy profile diagrams.

July 2022

**July Week 1,2 :** Methods of formation and reactions of aryl halides, The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivity's of alkyl halides vs allyl, vinyl and aryl halides.

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Lesson Plan  
B. Sc. Ist Year (IInd Semester)  
Paper-V (CH-105) Physical Chemistry

Teacher name: Mr Amit Kumar

March – April 2022

**March Week 3,4 :** Kinetics-I : Rate of reaction, rate equation and its types, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light, catalyst.  
**April Week 1,2 :** Order of a reaction, integrated rate expression for zero order, first order, second and third order reactions. Half life period of a reaction.  
**April week 3,4 :** Kinetics- II : Effect of temperature on the rate of reaction – Arrhenius equation. Theories of reaction rate – Simple collision theory for unimolecular collision.

May 2022

**May week 1,2:** Transition state theory of bimolecular reactions. Electrochemistry Electrolytic conduction, factors affecting electrolytic conduction, specific conductance,  
**May Week 3,4:** molar conductance, equivalent conductance and relation among them, their variation with concentration. Arrhenius theory of ionization, Ostwald's Dilution Law.

June 2022

**June Week 1,2:** DebyeHuckel – Onsager's equation for strong electrolytes (elementary treatment only), Application of Kohlrausch's Law in calculation of conductance of weak electrolytes at infinite dilution.  
**June Week 3,4 :** Applications of conductivity measurements: determination of degree of dissociation, determination of  $K_a$  of acids determination of solubility product of sparingly soluble salts,

July 2022

**July Week 1,2:** conductometric titrations, Concepts of pH and pKa , Buffer solution, Buffer action, Henderson – Hazel equation, Buffer mechanism of buffer action.

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Lesson Plan

B. Sc. II Year (IIIrd Semester)

Paper-VIII (CH-201) Inorganic Chemistry

Teacher name: Mr Amit Kumar

OCT. 2021

**OCT. Week 3,4 :** Definition of transition elements, position in the periodic table, General characteristic properties of d-Block elements, Comparison of properties of 3d elements with 4d and 5d elements with reference only to ionic radii, oxidation state,

NOV. 2021

**Nov. Week 1,2 :** magnetic and spectral properties and stereo chemistry. Stability of various oxidation states and e.m.f (Latimer and Frost diagrams).

**Nov. Week 3,4 :** Structure and properties of some compounds of transition elements-  $\text{TiO}_2$ ,  $\text{VOCl}_2$ ,  $\text{FeCl}_3$ ,  $\text{CuCl}_2$  and  $\text{Ni}(\text{CO})_4$ .

DEC. 2021

**Dec. Week 1,2 :** Coordination Compounds Werner's theory of coordination compounds, effective atomic number, chelates.

**Dec. Week 3,4 :** nomenclature of coordination compounds, Isomerism in coordination compounds, valence bond theory of transition metal complexes.

JAN- FEB 2022

**Jan. week 1,2 :** Non-aqueous solvents : Physical properties of solvents, types of solvents and their general characteristics.

**Jan. Week 3,4 :** reactions in non aqueous solvents with reference to liquid  $\text{NH}_3$  and liquid  $\text{SO}_2$ . 15

**Feb. Week 1,2 :** Revision

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## Lesson Plan

B.Sc. IInd Year (IIIrd Semester)

Paper-X (CH-203) Organic Chemistry

Teacher name: Mr Amit Kumar

October 2021

**Oct. Week 3,4 :** Alcohols nomenclature, methods of formation by reduction of—Monohydric alcohols aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)<sub>4</sub> and HIO<sub>4</sub>] and pinacol-pinacolone rearrangement. Phenols Nomenclature, structure and bonding.

November 2021

**NOV. Week 1,2 :** Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols — electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, **Nov. Week 3,4 :** Reimer-Tiemann reaction, Kolbe's reaction and Schotten and Baumann reactions. Epoxides Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

December 2021

**Dec. Week 1,2 :** Ultraviolet (UV) absorption spectroscopy Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. **Dec. Week 3,4 :** Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and mix of simple enones, Woodward-Fieser rules, calculation of  $\lambda_{max}$  of  $\alpha,\beta$ -unsaturated ketones

January 2022

**Jan. Week 1,2 :**  $\beta,\alpha$  conjugated dienes and Applications of UV Spectroscopy in structure elucidation of simple organic compounds. Carboxylic Acids & Acid Derivatives Nomenclature of Carboxylic acids, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. **Jan. Week 3,4 :** Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Mechanisms of esterification and hydrolysis (acidic and basic).

February 2022

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## Lesson Plan

B.Sc. IInd Year (IIIrd Semester)

Paper-IX (CH-202) Physical Chemistry

Teacher name: Mr Amit Kumar

October 2021

**Oct. Week 3,4 :** Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Thermodynamic equilibrium, Concept of heat and work.

November 2021

**Nov. Week 1,2 :** First law of thermodynamics: statement, concepts of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship.  
**Nov. Week 3,4 :** Joule–Thomson coefficient for ideal gas and real gas and inversion temperature.

December 2021

**Dec. Week 1,2 :** Calculation of  $w, q, dU$  &  $dH$  for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.  
**Dec. Week 3,4 :** Chemical Equilibrium Equilibrium constant and free energy, concept of chemical potential,

January 2022

**Jan. Week 1,2 :** Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant.  
**Jan. Week 3,4 :** Clausius–Clapeyron equation and its applications. Distribution Law Nernst distribution law – its thermodynamic derivation Applications of distribution law: (i) Determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride (ii) Determination of equilibrium constant of potassium tri-iodide complex and (iii) Process of extraction. More stress on numerical problems

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Lesson Plan

B. Sc. II Year (IVth Semester)

Paper-XI (CH-204) Inorganic Chemistry

Teacher name: Mr Amit Kumar

March – April 2022

**March Week 3,4 :** Chemistry of f-Block elements Lanthanides: Electronic structure, oxidation states,  
**April Week 1,2 :** magnetic properties, complex formation, colour, ionic radii and  
**April Week 3,4 :** lanthanide contraction, occurrence, separation of lanthanides, Lanthanide compounds.

May 2022

**May Week 1,2 :** Actinides: General characteristics of actinides, chemistry of separation of Np, Pu and Am from uranium, Transuranic elements,  
**May Week 3,4 :** comparison of properties of Lanthanides and actinides with transition elements.

June 2022

**June Week 1,2:** Theory of Qualitative and Quantitative Analysis Chemistry of analysis of various groups of basic and acidic radicals,  
**June week 3,4:** chemistry of identification of acid radicals in typical combination, chemistry of interference of acid radicals including their removal in the analysis of basic radicals,

July 2022

**July week 1,2 :** Common ion effect, solubility product, theory of precipitation, co-precipitation, post precipitation, purification of precipitates.

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Lesson Plan  
B. Sc. II Year (IVth Semester)  
Paper-XI (CH-204) Organic Chemistry

Teacher name: Mr. Amit Kumar

March – April 2022

**March Week 3,4 :** Carboxylic Acids & Acid Derivatives Nomenclature of carboxylic acids, structure and bonding, physical properties, acidity of carboxylic acids,  
**April week 1,2 :** effects of substituents on acid strength. Preparation & Reactions of carboxylic acids. Hell-Volhard, -Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation. Structure, nomenclature and preparation of acid chlorides,  
**April Week 3,4 :** esters, amides and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Mechanisms of esterification and hydrolysis

May 2022

**May Week 1,2 :** Infrared (IR) absorption spectroscopy Molecular vibrations. Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region,  
**May Week 3,4 :** characteristic absorptions of various functional groups and interpretation of IR Spectra of simple organic compounds. Applications of IR spectroscopy in structure elucidation of simple organic compounds.

June 2022

**June Week 1,2 :** Amines Structure and nomenclature of amines, physical properties. Separation of a mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds),  
**June Week 3,4 :** nitriles, reductive amination of aldehydic and ketonic compounds. Gabriel phthalimide reaction, Hofmann bromamide reaction. Electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.

July 2022

**July Week 1,2 :** Diazonium Salts Mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, NO<sub>2</sub> and CN groups, reduction of diazonium salts to hydrazines, coupling reaction and its synthetic application.

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Lesson Plan

B. Sc. IIInd Year (IVth Semester)

Paper XII (CH-205) Physical Chemistry

Teacher name: Mr. Amit Kumar

March – April 2022

**March Week 3,4 :** Second law of thermodynamics, need for the law, different statements of the law, Carnot's cycles and its efficiency, Carnot's theorem,  
**April Week 1,2 :** Thermodynamics 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, entropy as a criteria of spontaneity and equilibrium.  
**April Week 3,4 :** Third law of thermodynamics: Nernst heat theorem, statement of concept of residual entropy, evaluation of absolute entropy from heat capacity data.

May 2022

**May Week 1,2:** Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, G as criteria for thermodynamic equilibrium and spontaneity, its advantage over entropy change. Variation of G with P, V and T.  
**May Week 3,4 :** Electrochemistry Electrolytic and Galvanic cells – reversible & irreversible cells, conventional representation of electrochemical cells. Calculation of thermodynamic quantities of cell reaction ( $\Delta G$ ,  $\Delta H$  &  $K$ ).

June 2022

**June Week 1,2 :** Types of reversible electrodes – metal- metal ion, gas electrode, metal –insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equations, derivation of cell EMF and single electrode potential.  
**June Week 3,4 :** Standard Hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, Concentration cells with and without transference,

July 2022

**July Week 1,2 :** Liquid junction potential and its measurement, Applications of EMF measurement in solubility product and potentiometric titrations using glass electrode. More stress on numerical problems.

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## Lesson Plan

B. Sc. III Year (Vth Semester)

Paper-XV (CH-301) Inorganic Chemistry

Teacher name: Mr. Amit Kumar

October 2021

**October Week 3,4 :** Metal- Ligand Bonding in Transition Metal complexes Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planer complexes,

November 2021

**November Week 1,2 :** Factors affecting the crystal field parameters. Thermodynamics and Kinetic Aspects of metal complexes .

**Nov. Week 3,4 :** A brief outline of thermodynamic stability of metal complexes and factors affecting the stability

December 2021

**Dec. Week 1,2 :** Irving William Series, substitution reactions of square planer complexes of Pt(II), Trans effect.

**Dec. Week 3,4 :** Magnetic properties of Transition metal complexes Types of magnetic materials, magnetic susceptibility, method of determining magnetic susceptibility, spin only formula

January 2022

**Jan. Week 1,2 :** L-S coupling, correlation of  $\mu_s$  and  $\mu_{eff}$  values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

**Jan. Week 3,4 :** Electronic spectra of Transition metal complexes Selection rules for d-d transition, spectroscopic ground states, spectrochemical series, Orgel energy level diagram for d1 and d9 states, discussion of electronic spectrum of  $[Ti(H_2O)_6]^{+3}$  complex ion.

February 2022

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Lesson Plan  
B. Sc. IIIrd Year (Vth Semester)  
Paper-XVII (CH-303) Organic Chemistry

Teacher name: Mr. Amit Kumar

October 2021

**Oct. Week 3,4 :** NMR Spectroscopy 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.

November 2021

**Nov. Week 1,2 :** Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide, 1,1-dibromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone. .

**Nov. Week 3,4 :** Simple problems on PMR spectroscopy for structure determination of organic compounds. Carbohydrates Classification and nomenclature of Monosaccharides

December 2021

**Dec. Week 1,2 :** Mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threodiastereomers.

**Dec. Week 3,4 :** Conversion of glucose into mannose. Formation of glycosides, Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism of mutarotation.

January 2022

**Jan. Week 1,2 :** Structures of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

**Jan. week 3,4 :** Organometallic Compounds Organomagnesium compounds: the Grignard reagents- formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions

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## Lesson Plan

B. Sc. III Year (Vth Semester)

Paper-XVI (CH-302) Physical Chemistry

Teacher name: Mr. Amit Kumar

October 2021

**Oct. Week 3,4 :** Quantum Mechanics-I Black-body radiation, Plank's radiation law, photoelectric effect, postulates of quantum mechanics, quantum mechanical operators, 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

November 2021

**Nov. Week 1,2 :** Determination of wave function & energy of a particle in one dimensional box. Physical Properties and Molecular Structure Optical activity, polarization.

**Nov. week 3,4 :** Orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules

December 2020

**Dec. Week 1,2 :** Magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetism. Spectroscopy Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy.

**Dec. week 3,4 :** statement of Born-oppenheimer approximation, Degrees of freedom. 25 Rotational Spectrum Selection rules, Energy levels of rigid rotator (semi-classical principles), rotational spectra of diatomic molecules ,

January 2022

**Jan. week 1,2 :** Spectral intensity distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length and isotopic effect. Vibrational spectrum Selection rules, Energy levels of simple harmonic oscillator, pure vibrational spectrum of diatomic molecules, determination of force constant and qualitative relation of force constant and bond energy.

**Jan. Week 3,4 :** 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, Quantum theory of Raman spectra.

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Lesson Plan

B. Sc. III Year (VIth Semester)

Paper-XVIII (CH-304) Inorganic Chemistry

Teacher name: Mr. Amit Kumar

March – April 2022

**March week 3,4 :** Acids and Bases Arrhenius, Bronsted-lowry, Lux-flood, solvent system and Lewis concept of acids and bases.

**April Week 1,2 :** relative strength of acids and bases, levelling solvents, hard and soft acids and bases(HSAB), Applications of HSAB principle.

**April Week 3,4 :** Organometallic chemistry Definition, classification and nomenclature of

May 2022

**May Week 1,2 :** organometallic compounds, preparation, properties and bonding of alkyls of Li, Al, Hg and Sn, concept of hapticity of organic ligand.

**May Week 3,4 :** Structure and bonding in metal-ethylenic complexes, Structure of Ferrocene, classification in metal carbonyls, preparation, properties and bonding in mononuclear carbonyls.

June 2022

**June week 1,2 :** Bio inorganic chemistry Metal ions present in biological system, classification on the basis of action (essential, non essential, trace, toxic), Metalloporphyrins with special reference to haemoglobin and myoglobin.

**June week 3,4 :** Biological role of  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Fe}^{+2}$  ions, Cooperative effect, Bohr effect. Silicones and Phosphazenes Nomenclature, classification,

July 2022

**July week 1,2 :** Preparation and uses of silicones, elastomers, polysiloxane copolymers, poly phosphazenes and bonding in triphosphazene.

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Lesson Plan  
B. Sc. IIIrd Year (VIth Semester)  
Paper-XX (CH-306) Organic Chemistry

Teacher name: Mr. Amit Kumar

March – April 2022

**March Week 3,4 :** Organosulphur Compounds Nomenclature" structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.  
**April Week 1,2 :** Synthetic detergents alkyl and aryl sulphonates. 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.  
**April week 3,4 :** Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine. piperidine and pyrrole.

May 2022

**May Week 1,2 :** Introduction to condensed five and six- membered heterocycles. Prepration and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis,  
**May Week 3,4 :** Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of, quinoline and isoquinoline

June 2022

**June Week 1,2 :** Organic Synthesis viuEnolates Acidity of -hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enoltautomerism of ethyl acetoacetate.  
**June Week 3,4 :** Amino Acids, Peptides& Proteins Classification, of amino acids. Acid-base behavior, isoelectric point and electrophoresis. Preparation of -amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins.

July 2022

**July week 1,2 :** Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solidphase peptide synthesis. Structures of peptides and proteins: Primary & Secondary structure. Synthetic Polymers Addition or chain-growth polymerization' Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubtrers.

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Lesson Plan  
B. Sc. IIIrd Year (VIth Semester)  
Paper-XIX (CH-305) Physical Chemistry

Teacher name: Mr. Amit Kumar

March – April 2022

**March Week 3,4 :** Introduction to statistical mechanics Need for statistical thermodynamics, thermodynamic probability, Maxwell Boltzmann distribution statistics, Born oppenheimer approximation, partition function and its physical significance.  
**April Week 1,2 :** Factorization of partition function. Photochemistry Interaction of radiation with matter, difference between thermal and photochemical processes.  
**April Week 3,4 :** Laws of photochemistry: Grotthus-Drapper law, StarkEinstein law (law of photochemical equivalence), Jablonski diagram depicting various processes occurring in the excited state,.

May 2022

**May Week 1,2 :** Qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simple examples).  
**May Week 3,4 :** Solutions, Dilute Solutions and Colligative Properties Ideal and non-ideal solutions, methods of expressing concentrations of solutions, Dilute solutions, Raoult's law. Colligative properties: (i) relative lowering of vapour pressure (ii) Elevation in boiling point (iii) depression in freezing point (iv) osmotic pressure

June 2022

**June week 1,2 :** Thermodynamic derivation of relation between amount of solute and elevation in boiling point and depression in freezing point.. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.  
**June Week 3,4 :** Phase Equilibrium Statement and meaning of the terms – phase, component and degree of freedom, thermodynamic derivation of Gibbs phase rule,

July 2021

**July Week 1,2 :**Phase equilibria of one component system –Example – water system. Phase equilibria of two component systems solid-liquid equilibria, simple eutectic Example Pb-Ag system, desilverisation of lead.

Teacher Signature: *Amit Kumar*

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