Lesson Plan for Even Semester (January to May 2024)

**CLASS: B.Sc. I , Sem. 2nd  Paper: Physical Chemistry Code: CCL - 204**

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| Month | Contents |
| January  2024 | **Chemical Energetics**  Review of thermodynamics. First the Laws of Thermodynamics. Second the Laws of Thermodynamics. Third the Laws of Thermodynamics. Important principles & definitions of thermochemistry. |
| February  2024 | Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution.Variation of enthalpy of a reaction with temperature – Kirchhoff’s equation.  Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.  Back log of chapter if any, discussion and problems taken |
| March  2024 | **Chemical equilibrium**  Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between *G* and *G*o, Le Chatelier’s principle.  Relationships between *Kp, Kc* and *Kx* for reactions involving ideal gases. Back log of chapter if any, discussion and problems taken |
| April  2024 | **Ionic Equilibria-I**  Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization. Ionization constant and ionic product of water. Ionization of weak acids and bases. pH scale, common ion effect. Back log of chapter if any, discussion and problems taken.  **Ionic Equilibria-II**  Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts  Applications of solubility product principle. Back log of chapter if any, discussion and problems taken |
| May  2024 | Revision of topics |

Lesson Plan for Even Semester (January to May 2024)

**CLASS: B.Sc. I , Sem. 2nd  Paper: Organic Chemistry Code: CCL - 205**

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| Month | Contents |
| January  2024 | **Aromatic hydrocarbons** : Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft’s reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene). |
| February  2024 | **Alkyl and Aryl Halides** : Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson’s ether synthesis: Elimination vs substitution. Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by – OH group) and effect of nitro substituent. Benzyne Mechanism: KNH2/NH3 (or NaNH2/NH3). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides. |
| March  2024 | **Alcohols, Phenols and Ethers** (Upto 5 Carbons) :Alcohols: Preparation: Preparation of 1о , 2о and 3о alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. KMnO4, acidic dichromate, conc. HNO3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement. Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben– Hoesch Condensation, Schotten – Baumann Reaction. Ethers (aliphatic and aromatic): Cleavage of ethers with HI. |
| April  2024 | **Aldehydes and ketones** (aliphatic and aromatic) (Formaldehye, acetaldehyde, acetone and benzaldehyde) Preparation: from acid chlorides and from nitriles. Reactions – Reaction with HCN, ROH, NaHSO3, NH2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro’s reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. MeerweinPondorff Verley reduction. |
| May  2024 | Revision of topics |

Lesson Plan for Even Semester (January to May 2024)

**CLASS: B.Sc. II, Sem. 4th  Paper: Inorganic Chemistry Code: CCL - 404**

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| Month | Contents |
| January  2024 | **Transition Elements (3d series)**  Electronic configuration, Variable valency  Spectral & Magnetic properties, Catalytic properties  Complex formation and Latimer Diagrams of Fe, Cu and Mn |
| February  2024 | **Lanthanides and Actinides**  Electronic configuration, Oxidation states  Spectral & Magnetic properties  Lanthanide contraction  Complex formation  Separation of lanthanides (Ion exchange method) |
| March  2024 | **Coordination Chemistry**  Coordination compounds: Nature of metal & ligands.  Nomenclature  Structural & stereoisomerism in complexes (coordination No. 4 & 6)  Valence bond theory Inner & outer orbital complexes (coordination no. 4 & 6)  Drawbacks of VBT |
| April  2024 | **Crystal Field Theory**  Crystal field in octahedral symmetry  Crystal field stabilization energy (CFSE)  Strong and weak field ligands  Crystal field in tetrahedral symmetry  Factors affecting CFSE  Spectrochemical series  Tetragonal distortion in octahedral symmetry  Jahn-Teller distortion  Square planar coordination |
| May  2024 | Revision of topics |

Lesson Plan for Even Semester (January to May 2024)

**CLASS: B.Sc. II, Sem. 4th  Paper: Physical Chemistry Code: CCL - 405**

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| Month | Contents |
| January  2024 | **Kinetic Theory of Gases**  Kinetic Theory of Gases, Derivation of the kinetic gas equation.  Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. Vander Waals equation of state for real gases. Boyle temperature. Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO2. |
| February  2024 | Maxwell Boltzmann distribution laws of molecular velocities and molecular energies. Most probable, average and root mean square velocities. Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules.  **Liquids**  Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid. |
| March  2024 | **Solids**  Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices.  Miller indices.X–Ray diffraction by crystals, Bragg’s law. Structures of NaCl, KCl and CsCl. Defects in crystals. |
| April  2024 | **Chemical Kinetics**  The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction.  Derivation of integrated rate equations for zero, first and second order reactions Half–life of a reaction. General methods for determination of order of a reaction.  Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories. |
| May  2024 | Revision of topics |

Lesson Plan for Even Semester (January to May 2024)

**CLASS: B.Sc. III, Sem. 6th Paper: Inorganic Chemistry Code: CCL 603(i)**

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| Month | Contents |
| January  2024 | **Chapter-1: Chemistry of 3d metals**  Oxidation states displayed by Cr, Fe, Co, Ni and Co.  A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr, K2Cr2O7, KMnO4, K4[Fe(CN)6], sodium nitroprusside, [Co(NH3)6]Cl3, Na3[Co(NO2)6]. |
| February  2024 | **Organometallic Compounds :**Definition and Classification with appropriate examples based on nature of metalcarbon bond (ionic, s, p and multicentre bonds).  Structures of methyl lithium , Zeiss salt and ferrocene. EAN rule as applied to carbonyls |
| March  2024 | Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals.  p-acceptor behaviour of carbon monoxide.  Synergic effects (VB approach)-(MO diagram of CO can be referred to for synergic effect to IR frequencies). |
| April  2024 | **Bio-Inorganic Chemistry**  A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na+, K+ and Mg2+ ions: Na/K pump;  Role of Mg2+ ions in energy production and chlorophyll. Role of Ca2+ in blood clotting, stabilization of protein structures and structural role (bones). |
| May  2024 | Revision of topics |

Lesson Plan for Even Semester (January to May 2024)

**Class: B.Sc. III, 6th Sem  Paper: Organic Chemistry Code: CCL – 604(i)**

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| Month | Contents |
| January  2024 | **Polynuclear and heteronuclear aromatic compounds**  Properties of the following compounds with reference to electrophilic and nucleophilic substitution:  Naphthalene, Anthracene, Furan, Pyrrole, |
| February  2024 | Properties of the following compounds with reference to electrophilic and nucleophilic substitution:  Thiophene, and Pyridine  Revision of chapter  **Active methylene compounds**  *Preparation:* Claisen ester condensation. Keto-enol tautomerism.  *Reactions:* Synthetic uses of ethyl acetoacetate (preparation of non-hetero molecules having up to 6 carbon). |
| March  2024 | **Application of Spectroscopy to Simple Organic Molecules**  Application of visible, ultraviolet and infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, *λ*max & εmax, chromophore, auxochrome, bathochromic and hypsochromic shifts.  Application of electronic spectroscopy and Woodward rules for calculating *λ*max of conjugated dienes and α,β-unsaturated compounds.  Revision of chapter and class test |
| April  2024 | Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding),  IR spectra of aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).  Back log of chapter if any, discussion and problems taken |
| May  2024 | Revision of Topics |