GOVERNMENT COLLEGE FOR WOMEN, ATELI

Lesson Plan (From July 2024 to November 2024)

Neelam Bharti
Assistant Professor of Chemistry

B.Sc. 1st Sem.

Week 1 _____

Atomic Structure : Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, , quantum numbers,

Week 2 _____

Radial and angular wave functions and probability distribution curves, significance of ψ and ψ^2 shapes of s, p, d orbitals. Rules of filling of electrons in various orbitals, effective nuclear charge, Slater's rules.

Unit Test

Week 3 _____

Periodic Table and Atomic Properties :General principles of periodic table: Aufbau and Pauli exclusion principles, Hund's multiplicity rule.

Week 4 _____

Electronic configurations of the elements. Atomic and ionic radii, ionization energy, electron affinity and electronegativity –definition, methods of determination or evaluation, trends in periodic table (in s &p block elements)

Week 5 _____

Gaseous States : Kinetic theory of gases, Maxwell's distribution of velocities and energies (derivation excluded) Calculation of root mean square velocity, average velocity and most probable velocity. Collision diameter, collision number, collision frequency and mean free path.

Week 6 _____

Deviation of Real gases from ideal behaviour. Derivation of Vander Waal's Equation of State, its application in the calculation of Boyle's temperature (compression factor).

Week 7 _____

Critical Phenomenon: Critical temperature, Critical pressure, critical volume and their determination. PV isotherms of real gases, continuity of states, the isotherms of Vander

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Waal's equation, relationship between critical constants and Vander Waal"s constants. Critical compressibility factor.

Week 8_____

Structure and Bonding :Localized and delocalized chemical bond, van der Waals in teractions, resonance: conditions, resonance effect and its applications, hyperconjugation, inductive effect, Electromeric effect & their comparison.

Week 9 _____

Mechanism of Organic Reactions : Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking.

Week 10 _____

Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates carbocations, carbanions.

Week 11 _____

Free radicals, carbenes , arynes and nitrenes (formation, structure & stability). Assigning formal charges on intermediates and other ionic species

Week 12 _____

Liquid States : Structure of liquids. Properties of liquids – surface tension, viscosity vapour pressure and optical rotations and their determination.

Unit Test

Week 13 _____

Solid State : Classification of solids, Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry.

Week 14 _____

Symmetry elements of crystals. Definition of unit cell & space lattice. Bravais lattices, crystal system. Xray diffraction by crystals. Derivation of Bragg equation.

Week 15 _____

A simple account of Laue method. Rotating crystal method and powder pattern method.

Unit Test

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Week 16 _____
Unit wise Revision

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GOVERNMENT COLLEGE FOR WOMEN, ATELI

Lesson Plan (From July 2024 to November 2024)

Neelam Bharti **B.Sc. 3rd Sem.**
Assistant Professor of Chemistry

Week 1_____

Alcohols: Monohydric alcohols nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.

Week 2_____

Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.

Week 3_____

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

Week 4_____

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. Reactions of phenols — electrophilic aromatic substitution, Mechanisms of Fries rearrangement, Claisen rearrangement, Reimer-Tiemann reaction, Kolbe's reaction and Schotten and Baumann reactions.

Week 5_____

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Ultraviolet (UV) absorption spectroscopy: Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones, Woodward- Fieser rules, calculation of max of simple conjugated dienes and , -unsaturated ketones. Applications of UV Spectroscopy in structure elucidation of simple organic compounds.

Unit test

Week 6_____

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. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation.

Week 7_____

Structure , nomenclature and preparation of acid chlorides, esters, amides and acid anhydrides. Relative s tability of acyl derivatives. Physical properties, interconvers ion of acid derivatives by nucleophilic acyl substitution. Mechanisms of esterification and hydrolysis (acidic and basic).

Week 8_____

Chemistry of Elements of I transition series: Definition of transition elements, position in the periodic table, General characteristics & properites of Ist transition elements,. Structures & properties of some compounds of transition elements – TiO_2, $VOCl_2$, $FeCl_3$, $CuCl_2$ and $Ni(CO)_4$

Week 9_____

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Chemistry of Elements of IInd & IIIrd transition series: General characteristics and properties of the II and III transition elements Comparison of properties of 3d elements with 4d & 5d elements with reference only to ionic radii, oxidation state, magnetic and Spectral properties and stereochemistry

Week 10_____

Coordination Compounds : Werner's coordination theory, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes

Week 11_____

Non-aqueous Solvents: Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

Unit Test

Week 12_____

Thermodynamics-I: Definition of thermodynamic terms: system, surrounding etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work. Zeroth Law of thermodynamics, First law of thermodynamics: statement, definition of internal energy and enthalpy.

Week 13_____

Thermodynamics-II : Calculation of w.q. dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process, Temperature dependence of enthalpy, Kirchoffs equation. Bond energies and applications of bond energies.

Week 14_____

Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law – Joule – Thomson coefficient for ideal gas and real gas: and inversion temperature.

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Week 15_____

Chemical Equilibrium: Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant; Van't Hoff reaction isochore, Van't Hoff reaction isotherm. Le-Chatelier's principle and its applications Clapeyron equation and Clausius – Clapeyron equation its applications.

Unit Test

Week 16_____

Distribution Law: Nernst distribution law – its thermodynamic derivation, Modification of distribution law when solute undergoes dissociation, association and chemical combination. 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 process of extraction.

Unit wise Revision

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Lesson Plan (From July 2024 to November 2024)

Neelam Bharti **B.Sc. V Sem.**
Assistant Professor of Chemistry

Week 1 _____

Carbohydrates-I : Classification and nomenclature. Monosaccharides, mechanism of osazone formation, inter conversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose in to mannose. Formation of glycos ides, ethers and esters. Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism of mutarotation. Structures of ribose and deoxyribose.

Week 2 _____

Carbohydrates-II: An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Week 3 _____

Metal-ligand Bonding in Transition Metal Complexes : Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field split ting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters

Week 4 _____

Spectroscopy-I: Introduction: Electromagnetic radiation, regions of spectrum, basic features of spectroscopy, statement of Bornoppenheimer approximation, Degrees of freedom. Rotational Spectrum Diatomic molecules.

Week 5 _____

Energy levels of rigid rotator (semi-classical principles), selection rules, spectral intensity distribution using population distribution (Maxwell-Boltzmann

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distribution), determination of bond length, qualitative description of non-rigid rotor, isotope effect

Unit Test

Week 6 _____

Magnetic Properties of Transition Metal Complexes : Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3dmetal complexes.

Week 7 _____

Electron Spectra of Transition Metal Complexes: Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d1 and d9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion

Week 8 _____

Spectroscopy-II Vibrational spectrum Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effects of an harmonic motion and isotopic effect on the spectra., idea of vibrational frequencies of different functional groups.

Week 9 _____

Raman Spectrum: Concept of polarizibility, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules, Quantum theory of Raman spectra

Unit Test

Week 10 _____

Organometallic Compounds : Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc compounds:

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formation and chemical reactions. Organolithium compounds: formation and chemical reactions

Week 11 _____

NMR Spectroscopy-I : 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.

Week 12 _____

Thermodynamic and Kinetic Aspects of Metal Complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes of Pt(II)

Week 13 _____

Quantum Mechanics-I: Black-body radiation, Plank's radiation law, photoelectric effect, heat capacity of solids, Compton effect, wave function and its significance of Postulates of quantum mechanics , quantum mechanical operator, commutation relations,

Week 14 _____

Hamiltonial 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, Determination of wave function & energy of a particle in one dimensional box, Pictorial representation and its significance.

Unit Test

Week 15 _____

NMR Spectroscopy-II : Discuss ion of PMR spectra of the molecules: ethyl bromide, npropyl bromide, isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde and acetophenone..Simple problems on PMR spectroscopy for structure determination of organic compounds

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Week 16 _____

Physical Properties and Molecular Structure : Optical activity, polarization – (clausius – Mossotti equation). Orientation of dipoles in an electric field, dipole moment, included dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, Magnetic permeability, magnetic susceptibility and its determination. Application of magnetic susceptibility, magnetic properties – paramagnetism, diamagnetism and ferromagnetism

Revision Unit wise

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