Lesson Plan

Name of Assistant Professor: Mr. Hardeep
Class: B.Sc. Semester: 4th
Subject: PHYSICAL CHEMISTRY-III: STATES OF MATTER & CHEMICAL KINETICS
Lesson Plan: From 16 January 2023 to 12 May 2023.

Week 1 16.01.2023- 22.01.2023	Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation
Week 2 23.01.2023- 29.01.2023	van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation. Andrews isotherms of CO2.
Week 30.01.2023 -05.02.2023	Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.
Week 4 06.02.2023- 12.02.2023	Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules.
Week 5 13.02.2023-19.02.2023	Liquids: Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer.
Week 6 20.02.2023- 26.02.2023	Holi Vacations
Week 7 27.02.2023- 05.03.2023	Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).
Week 8 06.03.2023- 12.03.2023	Solids: Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes.
Week 9 13.03.2023- 19.03.2023	Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law.
Week 10 20.03.2023- 26.03.2023	Structures of NaCl, KCl and CsCl (qualitative treatment only).Defects in crystals.
Week 11 27.03.2023-02.04.2023	Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates.Order and molecularity of a reaction.
Week 12 03.04.2023-09.04.2023	Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants).
Week 13 10.04.2023- 16.04.2023	Half–life of a reaction. General methods for

	determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.
Week 14 17.04.2023-23.04.2023	Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).
Week 15 24.03.2023-30.04.2023	Test, Assignment
Week 16 01.05.2023-08.05.2023	Revision
Week 1709.05.2023-12.05.2023	Revision

Note: - This lesson plan is tentative.

HOD **Principal**

Lesson Plan

Name of Assistant Professor: Mr. Hardeep
Class: B.Sc. Semester: 6th
Subject: SPECTROSCOPY & PHOTOCHEMISTRY and QUANTUM CHEMISTRY
Lesson Plan: From 16 January 2023 to 12 May 2023.

Week 1 16.01.2023- 22.01.2023	Interaction of electromagnetic radiation with molecules and various types of spectra; BornOppenheimer approximation. Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.
Week 2 23.01.2023- 29.01.2023	Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.
Week 30.01.2023 -05.02.2023	Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.
Week 4 06.02.2023- 12.02.2023	Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.
Week 5 13.02.2023-19.02.2023	Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spinspin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules.
Week 6 20.02.2023- 26.02.2023	Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.
Week 7 27.02.2023- 05.03.2023	Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws, of photochemistry, quantum yield, actinometry, examples of low and high quantum yields
Week 8 06.03.2023- 12.03.2023	Holi Vacations
Week 9 13.03.2023- 19.03.2023	photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.
Week 10 20.03.2023- 26.03.2023	Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to

	free particle and “particle-in-a-box” (rigorous treatment), quantization of energy levels, zero-point energy
Week 11 27.03.2023-02.04.2023	Heisenberg Uncertainty principle; wavefunctions, probability distribution functions, nodal properties, Extension to two and three dimensional boxes, separation of variables, degeneracy.
Week 12 03.04.2023-09.04.2023	Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wave functions. Vibrational energy of diatomic molecules and zero-point energy.
Week 13 10.04.2023- 16.04.2023	Angular momentum: Commutation rules, quantization of square of total angular momentum and zcomponent. Rigid rotator model of rotation of diatomic molecule.Schrödinger equation.
Week 14 17.04.2023-23.04.2023	Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus.
Week 15 24.03.2023-30.04.2023	Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).
Week 16 01.05.2023-08.05.2023	Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H2 + . Bonding and antibonding orbitals.Qualitative extension to H2. Comparison of LCAOMO and VB treatments of H2 (only wavefunctions, detailed solution not required) and their limitations.
Week 1709.05.2023-12.05.2023	Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB).Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH).

Note: - This lesson plan is tentative.

HOD **Principal**