**LESSON PLAN**

**OF**

**CHEMISTRY DEPT.**

**UG Course**

**Odd Semester**



**2023-24**

**INDIRA GANDHI (PG) MAHILA MAHAVIDYALAYA**

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**INDIRA GANDHI MAHILA MAHAVIDYALAYA**

**CLASS:- B.Sc SESSION:- 2023-2024 Subject: Chemistry (major) Semester: 1st**

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| **Sr.No** | **Date** | **Content** |
| 1 | 24 July-29 July | Atomic Structure Dual behaviour of matter and radiation, de Broglie’s relation, Heinsenberg’s uncertainty principle, concept of atomic orbitals, significance of quantum numbers, radial and angular wave functions. |
| 2 | 31 July-5 August | Normal and orthogonal wave functions, significance of Ψ and Ψ2 , shapes of s, p, d, f orbitals. |
| 3 | 7 August-12August | Rules for filling electrons in various orbitals, effective nuclear charge, Slater’s rules. |
| 4 | 14 August-19 August | Periodic table and atomic properties Classification of periodic table, definition of atomic and ionic radii, ionisation energy, electron affinity and electronegativity. |
| 5 | 21 August-26 August | 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. |
| 6 | 28August-2 September | Gaseous State Kinetic theory of gases, Maxwell’s distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity. |
| 7 | 4 September- 9 September | Average velocity, and most probable velocity. Collision diameter, collision number, collision frequency and mean free path (Derivations excluded) |
| 8 | 11 September – 16September | Deviation of Real gases from ideal behaviour, Derivation of Van der Waal’ s Equation of State, its application in the calculation of Boyle’ s temperature |
| 9 | 18 September -23 September | Critical Phenomenon Concept of Critical temperature, critical pressure, critical volume, relationship between critical constants and Van der Waal’ s constants (Derivation excluded). |
| 10 | 25 September –30 September | Structure and Bonding Localized and delocalized chemical bond, Van der Waals interactions. Concept of resonance and its applications, hyperconjugation, inductive effect, Electromeric effect and their comparison. |
| 11 | 3 October-7 October | Mechanism of Organic Reactions Curved arrow notation, homolytic and heterolytic bond fission. Types of reagents: electrophiles and nucleophiles. Types of organic reactions. |
| 12 | 9 October -14 October | Substitution, Addition, Condensation, Elimination, Rearrangement, Isomerization and Pericyclic reactions. |
| 13 | 16 October-21 October | Reactive intermediates: Carbocations, carbanions, free radicals, carbenes (structure & stability). |
| 14 | 23 October-28 October | Solid State Classification of solids, Law of constancy of interfacial angles, law of rational indices, Miller indices |
| 15 | 30 October- 4 November | Elementary ideas of symmetry and symmetry elements. |
| 16 | 6 November- 9 November | Seven crystal systems and fourteen Bravais lattices; X-ray diffraction. |
| 17 | 17 November-18 November | Bragg’s law, a simple account of Laue method, rotating crystal method and powder pattern method. |
| 18 | 20 November-25 November | Liquid State Structure of liquids, Properties of liquids – surface tension, refractive index |
| 19 | 27 November- 2 December | Viscosity, vapour pressure and optical rotation. |
| 20 | 4 December- 9 December | Revision |
| 21 | 11 December- 16 December | Revision. |
| 22 | 18 December- 23 December | Revision. |
| 23 | 25 December- 30 December | Revision . |

**INDIRA GANDHI MAHILA MAHAVIDYALAYA**

**CLASS:- B.Sc SESSION:- 2023-2024 Subject: Chemistry (minor) Semester: 1st**

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| **Sr.No** | **Date** | **Content** |
| 1 | 24 July-29 July | Covalent Bond Valence bond theory approach, shapes of simple inorganic molecules and ions based on valence shell electron pair repulsion |
| 2 | 31 July-5 August | Trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. Molecular orbital theory of homonuclear (N2, O2) |
| 3 | 7 August-12August | Heteronuclear (CO and NO) diatomic molecules, dipole moment and percentage ionic character in covalent bond |
| 4 | 14 August-19 August | Chemical Kinetics Concept of reaction rates, rate equation, factors influencing the rate of reaction, |
| 5 | 21 August-26 August | Order and molecularity of a reaction, integrated rate expression for zero, |
| 6 | 28August-2 September | First, second order reactions (for equal conc. of reactants), Half-life period of a reaction |
| 7 | 4 September- 9 September | Alkanes (upto 5 carbon atoms) Alkanes, nomenclature, classification of carbon atoms in alkanes |
| 8 | 11 September – 16September | Isomerism in alkanes, sources, methods of formation: Wurtz reaction, Kolbe reaction. |
| 9 | 18 September -23 September | Physical properties. Mechanism of free radical halogenation of alkanes. |
| 10 | 25 September –30 September | Reactivity and selectivity. |
| 11 | 3 October-7 October | Metallic Bond and semiconductors Metallic bond |
| 12 | 9 October -14 October | Qualitative idea of valence bond |
| 13 | 16 October-21 October | Band theories of metallic bond |
| 14 | 23 October-28 October | Semiconductors – Introduction, types, and applications |
| 15 | 30 October- 4 November | Conductors, semiconductors, insulators |
| 16 | 6 November- 9 November | Corey-House reaction and decarboxylation of carboxylic acids |
| 17 | 17 November-18 November | (VSEPR) theory and hybridization with suitable examples of linear |
| 18 | 20 November-25 November | Molecular orbital theory of homonuclear (N2, O2) |
| 19 | 27 November- 2 December | Revision |
| 20 | 4 December- 9 December | Revision |
| 21 | 11 December- 16 December | Revision. |
| 22 | 18 December- 23 December | Revision. |
| 23 | 25 December- 30 December | Revision . |

**INDIRA GANDHI MAHILA MAHAVIDYALAYA**

**Subject Name:-Chemistry**

**Class:- B.Sc 3rd sem Session:-2023-2024**

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| **Sr.No** | **Date** | **Content** |
| 1 | 24 July-29 July | Thermodynamics: Deﬁnation of thermodynamic terms: system, surrounding etc. Thermodynamic process. Thermodynamic equilibrium, Concept of heat and work |
| 2 | 31 July-5 August | Types of systems, intensive and extensive properties. State and path functions and their differentials. |
| 3 | 7 August-12August | First law of thermodynamics: statement, concepts of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. |
| 4 | 14 August-19 August | Joule-Thomson coefficient for ideal gas and real gas and inversion temperature. Calculation of w, q, dU& dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. |
| 5 | 21 August-26 August | Chemical Equilibrium: Equilibrium constant and free energy, concept of chemical potential. |
| 6 | 28August-2 September | Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant |
| 7 | 4 September- 9 September | Clausius- Clapeyron equation and its applications.  Distribution Law: Nernst distribution law–its thermodynamic derivation. |
| 8 | 11 September – 16September | Applications of distribution law: (i) Determination of degree of hydrolysis and hydrolysis constant of aniline hydrochloride |
| 9 | 18 September -23 September | Determination of equilibrium constant of potassium tri-iodidecomplex and (iii) Process of extraction. |
| 10 | 25 September –30 September | Coordination Compounds, Werner’s theory of coordination compounds, effective atomic number. |
| 11 | 3 October-7 October | Chelates, nomenclature of coordination compounds, Isomerism in coordination compounds |
| 12 | 9 October -14 October | Valence bond theory of transition metal complexes. |
| 13 | 16 October-21 October | Non-aqueous solvents:  Physical properties of solvents. |
| 14 | 23 October-28 October | Types of solvents and their general characteristics. |
| 15 | 30 October- 4 November | Reactions in non-aqueous solvents with reference to liquid NH3 and liquid SO2 |
| 16 | 6 November- 9 November | Revision |
| 17 | 17 November-24November | Revision |

**INDIRA GANDHI MAHILA MAHAVIDYALAYA**

**Subject Name:-Chemistry**

**Class:- B.Sc 3rdsem Session:-2023-2024**

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| **Sr.No** | **Date** | **Content** |
| 1 | 24 July-29 July | Alcohols: Monohydric alcohols nomenclature, methods of formation by reduction of aldehydes, Ketones , carboxylic acids and esters. Hydrogen bonding. Acidic nature. |
| 2 | 31 July-5 August | Reactions of alcohols. Dihydric alcohols- nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage.  [Pb(OAc)4 and HIO4] and pinacol-pinacolone rearrangement |
| 3 | 7 August-12August | Phenols: Nomenclature, structure and bonding. Preparation of phenols,  Physical properties and acidic character. Comparative acidic. Strengths of alcohols and phenols, resonance stabilization of phenoxide ion. |
| 4 | 14 August-19 August | Reactions of phenols: electrophilic aromatic  substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, Reimer-Tiemann reaction, Kolbe’s reaction and Schotten and Baumann reactions. |
| 5 | 21 August-26 August | Epoxides: Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening. |
| 6 | 28August-2 September | Ultraviolet (UV) absorption spectroscopy  Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation |
| 7 | 4 September- 9 September | Concept of chromophore and auxochrome. Bathochromic, hypsochromic , hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. |
| 8 | 11 September – 16September | Woodward Fieser rules, calculation of max of simple conjugated dienes and unsaturated ketones. Applications of UV Spectroscopy in structure elucidation of simple  Organic compounds. |
| 9 | 18 September -23 September | Carboxylic Acids & Acid Derivatives  Nomenclature of Carboxylic acids, structure and bonding, physical  properties, acidity of carboxylic acids, effects of substituents on acid strength. |
| 10 | 25 September –30 September | Preparation of carboxylic acids. Reactions of  Carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation. |
| 11 | 3 October-7 October | Relative stability of acyl derivatives. Physical properties, Interconversion of acid derivatives by nucleophilic acyl substitution. |
| 12 | 9 October -14 October | Mechanisms of esterification and hydrolysis (acidic and basic). |
| 13 | 16 October-21 October | Chemistry of d-Block elements:  Definition of transition elements, position in the periodic table, General characteristic properties of d-Block elements. |
| 14 | 23 October-28 October | Comparison of properties of 3d elements with 4d and 5d elements with reference only to ionic radii, oxidation state, magnetic and spectral properties and stereo chemistry.  Stability of various oxidation states and e.m.f (Latimer and Frost diagrams). |
| 15 | 30 October- 4 November | Structure and properties of some compounds of transition elements- TiO2, VOCl2, FeCl3, CuCl2 and Ni(CO)4. |
| 16 | 6 November- 9 November | Revision |
| 17 | 17 November-24November | Revision |

**INDIRA GANDHI MAHILA MAHAVIDYALAYA**

**Subject Name:-Chemistry**

**Class:- B.Sc 5th sem Session:-2023-2024**

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| **Sr.No** | **Date** | **Content** |
| 1 | 24 July-29 July | Quantum Mechanics-I  Black-body radiation, Plank’s radiation law, photo electric effect, postulates of quantum mechanics |
| 2 | 31 July-5 August | Quantum mechanical operators, commutation relations, Hamiltonian operator, Hermitian operator, average value of square of Hermitian as a positive quantity, |
| 3 | 7 August-12August | Role of operators in quantum mechanics, To show quantum mechanically that position and momentum cannot be predicated simultaneously, Determination of wave function & energy of a particle in one dimensional box. |
| 4 | 14 August-19 August | Physical Properties and Molecular Structure :  Optical activity, polarization (Clausius–Mossotti equation derivation excluded).Orientation of dipoles in an electric field. |
| 5 | 21 August-26 August | Dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole  Moment and structure of molecules. |
| 6 | 28August-2 September | Magnetic permeability, Magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties–paramagnetism, diamagnetism and ferromagnetism. |
| 7 | 4 September- 9 September | Spectroscopy: Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy. Statement of Born-oppenheimer approximation, Degrees of freedom. |
| 8 | 11 September – 16September | Rotational Spectrum: Selection rules, Energy levels of rigid rotator (semi-classical principles), rotational spectra of diatomic molecules. |
| 9 | 18 September -23 September | Spectral intensity distribution using population Distribution (Maxwell-Boltzmann distribution), determination of bond length and Isotopic effect. Give more stress on numerical problems of all spectroscopy. |
| 10 | 25 September –30 September | Vibrational spectrum: Selection rules, Energy levels of simple harmonic oscillator, pure vibrational spectrum of diatomic molecules. |
| 11 | 3 October-7 October | Determination of force constant and  Qualitative relation of force constant and bond energy, idea of vibrational frequencies of different functional groups. |
| 12 | 9 October -14 October | Raman Spectrum: Concept of polarizibility, pure rotational and pure vibrational Raman spectra of  Diatomic molecules. Selection rules, Quantum theory of Raman spectra |
| 13 | 16 October-21 October | Magnetic properties of transition metal complexes: Types of magnetic materials, magnetic susceptibility, method of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of µs and µeff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes. |
| 14 | 23 October-28 October | Electronic spectra of transition metal complexes: Selection rules for d-d transition, spectroscopic ground states, spectrochemical series. |
| 15 | 30 October- 4 November | Orgel energy level diagram for d1 and d9 states, discussion of electronic spectrum of [Ti(H2O)6]+3 complex ion. |
| 16 | 6 November- 9 November | Quantum Mechanics-I  Black-body radiation, Plank’s radiation law, photo electric effect, postulates of quantum mechanics |
| 17 | 17 November-24November | Revision |

**INDIRA GANDHI MAHILA MAHAVIDYALAYA**

**Subject Name:-Chemistry**

**Class:- B.Sc 5th sem Session:-2023-2024**

|  |  |  |
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| **Sr.No** | **Date** | **Content** |
| 1 | 24 July-29 July | NMR Spectroscopy : Principle of nuclear magnetic resonance, the PMR spectrum, number of signals, peak areas, equivalent and non equivalent protons positions of signals and chemical shift, shielding and deshielding of protons, |
| 2 | 31 July-5 August | Proton counting, splitting of signals and coupling constants, magnetic equivalence of protons. 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 |
| 3 | 7 August-12August | Simple problems on PMR. Spectroscopy for structural determination of organic compounds. |
| 4 | 14 August-19 August | Carbohydrates : Classification and nomenclature of Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. |
| 5 | 21 August-26 August | Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, Determination of ring size of glucose and fructose. |
| 6 | 28August-2 September | Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism of mutarotation. |
| 7 | 4 September- 9 September | Structures of ribose and deoxyribose.An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. |
| 8 | 11 September – 16September | Organometallic Compounds: Organo-magnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organo-zinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions. |
| 9 | 18 September -23 September | Metal- Ligand Bonding in Transition Metal complexes: Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, |
| 10 | 25 September –30 September | Tetrahedral and square planer complexes |
| 11 | 3 October-7 October | Factors affecting the crystal field parameters. |
| 12 | 9 October -14 October | Thermodynamics and Kinetic Aspects of metal complexes:  A brief outline of thermodynamic stability of metal complexes |
| 13 | 16 October-21 October | Factors affecting the stability. |
| 14 | 23 October-28 October | Irving William Series, substitution reactions of square planer complexes of Pt[II], |
| 15 | 30 October- 4 November | Trans effect |
| 16 | 6 November- 9 November | Revision |
| 17 | 17 November-24November | Revision |